Offshore Wind Turbines: An Overview of the Effects on the Marine Environment

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ABSTRACT

The wind energy industry is growing worldwide. Recently, a number of physical and numerical modeling studies have been carried out in Europe to implement the offshore wind turbine technology, as well as the wind resource. Accordingly, the consideration of the possible environmental impacts of this technology on the marine environment, already affected by several anthropogenic pressures (e.g. fishery, maritime traffic) becomes increasingly important. Main goal of this paper is to provide an overview of the offshore wind farm developments and the associated environmental impacts at European level. The Italian state of the art is also presented.

KEY WORDS: Offshore wind farms, wind turbines; environmental impacts; marine environment.

INTRODUCTION

The use of renewable energy is a key point to reach the objectives of United Nations Climate Change Conference COP21, held in Paris on December 2015. In the framework of recent COP21, each State published its own Intended Nationally Determined Contribution, (INDC) or rather than its commitment to reduce greenhouse gas emissions by 2025-2030 in order to mitigate global warming. 195 countries signed an agreement to limit global temperature rise to well below 2°C above pre-industrial levels, and to undertake efforts to meet a 1.5°C goal (http://www.cop21.gouv.fr). Among the possible energy alternatives (e.g. solar, hydro, wave), wind represents one of the most promising renewable energy resource which aims to reduce gas emissions. While onshore wind is in continuous development, offshore wind is attracting people attention and is moving faster than the other renewable resources (Leung & Yang, 2012). Therefore, it is necessary to consider the potential effects on the environment due to the development of this technology. Even if the environmental monitoring of such effects are rapidly developing, it remains a high degree of uncertainty regarding the environmental implications of construction, operation and decommissioning activities (Leeney et al., 2014). The present review gives an overview of the offshore wind energy technologies and the environmental impacts of the existing European offshore wind farms (hereafter OWFs). The effects on the different marine ecosystem components such as benthic or pelagic habitats, large marine vertebrates (i.e. sea birds, marine mammals) are described. Up to now at Italian level offshore wind energy projects are still at proposal or planning stage. Therefore, an overview of the current Italian regulatory processes and the Italian presented projects is given. Knowledge gaps that could be addressed by future research are also outlined.

GLOBAL AND EUROPEAN STATUS OF WIND ENERGY

The wind energy resource exploitation is rapidly growing globally. According to Global Wind Energy Council (GWEC), the 2015 registered a record in term of global wind industry annual installations (onshore and offshore) crossing the 60 GW mark for the first time from 2000 (Fig. 1).

![Figure 1. Global annual installed wind (onshore and offshore) capacity 2000-2015 (GWEC, 2016).](image)