IEC TC114 Project Teams

- Terminology
- Design Requirements
- Mooring Systems
- Power Quality
- Wave Energy Converters Performance
- Wave Energy Resources
- Wave Energy Converters Performance - 2nd Site
- Guidelines – Wave Energy Converters
- Tidal Energy Converters Performance
- Tidal Energy Resources

Message from the Chair

It is hard to believe that it was only a year ago that our committee received full funding support from the ecoENERGY Innovation Initiative. This funding has provided the committee with the stability to focus on actively engaging on the development of standards to support the marine energy industry. We are already seeing a greater awareness amongst industry players of these standards documents and an interest in beginning to use these documents to evaluate and improve their pre-commercial products. The feedback provided by the industry over the next couple of years will be directed to the committee for inclusion in the next release.

In this last year, we have made significant progress in many areas. The Canadian committee has demonstrated strong participation in all of the active Project Teams (PTs) and Ad hoc Groups (AHG) of IEC TC114. The Canadian committee has continued to show leadership on the international stage by initiating and agreeing to lead the development of a standard on the performance assessment of river hydrokinetic turbines. This is an area of strategic importance as Canada possesses both a significant untapped resource and an active group of companies developing technology to address this market. The recent publication from CanmetENERGY/NRC on "Assessment of Canada's Hydrokinetic Power Potential" provides further evidence of this market.

The SMC/TC114 website (http://tc114.oreg.ca/) has continued to evolve with updates to Project team progress as well as the addition of a new section highlighting the research that is being performed in support of Standard's development.

Our committee will be coming together in Ottawa this Fall immediately prior to the Marine Renewables Canada conference. The meeting will provide the committee with an opportunity to review the current volunteer requirements and to assess where additional support is required. The committee has also been requested by the IEC/ TC114 to provide feedback on Canada's top 5 areas that require standards development. The committee will perform a strategic review to assess, from the Canadian perspective, which areas of marine energy most urgently require standardization work.

This has been a very busy and productive year and I anticipate the pace will continue throughout the remainder of the year as we also begin to plan next years Project team support, research activities and the TC114 Plenary meetings which will be held in Vancouver the week of April 21-25, 2014.

Cheers,
Russell Stothers
Chair, Canadian Mirror Committee to IEC TC114

- Ocean Thermal Energy Conversion (OTEC) Systems
- Power Performance Assessment for River Energy Converters

Quick Links

- IEC TC114 Standards Website
- International Electrotechnical Commission (IEC)
- Marine Renewable Energy Technology Roadmap

Research Initiatives

When Canadian chair Russel Stothers set out to develop a proposal for funds to sustain the Canadian involvement with TC114 he was thinking forward to "what might be" rather than accepting that our early decisions on where Canada should contribute had fully plot the course. He carved out a budget proposal to allow pursuit of projects that could explore new areas for standards work, could answer questions raised by existing work or develop expertise and knowledge to allow us to lead in definition of standards, all of this with a view to developing standards of particular relevance to Canada in their application or in having Canadian expertise lead the world in their implementation.

The project was indeed supported under the EcoEnergy Innovation Initiative of Natural Resources Canada and we had a budget allocation to pursue these goals. in FY2012/13 it was pretty small and a preliminary project on tidal blockage was launched. This year we had a competition and two projects were selected. One was to continue leadership in the tidal blockage work and the other was to develop strength in the river current resource field; this latter was in a key area identified for Canadian leadership in our 2011 Roadmap, builds on the recent NR Canada and National Research Council resource assessment inventory, demonstrates expertise and supports the effort to launch TCC114 work on river current. Both were felt to build on and demonstrate Canadian strengths that may have commercial roles in the international industry.

We could not act on all proposals but were pleased that all but one did make an effort to respond to the mission we had proposed. We will have another competition late this year for start-up in April 2014, and this time we will likely have $130k or slightly more to commit.

The criteria we have been using to look at the proposals are essentially as follows:

1. Research that supports and delivers on the overall strategy for the SMC/ IEC TC114.
2. Research supports, and addresses a gap in, an existing TC 114 PT and provides a direct contribution to the technical specification development from Canada.
3. Research supports an anticipated TC 114 new work item proposal. .
4. Research supports an anticipated TC 114 new work item proposal that Canada may wish to propose in the future.
5. Research focuses on users of standards including regulators, test centres, industry, utilities, and certifying bodies.
6. Research supports activities and develops expertise in areas that are strategic to Canada, are in Canada’s national interest, including delivering on recommendations from the Canadian Technology Roadmap.

