Tidal & River Energy Converters Power Curve Assessment: a standard protocol derived from IEC 62600 - 200

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Abstract

Tidal Current Energy Converter technologies are being developed today using various range of designs, shapes and sizes. The only way to compare the efficiency and integrity of the technologies is then to test the device in real conditions and perform power curve assessment based on comparable methods.

In this respect, IEC62600-200 is a technical specification describing the methodology to evaluate the performance of tidal converter in a marine environment. Regarding the small number of devices commissioned at sea and connected to the grid, this standard has been hardly applied.

In order to allow the machines to be tested in real conditions at a reasonable cost, test sites have been set up all over the world. As such, SEENEOH, an estuarine tidal test site for full-scale river and intermediate-scale ocean tidal devices which is located on the Garonne River in Bordeaux has been one of the pioneers in France and the site is now supporting two technology developers in their demonstration phase. Indeed, the test site enables technology developers to rigorously test their river / tidal energy converter solutions and valid performance criteria prior to stepping in the market. Multiple aspects are included in the testing phase: durability, wear and tear analysis, fish impact assessment, environmental impact, operation and maintenance procedures as well as any other factor that could be essential to ensure the energy converters are robust enough and economically viable.

The additional value of SEENEOH is its capability to carry out power curve assessment based on a standardized methodology developed together with Valemo, Energie de la Lune and Bureau Veritas and thus, for the technology developers, to get their machines power performance certified by a recognized third party. This third-party assessment provided by Bureau Veritas and SEENEOH ensure the necessary reliability in front of investors and thus allow projects bankability.

The main goal of this power curve assessment is to demonstrate technology efficiency based on the existing relationship between water current speed and the electrical power output generated by the energy converter. In order to achieve a reliable and meaningful

comparison of machines, it is then important to ensure that the measurement methods as well as the related post processing / results assessment efforts are made according to a fairly comparable method. For machine tested at sea, power curve certification guarantees that the procedure used by the technology developer to perform a power curve is compliant with the existing standards, such as IEC62600-200 (“Marine energy – Wave, tidal and other water current converters – Part 200: Electricity producing tidal energy converters – Power performance assessment”).

However, when it comes to test in an estuary that is constrained by high tide and low tide, and more particularly in a macro-tidal environment where the tidal range is high, no existing standard provides a strong enough procedure that would be able to measure machines performance in a similar or at least comparable way versus what could be found in open sea test sites. With respect to this major constraint, SEENEOH and Bureau Veritas have decided to develop together a power curve assessment methodology derived from IEC standards in order to allow SEENEOH users to get their power performance tests certified.

This paper will detail the procedure developed by SEENEOH & Bureau Veritas to perform the power curve assessment on SEENEOH test site as the adaptation from the existing IEC62600-200 and the IEC62600-300 draft. This has been one of the major works achieved within this collaboration. The document issued intends to be used as the basis for a future IEC standard to be submitted in the framework of IEC Technical Committee (TC) 114: Marine Energy – Wave, tidal and other water current converters.

The paper will also describe how SEENEOH has structured and equipped its test site in order to focus on both the integrity assessment of the machines as well as the performance assessment to allow their clients to achieve a recognized power curve certification.

A case study will be developed using the feedbacks of Hydroquest (subject to confidential data and with the authorization of the developer), which is the first turbine installed in the testing site of SEENEOH (commissioned forecasted at the end of December or early January for a period of 12 months).