A SPATIAL PLANNING APPROACH TO COASTAL MANAGEMENT: THE CASE OF MARINE RENEWABLE ENERGY INSTALLATIONS.

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Paper topic: Coastal risks and management, including climate changes

1. Introduction

The increasing awareness of the cumulative effects of human activities on the marine ecosystem and the rapid development of the offshore renewable energy sector has led to an increased requirement for Marine Spatial Planning (MSP) to fulfill the need of a holistic and integrated approach to management (Backer, 2011). The development of the Marine Renewable Energy sector in the complex framework of existing uses, pressures and future developments, makes the need for MSP even more urgent. Marine renewable energy installations (MREIs) are likely to become a large part of the future energy mix worldwide. As MREIs develop, it is likely to result in further transformation of our coastal seas, already affected by significant pressure from human activity. In this perspective, both the potential for combining different renewable technologies, and the impact associated to such development should be considered in the context of the existing pressures. Spatial planning approaches to coastal areas are increasingly required and a distinct field of study and practice is emerging as the result of this new awareness (Douvere and Ehler 2008; Ehler and Douvere 2009; Jay 2010). One important incentive for this development has been the awakening to a potential future shortage of space in coastal seas, partly a result of the rapidly expanding interest in offshore wind-power developments. At the same time marine ecosystems around the world are increasingly reported to be in a degraded state (e.g. UNEP 2010), creating public and expert pressure to constrain human activities. The spatial conflicts of sea uses and the demand for sea space are in fact increasingly growing. The development of the MRE sector in such a complex framework of existing uses, pressures and foresees developments, makes the need for MSP even more urgent. Spatial decision support systems, through the efficient exchange of information between experts, stakeholders and decision makers offer the opportunity to guide the transition from the single sector management toward the integrated management of sea uses. The early prediction of the areas of potential conflicts creates also the ground for mitigation actions or early negotiations between stakeholders. In this study the optimal siting and the environmental impact of MREIs is analyzed through a MSP approach in two different case studies, one along the California cost and another in the Danish portion of the Baltic sea.

2. Study Area and Methods

In this investigation two case studies are analysed. The first case study attains the Danish portion of the Baltic sea, where many offshore wind farms are already installed and many projects are in construction or in the planning stage. The second case study concerns the coast off California where both wind and wave energy potential is quite high but currently remains undeveloped.

Both case studies provide good examples for illustrating the complexity of issues at play in the dimensions of maritime spatial planning. The Baltic Sea is, in fact, under large anthropogenic pressure due to shipping and other offshore activities. In the Baltic Sea (including the Kattegat), about 76 ports handle more than 1 million tonnes of cargo/year (Lu et al., 2012) and a multitude of human activities, both on the sea itself and its catchment contribute to the environmental impact affecting the area (HELCOM 2009b; HELCOM 2009a; HELCOM 2010). Human activities offshore include e.g. intensive marine traffic, industrial fisheries (mainly of cod, herring and sprat),

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leisure boating as well as construction and operation of technical installations such as offshore oil platforms, wind power farms as well as cables and pipelines (HELCOM 2009a), such as the recently finalized Nord Stream Gas Pipeline project (NSGP) between Russia and Germany.

The environmental issues along the California coast tend to be more localized and a certain number of critical coastal areas are present mostly where portions of watersheds drain to threatened or impaired coastal waters or into areas with known coastal resource value. California's offshore wind resource is high (Jiang et al., 2008; Dvorak et al., 2010), but currently remains undeveloped because of the deep water off California's coast. Similarly, California has a good wave energy resource especially in the north (Wilson and Beyene, 2007). Recently has been proposed that resource diversity may be used to manage the variability of renewable power and lower the system integration costs of renewables (Fusco et al., 2010; Stoutenburg et al. 2010).

In such a complex framework, quantitative MSP criteria are requested to evaluate the sustainability of conflicting human activities in the perspective of minimizing the overall environmental impacts. A grid is created for the study area for the purpose of the spatial analysis. Several indicators of environmental vulnerability and pressures will be taken into account. The potential implications in terms of habitat loss or degradation due to the direct (e.g. noise production, sea bottom modification) or indirect impacts (e.g. behavioural changes induced by habitat alterations) of MREIs will be gridded and used for the analysis.

3. Key Results

This study shows how quantitative spatial planning methods may support the selection the sites of potential interest in the perspective of MREIs, the early identification of potential conflicts between competitive human activities and their environmental sustainability.

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