The RFP for 2014 will perhaps more fully address these objectives and it may be expected that the point #6 about advantage or leadership for Canada will be more emphasized. The potential for application as addressed by point #5 is also likely to be strengthened.

We are not going to launch an industry with this small research fund, but we are convinced that we can use it to strengthen Canadian leadership.

We hope that those already involved with TC114, or those who would like to influence this work, will begin thinking about what they could contribute if they were successful in accessing a part, or even all, of next year's funds. It will depend on the proposals whether the funds get invested in a single initiative, shared across small projects or in some combination. But for sure, any proposal will need to address these strategic priorities in order to help us make that decision.

Project Partners:

Canadian Sub-Committee (SMC/IEC TC114)

- Acadia University
- Bhuyan Consulting
- CanmetENERGY-NRCan
- Cascadia Coast Research
- Clean Current Power Systems
- CSA Group
- Dalhousie University
- Dynamic Systems Analysis
- Emera
- Glas Ocean Engineering Consulting
- Grantec Engineering
- Mavi Innovations
- National Research Council Canada
- Powertech Labs
- University of Victoria

Chris Campbell, Executive Director
Marine Renewables Canada

Research Projects:

River Current Resource Assessment Project

River current conversion technologies have received less attention than tidal and wave energy systems over the past decade, but the field is growing rapidly. Recent river current resource assessments in the US show an impressive theoretical hydrokinetic potential of
120 TWh/yr of technically recoverable power (Electric Power Research Institute, 2012). Work is ongoing by National Research Council of Canada (NRC) to better quantify the Canadian resource.

As project developers know, accurate and standardized resource assessments are an essential first step in implementing renewable energy projects. Yet no guidelines or standards currently exist for river current assessments. In Canada and other cold climates, the presence of river ice further complicates the resource assessment for such projects.

It is with this context in mind that Hatch Ltd. responded to a request for research proposals by SMC/IEC TC114, via Marine Renewables Canada, and proposed the project River Current Resource Assessment and Characterization Considering Ice Conditions. The proposal was accepted for the 2013/2014 funding cycle and is currently underway.

The project's objectives are two-fold: i.) to develop a practical, broadly-applicable methodology for river current resource assessment and ii.) address the impact of ice formation and dynamics on resource assessment. Hatch plans to validate its methodologies on hand of extensive field data (bathymetry and hydrological survey) from a previously-studied section of a major Canadian river.

The study draws on extensive Hatch expertise in hydrokinetic resource assessment, river ice, river hydraulics and hydroelectric energy conversion systems. It will also reference an ongoing study on the influence of ice processes on fluvial sediment, that was initiated in 2011 by Hatch, Manitoba Hydro, National Sciences and Engineering Research Council of Canada (NSERC), University of Ottawa, and the University of Manitoba to increase the level of understanding of ice processes and their influence on hydraulics and sediment transport in rivers.

Results of the study will be presented in the form of a report in early 2014. This should provide a practical tool for project developers and will complement ongoing work by NRC and Natural Resources Canada (NRCan) to define Canada's national hydrokinetic potential. This work will help accelerate the development of international marine energy technical specification and standards currently being developed through IEC/TC 114 and help ensure that Canada maintains a leading role in marine energy.

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Impact of channel blockage, free surface proximity and foundations on the performance of Tidal/River Energy Converters
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Members:

IEC-TC114

- Chair: Neil Rondorf (USA)
- Secretary: Danny Peacock (UK)
- Technical Officer: Charles Jacquemart

Sponsors:

Emera

MAVI INNOVATIONS INC. | Harnessing clean and predictable power from tidal and river currents

IEC Technical Specification (TS) 62600-200 (Electricity producing tidal energy converters – Power performance assessment) recognizes that Tidal Energy Converter (TEC) performance may vary depending on the degree of flow restriction (referred to as blockage) within a channel. Several academic studies have confirmed that TEC performance will improve as the amount of blockage increases. Most studies, however, were limited to simplified channel geometries, using simplified TEC models and neglected the impact of the water surface. As a result, insufficient data exists to provide firm guidance on acceptable levels of blockage within TS 62600-200.

University of Victoria researchers, Clean Current Power Systems and Mavi Innovations have therefore teamed up to address this knowledge gap. The team will build on existing work to quantify the effect of water surface proximity and foundations on turbine performance when affected by blockage. A combination of computer simulations (see figure 1) and experimental testing in a flume tank (see figure 2) are used to quantify how turbine performance changes under the various conditions studied. Both porous disks and actual axial type rotors will be tested as part of this study. All findings will be documented in a final project report that will be submitted to the TC114 committee at the end of March 2014. The outcomes of the project will be used to provide recommendations to IEC TC114 to improve future versions of the technical specification.

