In consideration of the determination of the Regione Piemonte – Direzione Coesione sociale No. 1057 of 25/7/2019 which approved the following apprenticeship position for the PhD project proposal submitted by the Politecnico di Torino in the framework of a specific regional call for proposals (Apprendistato di Alta Formazione e Ricerca 2016-2018 - Avviso Pubblico per la realizzazione dei percorsi formativi di: Laurea triennale e magistrale, Diploma Accademico di primo e secondo livello, Master di primo e secondo livello Universitario, Dottorato di ricerca e Diploma accademico di formazione alla ricerca, Attività di ricerca approvato con Determinazione 537 del 3/8/2016):

PhD in Mechanical Engineering

Research project "Ottimizzazione di sistemi di produzione di energia da moto ondoso"

Politecnico di Torino – Wave for Energy s.r.l.

Supervisor	Prof. Giovanni Bracco – Politecnico di Torino giovanni.bracco@polito.it Ing. Vincenzo Orlando – Wave for Energy Vincenzo.orlando@waveforenergy.com
Contact	http://www.dimeas.polito.it/en/research/research_groups/mechatronics_and_servosystems/research_projects (Politecnico di Torino) https://www.waveforenergy.com/ (Company)
Context of the research activity	During the last few decades, several technologies have been proposed for marine energy harvesting, that currently present different levels of development [1]. The last generation of Wave Energy Converters (WEC) is represented by different concepts that can be grouped in a unique category: offshore floating devices. The development of these devices is founded of two fundamental aspects: the technology innovation that provides the tools for

	exploring new environments and the availability of a higher power density far from coasts. On the other hand, the extreme environment is a source of higher loads for the device, resulting in the need of a more accurate design procedure. To meet the policy and market requirements, research is still needed on the key aspects of the design and development of such systems. For the design, development and optimization process of a floating WECs, it is necessary to develop reliable numerical models that consider the complete power conversion chain, from the waves to the electrical grid connection. Furthermore, despite the crucial role of the numerical tools, experimental campaigns are fundamental during all the development stages, to confirm the expectation, tune and validate the design tools. According to different studies present in literature, two key topics have been identified as most relevant for an improvement in the design and development tools and methodologies for floating MRES: the hydrodynamics of the floating device and the mooring system [2]. The present PhD topic aims to develop optimization methods for WECs from a 360 degrees of freedom perspective and in particular a tool to assess the WEC Levelized Cost of Energy (LCOE). [1] López, I., Andreu, J., Ceballos, S., de Alegría, I. M. and Kortabarria, I. [2013], 'Review of wave energy technologies and the necessary power-equipment', Renewable and Sustainable Energy Reviews 27, 413–434. [2] Davidson, J. and Ringwood, J. V. [2017], 'Mathematical modelling of mooring systems for wave energy converters—a review', Energies 10(12), 666. The Company Wave for Energy has planned for the winner of this position a collaboration within a contract of **high apprenticeship** according to the Italian Legislative Decree 81/2015, art. 45.

Objectives	1- Definition of Design Procedures: Definition of the most appropriate design process. 2- Development of in-house WEC design and optimization model: Implementation of linear and non linear modeling. Implementation and optimization of a Matlab-ANSYS Aqwa interface, in order to speed up the optimization process, increase sensitivity analyzes, and obtain optimal configurations. Development of a model in Orcina Orcaflex for complete design with moorings.

	3- Tank test: Obtain the geometries in scale in order to reproduce the properties of the mooring in an experimental campaign in the most likely way. 4- CFD analysis of complete moored system: Analysis of a System moored in CFD in order to validate power performance.

Skills and competencies for the development of the activity	The candidate shall be **less than 30 years old** at the moment of the hiring from the company. The following abilities are preferable in the candidate and they will be enhanced during the PhD: - Ability to carry out analysis and synthesis on the state of the art of technologies and methods - Ability to develop mathematical models - Ability to present a scientific work both in oral and written form - Proactivity, independent and parallel thinking - Familiarity with the Matlab/Simulink environment.