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Equitable Testing and Evaluation of Marine Energy Extraction Devices in terms of Performance, Cost and Environmental Impact

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EquiMar

Deliverable D6.2.1
Scientific guidelines. A draft.

DRAFT

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Summary

This report presents a draft version of the scientific guidelines which will be developed under the final deliverable with the same title. The structure and contents of the present deliverable correspond to the high level protocol version which will also be integrated and developed in the final protocol on Environmental Impact Assessment for marine energy renewables.

CONTENTS

1 INTRODUCTION

Environmental assessments are conducted to understand and evaluate the potential environmental effects of a marine renewable energy project and to promote the sustainable development and implementation of ocean energy projects. The assessment should be used by stakeholders and consenting or regulatory bodies to inform the decision making process from concept to decommissioning. An environmental assessment of a marine renewable energy project should be conducted to: identify, predict, evaluate and classify the potential environmental and socio-economic impacts (beneficial and harmful) from concept to decommissioning; recognize and evaluate possible cumulative impacts of the project itself and in combination with other projects and / or marine activities; contribute to site selection by identifying significant environmental and socio-economic features of the possible deployment areas, by estimating their sensitivity to the project characteristics (baseline survey outcomes); identify appropriate mitigation measures for harmful impacts; establish a monitoring programme for the deployment, operation, decommissioning and post-decommissioning stages; consult with and inform stakeholder groups and the public in general; propose and implement environmental management actions; inform the project development process.

The environmental analysis is normally reported by the results of the Environmental Impact Assessment (EIA). In the European Union, regulation on EIA is established in the so called EIA Directive (85/337/EEC, amended by Directive 97/11/EC and Directive 2003/35/EC[1]). This Directive refers to other two Directives – Wild Birds Directive and Habitats Directive – on the nature conservation policy in the European Union. All areas classified under these Directives form an ecological network known as Natura 2000. Although the EIA Directive has been reviewed, it does not specifically address wave and tidal energy projects due to the relatively recent development of these technologies. Although there is a lack in legislation on environmental impact assessment for ocean energy projects it is reasonable to presume that related legal instruments will be updated as the wave and tidal energy industry develops. Therefore, regulation on EIA is supposed to become an essential element for allowing ocean energy schemes.

An EIA usually comprises the following phases:

- Screening: which identifies the areas of legislation under which the project falls;
- Scoping: which establishes the boundaries of the investigation, the assessments and measurements required, and any assumptions to be made;
- Baseline survey: which describes the state of the environment at the deployment site and in surrounding areas, prior to any installation or deployment activity;
- Potential environmental impacts, both positive and negative; consultation report with feedback from stakeholders and general public;
- Monitoring plan: for the deployment, operation, decommissioning and post-decommissioning stages of the project in order to follow the ;
- Mitigation measures identification: to be implemented to reduce or eliminate adverse impacts.

Since the environmental analysis can also be considered a planning instrument, it would be desirable that it could form an integral part of the project development from the beginning. In this way, there are several environmental assessment techniques (SEA, ERA, LCA) which can be consulted / applied before / during conducting an EIA to inform and support the decision making process of the device concept design and activities planning. The results of these complementary environmental assessment techniques / instruments can further be integrated in the EIA report.

This report presents a draft version of the scientific guidelines of EIA for ocean energy projects which will be detailed under the final deliverable with the same title. Since EIA is the formal prescribed process for the effects assessment of certain public and private projects on the environment, the outline of the present document assumes roughly its sequence and topics. Part of this deliverable contents were also included in the high level protocol on EIA which provides a an approach to the development of the detailed protocol[2]. The information produced in this report considers the ocean energy project's phases / steps presented in Figure 1.

2 PLANNING AND MANAGEMENT OF THE ENVIRONMENTAL ASSESSMENT

The environmental assessment is a process that can be conducted at different levels. Environmental Impact Assessment (EIA) is the traditional approach that has been widely used to address environmental impacts of a given project. Strategic Environmental Assessment (SEA) is a more recent mechanism for identifying and assessing the likely significant environmental effects of a plan or programme and its alternatives. SEA and EIA are tools that share a common root - impact assessment, but have different assessment foci: strategies for future development with a high level of uncertainty in SEA; proposals and measures, concrete and objective, for the execution of projects in EIA [1].