Figure 1: Simulation of an axial rotor turbine. Results will be compared to flume tank experiments.

Figure 2: Flume tank at the University of Victoria

Committee Updates & Initiatives

Ad Hoc Group 2: Power Performance Assessment of Electricity Producing River Energy Converters

River Energy Converters (RECs) extract kinetic energy from natural flowing water within the main body of a river without dams or diversion of water flow. An Assessment of Canada's Hydrokinetic Power Potential, currently being developed by the National Research Council and Natural Resources Canada, estimates that the hydrokinetic power potential in Canada is on the order of 300GW, though it remains to be finalized how much of this power is extractable based on current speeds, water depths, etc. This consideration, as well as potential export opportunities, is motivating a number of Canadian companies to develop REC technologies, including New Energy Corporation, Clean Current Power Systems, Mavi Innovations, RSW-RER Ltd. and Verdant Power Canada. REC systems have been demonstrated in remote applications and are being developed as options to reduce dependency on diesel generation in addition to providing power to the grid.

To build upon priorities identified in Canada's Marine Renewable Energy Technology Roadmap, the Standards Council of Canada Mirror Committee (SMC) / IEC TC114 has identified river energy resource assessment and characterization, and power performance assessment of electricity producing RECs, as priorities for Canada. Current Technical Specifications (TSs) under development by IEC/TC114 cover important topics for the wave and tidal energy industries; however, specifications applicable to rivers were slow in being proposed as part of TC114. To start the process of developing specifications applicable to RECs, Canada submitted a New Work Item Proposal (NWIP) to IEC/TC114 on the Power Performance Assessment of Electricity Producing RECs in September 2012.

The objective of this proposed TS is to establish procedures for the transparent and consistent assessment of REC performance. This will enable the performance of devices to be validated and, consequently, enable government, industry and the finance/investment community to form evidence-based judgements on the commercial prospects of the technologies being demonstrated. To ensure that the performance of different devices is assessed on a consistent basis, an explicit written TS/Standard is required.

Scope of this TS will establish general principles for assessing the power production performance of RECs when deployed in a river environment. It is expected to include the definition of rated power and rated water velocity; a methodology for production of power curves for REC; a process to estimate electricity production from prospective sites where sufficient resource information exists; and a framework to report the results. Device performance will be characterised using a measured power curve, reporting on the record of operational status, and potentially annual energy production. Though the scope is yet to be finalized, it will likely apply to RECs contributing power to either the electrical grid or a local network, and to both floating and bottom-mounted devices.

Canada provided a presentation proposing the performance assessment TS at the IEC/TC114 plenary meeting in October 2012. A key point of discussion was whether there was a need for a separate TS on performance assessment of electricity producing RECs, or whether it could be added to the scope of TS 62600-200: Electricity producing tidal energy converters – Power performance assessment (published in May 2013). It was decided during the meeting that an Ad Hoc Group (AHG) should be established with the objective to "investigate whether a TC114 deliverable should be developed in the field of

power performance assessment of electricity producing river current energy converters, and if so, the schedule and scope of the deliverable." The designation for this AHG was AHG2, as this was the 2nd AHG set up by IEC/TC114. The plenary meeting appointed Ghanashyam Ranjitkar as AHG2 Leader and the following members were nominated by the respective national committees that voted in favour: J.G.A. (George) Bitter, Gerben Jan de Vries and JanBert de Hoop (Netherlands); Jonathan Colby (USA); Wayne Jenkinson and Bill Rawlings (Canada).

The AHG2 had its first conference call in March 2013, followed by monthly calls thereafter. It reviewed the draft TS 62600-200 (Electricity producing tidal energy converters – Power performance assessment) to identify key differences between the assessment of TECs and RECs. It was agreed among the AHG2 members that there is a clear need to create a unique TS addressing the performance assessment of RECs, as opposed to adding REC performance assessment to an annex of TS 62600-200. The AHG2 also agreed that any potential River Energy Resource Assessment and Characterization TS will have significant impact on the content of the Power Performance Assessment of Electricity Producing RECs.

