

## Concept study of offshore wind and tidal hybrid conversion based on real time simulation

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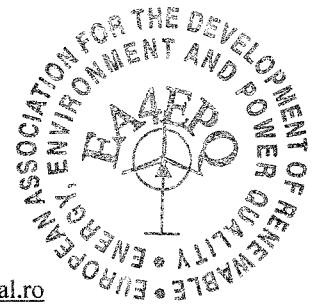
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### Abstract.

This paper deals with a conversion system concept based on the real time simulation of a hybrid offshore wind and tidal current system. In order to provide reliable, environmental, and cost-effective electrical energy we present a simulation research device composed by two real time emulators: one for each type of energy: a wind turbine emulator and a tidal turbine emulator. The wind turbine emulator based on a permanent magnet synchronous machine, is used to simulate the characteristics of a working turbine and an electrical generator. The tidal turbine emulator has in its composition 3 electrical drives: an asynchronous drive with vector control used to simulate the behaviour of a tidal turbine, a double feed asynchronous generator and an active break. Both of them are using the "hardware-in-the-loop" techniques.

### Key words

Offshore wind turbine, tidal turbine, real time simulation, hardware-in-the-loop simulation, hybrid connection

### 1. Introduction

The seas and the oceans cover two thirds of the Earth's surface and contain different amount of energy, and its possible resources are far beyond the energy needed by the humanity. The energy resources came from two types of phenomenon: solar energy and gravity variations due to changes in positions of Earth, Moon and Sun [1]. The planetary ocean contains numerous forms of renewable energies, who, in absolute, deliver enough energy to meet the needs of the entire planet. The recovery of a very small part of this energy is now possible thanks to the recent growth of complementary techniques to exploit the various forms of marine energy,

including: wave energy, offshore wind energy, tidal energy and thermal energy [2].

Many researches are conducted in the studies of this renewable energies cause of the threat of climate change, diminishing fossil fuels resources and the existent risks over the global energetic security are all engines that dives the states, communities and industry to diversify their sources of supply.

In this study we intend to show how to maximize the electrical energy conversion from the resources that the nature (sea) gives in a certain point. In this case it is taken into consideration the possibilities to obtain electrical energy using a hybrid connection between the offshore wind turbine and the tidal marine turbine [3].

The harmonic development of this new way of exploiting the sea must be done in close consultation with other users of the maritime space. The necessary knowledge of all environmental impacts and societal impacts can be gained by experiments in pilot plants [4].

The wind energy is not really a marine energy, but the exploitation in the sea conditions presents particular characteristics:

- the wind is much powerful and much constant in the sea then on the land, giving a better energy production;
- the sea offers large open spaces and there for bigger machines can be installed.

It is desirable that the total power of the plant shall be as big as possible:

- During construction, the relative costs of development and mobilization of resources for the means of intervention are more rentable.

- A cable for connection to the grid is more reliable and much cheaper if it is used to transport the maximum energy that it can carry. [5]

Tidal energy is generated by the relative motion of the water which interacts via gravitational forces. Periodic