THE DEVELOPMENT OF A RISK-BASED GUIDELINE FOR THE DESIGN OF CURRENT AND TIDAL TURBINES

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ABSTRACT
Tidal turbines are emerging technologies offering a great potential by the harnessing of a renewable and predictable resource. However, exploitation at sea comes with significant design, installation, grid connection, and maintenance operations challenges. Consequently, guidelines and standards are required to ensure safety, reliability and quality for these innovative technologies, to support designers and to accelerate the development and commercialisation of the tidal technology. As tidal energy concepts are only at the demonstration stage, only few standards have been published about tidal and current turbines and no dedicated certification procedures have been developed so far.

The aim of this paper is to present a risk-based certification process developed by Bureau Veritas for tidal turbines and published in the Guidance Note NI603 Current and Tidal Turbines. Based on experience accumulated over the past years with tidal turbines technology developers, typical challenges related to the design and installation of tidal devices at sea will be highlighted in this paper. To support tidal turbines designers to take up these challenges, Bureau Veritas provides a decision-making guide gathering 1) recommendations from the existing experience at sea of tidal devices, 2) best practices from related sectors, such as shipping, wind energy or offshore oil & gas, 3) a risk-based approach to consider for the particular requirements of each tidal turbine installation.

In particular for tidal turbines, projects are highly site specific with huge impacts on farm layouts and foundation designs, to name but a few of the issues to be addressed. Paradoxically, the aim of certification societies is to develop rules and tools that can be applicable to a wide range of designs. Consequently, trying not to be design-specific, a proposal of a generic certification process is made in this paper. Existing certification principles from more mature sectors such as wind energy, offshore oil & gas or shipping have been adapted to the specificities of tidal turbines. This paper addresses different certification procedures such as prototype certification, component certification, type certification and project certification. Their respective application and interactions are developed, with a focus on prototype and type certification. In addition, particular attention is paid to the novelty induced by tidal turbines. Consequently, a risk-based guidance is provided to use qualification of new technology for the most innovative parts of the tidal device.

INTRODUCTION
Tidal energy is a growing market, currently developing from a research and development stage, involving tank tests and sea trials of small-scale prototypes, towards a commercial stage with installation at sea of full-scale devices at farm level.

To support and accelerate the development of the tidal sector, the development of codes and standards is required to ensure safety, quality and performance of these innovative technologies. Codes and standards aim at gathering best practices and design or operational requirements, forming a reference basis for certification. In a general way, certification (or conformity assessment) is the process where a certification body provides written assurance that a product, process or service is compliant with the requirements specified in a