In order to move ahead, the AHG2 recommended that a Project Team (PT) be established to commence work on a TS for River Energy Resource Assessment and Characterization. This was done in close collaboration with the USA Technical Advisory Group, who agreed to submit and lead this New Work Item Proposal (submitted in September 2013). Currently, AHG2 continues to develop a proposed scope for the Power Performance Assessment of Electricity Producing RECs, recruit additional member countries, and work closely with the proposed River Energy Resource and Characterization Project Team (PT). AHG2 is planned to transition to a PT by the IEC/TC114 plenary meeting in Vancouver scheduled for April 2014.

Leadership of AHG2 is currently being transitioned from Ghanashyam Ranjitkar, of Natural Resources Canada-CanmetENERGY, to Dr. Sue Molloy; however, Ghanashyam will continue to support AHG2 as a member of the SMC/TC114 shadow committee. SMC/TC114 looks forward to the creation of this TS to support the development of a REC industry capable of generating renewable electricity both in Canada and internationally.

Thank you to Ghanashyam Ranjitkar for his work to establish AHG2, as well as his contributions to this article.

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Marine Energy in the Canadian Electrical Code, Part I

History of C22.1 CSA Group's Canadian Electrical Code

C22.1 was first published in 1927 and exists to protect the safety of Canadians by standardizing the installation and maintenance of electrical equipment in Canada. It is updated regularly through a three-year cycle using a consensus-based approach involving stakeholders from many fields. However, each new edition does not become legislation in each province until theprovince individually adopts it. C22.1's latest edition was released in 2012.

Structure of C22.1

The Canadian Electrical Code is published in several parts:
Part I is the safety standard for electrical installations;
Part II contains individual standards used for evaluating electrical installations or equipment;
Part III is a standard focused on the safety of power distribution and transmission circuits;
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Part IV contains objective-based standards available for usage in institutional or industrial installation; and,
Part VI contains standards for inspecting the electrical installations of residential buildings.

Renewable Energy and C22.1
Section 64 of Part I pertains to renewable energy, and was first included in C22.1 with subsections relating to large and small wind systems, fuel cells, micro-hydropower, hydrokinetic systems, inverters, and storage batteries. Additionally, Part I Section 50 refers to photovoltaic energy. These sections will be merged in the 2015 edition.

Section 64 and Hydrokinetic Energy
It has been noted that Section 64's subsection on hydrokinetic energy may need to be reviewed and updated since there is more information available for this technology than three years ago. We are currently working with SMC/TC114 members to update this section, with a goal of having the necessary wording and approvals completed in time for the 2015 edition. SMC/TC114 is the national committee that represents Canada in the IEC/TC114 that is developing international standards in Marine Energy sector. Marine energy includes electric power generation from wave, tidal and water current.

Section 64 and Tidal Energy Conversion (TEC)
The 2012 edition of C22.1 does not include TEC. At the time of developing the edition, it was felt that TEC was not sufficiently developed in Canada due to a lack of running systems, standards, and guidelines. The SMC/TC114 feels that it may be appropriate to include a tidal energy converters installation section for small scale (less than 100kW) for the 2015 edition. There is now sufficient information to prepare a TEC section which will provide a foothold and positive visibility for marine energy in Section 64. Our "stretch goal" is to complete this section in time for the 2015 edition; otherwise we will prepare this for the 2018 edition.

If you are interested in helping with the efforts to include hydrokinetic and/or TEC energy, please contact Victoria Alleyne, Project Manager at CSA Group.

Upcoming Meetings

The SMC to TC114 meets on a monthly basis via teleconference to provide updates on all current activities. The subcommittee also plans for two face-to-face meetings, one typically in the spring and one in the fall to make more progress on significant issues. The meeting in the spring is focused on ensuring all committee members are in agreement with the Canadian position on all issues to be discussed at the annual TC114 plenary meeting. The SMC to TC114 meeting in the fall is focused on assessing the current and projected needs for the upcoming year.

For 2013, the meeting schedule is as follows:

January 23, 2013 -- Conference Call 10:00 AM PST
February 20, 2013 -- Conference Call 10:00 AM PST
March 20, 2013 -- Conference Call 10:00 AM PST

April 17-19, 2013 -- Spring Face-to-Face Meeting in Campbell River, BC
May 27-31, 2013 -- TC114 Plenary and PT Meetings In Tokyo, Japan
June 19, 2013 -- Conference Call 10:00 AM PST
August 21, 2013 -- Conference Call 10:00 AM PST
September 18, 2013 -- Conference Call 10:00 AM PST
October 23, 2013 -- Conference Call 10:00 AM PST
November 19, 2013 -- Fall Face-to-Face Meeting, Ottawa, ON
December 18, 2013 -- Conference Call 10:00 AM PST

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