

# ASSESSMENT OF CORROSION IN OFFSHORE ENVIRONMENT. STUDY IN WINDFLOAT PROTOTYPE: WIND\_ENERMAR PROJECT

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## ABSTRACT

In December 2011 WindFloat prototype, a semi-submersible floating structure was successfully deployed off the coast of Aguçadoura, North Sea of Portugal. The 2 MW WindFloat platform is the first offshore wind turbine in open Atlantic waters and as a demonstration project it appears as great opportunity to assess metal corrosion and anticorrosive protection systems efficiency in offshore environment. This kind of assessment has never been performed in Portugal. With this aim, the Materials and Coatings Laboratory (LMR) of LNEG carried out the Wind\_Enermar project - "*Prevention and control of corrosion in the exploitation of offshore wind energy*", which involved the exposure of AH36 steel samples with and without application of different anticorrosive protection systems, selected according to the different sections of the WindFloat platform: atmospheric, splash and immersion zone.

KEYWORDS: Offshore wind energy, corrosion, AH36 steel, anticorrosive protection systems, Windfloat.

## **EXTENDED ABSTRACT**

Oceans, seas and coasts are undoubtedly significant and large resources of energy, both fossil and renewable, that can help Europe to respond to the challenges of climate change and energy security of supply. The increasing development of offshore marine energy technologies brings with it a new level of corrosion problems due to the aggressive marine surroundings.

Marine corrosion is dependent on a number of factors such as the environmental zone that interacts with structural materials (marine atmosphere, splash/spray, tidal, shallow and deep water and mud); alloy composition and surface roughness of the material; water chemistry; physical factors; galvanic interactions and biological factors such as biofouling. The knowledge of how these factors may affect marine corrosion can support the design of materials, components and systems for optimal service performance and structural life. Early corrosion detection and the study of corrosion mechanisms, with a simultaneous correlation between testing on sea platforms and laboratory testing, enable not only to minimize damage caused by the corrosion phenomenon but also to acquire technical knowledge in the marine exploration area, both of them essential for the formulation and development of projects in the sea energy sector.

With the first offshore floating wind turbine pilot project being carried out in Portugal, the Materials and Coatings Laboratory (LMR) of LNEG (National laboratory for Energy and Geology) developed the Wind\_Enermar project - "*Prevention and control of corrosion in the exploitation of offshore wind energy*", with the aim to perform the assessment of metal corrosion and anticorrosive protection systems efficiency in offshore environment, taking into account the different areas of exposure.

To develop the WIND\_ENERMAR project the experimental design proposed was based on the ISO 9226 standard for the evaluation of atmospheric corrosivity and on current standards, ISO 12944, ISO 20340 and NORSOK M 501, for corrosion protection study of offshore structures. In this first stage samples preparation and installation on Windfloat platform were performed. The WIND\_ENERMAR project also includes the following activities: inspection of the samples during and after 2 years of exposure on windfloat platform, laboratory study using the tests methods in accordance with standards and specifications for offshore sector and characterization of materials.