SEA is considered a policy-aiding tool that helps organisations, plan developers and authorities to consider the effects of plans and programmes in a structured way and to demonstrate that environmental and other effects have been taken into account during their

[1] A consolidated version is currently available on the EU website: http://ec.europa.eu/environment/eia/eia-legalcontext.htm

[2] This initial document will explain the objectives, strategic needs and principles relevant to the protocol; it will form the foundation from which the full protocol will be developed within the project.

preparation. SEA application is recent. In Europe, the SEA Directive (2001/42/EC) entered into force in 2004 and thus few examples of its application are available. In UK, the Scottish government conducted an SEA for marine renewables. This document was concluded in March 2007 [2] and covers the entire west and north coast of Scotland to a distance of 12 nautical miles offshore based on where the main wave and tidal resource areas are located. In the UK, a series of SEA reports covering offshore energy (wind offshore, offshore oil and gas and gas storage) have been published with a specific SEA report targeting renewable wind published in 2009 available over the internet [3]. Outside of the European Community, examples of the SEA process application to offshore energy sector are available for Canada, where the Offshore Energy Environmental Research Association (OEER) was commissioned by the Nova Scotia Department of Energy to carry out an SEA focusing on tidal energy development in the Bay of Fundy [4]. When available, SEA results should be taken into account for an environmental assessment planning of a given project on marine renewable energy.

The EIA is a more specific tool which aims to evaluate the environmental viability of the project. Projects requiring an EIA should undergo a preparation step which involves several considerations over a wide range of issues including the timing and type of assessment that should be considered during the project phase development. A scheme regarding the timing and type of environmental assessment concerns is presented in Figure 1.

Risk assessment or analysis is a well established management tool for dealing with uncertainty. Environmental Risk Assessment (ERA) is a generic term for a series of tools and techniques concerned with the structured gathering of available information about environmental risks and then the formation of a judgment about them. EIA and ERA are very similar concepts since they have broadly the same goals, which is to inform decision-makers on the frequency and magnitude of adverse environmental consequences. However a major additional aspect provided by ERA is the probability that it gives for a particular impact to occur. A risk assessment framework has already been proposed for large renewable deployments (offshore wind) [5].

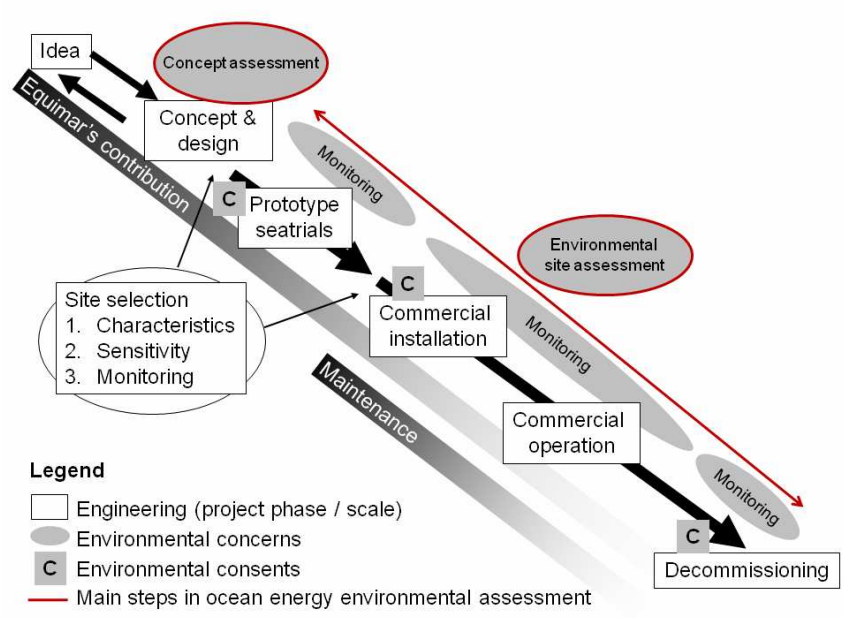

Figure 1 **Scope and time line of the environmental assessment: wave and tidal project phase sequence and environmental concerns during the process.**

3 BASELINE CHARACTERIZATION OF ENVIRONMENTAL COMPONENTS[3]

The protocol for the baseline characterization will describe a systematic approach to identify environmental and social factors that may affect site selection as well as monitoring requirements during the deployment phase. The environmental sensitivity is also important, which determines the extent and variety of data gathering from a given site. A rationale for characterising the sensitivity of a site should be developed, considering previous experience on marine environmental characterization of offshore energy projects. The protocol will also list the key aspects of the receiving environment that should, as a minimum be considered in environmental assessment of a site (including environmental, commercial and leisure uses).

Several recommendations will be considered under the protocol development. Site specificity is an important factor that should determine the requirements for baseline characterisation. Thus data gathering should utilise any established protocols that are appropriate to the site. Furthermore, any amendments to generic protocols required to deal with site specific issues should be based on expert advice, taking full account of the analytical framework within which the data collection is nested. It is also important that data collection programmes address the issue of variability (seasonal and inter-annual) so that subsequent monitoring can demonstrate environmental effects at the appropriate significance levels. Particular attention should be paid to environmental characteristics that correspond to the risks identified for the designs under consideration.

[3] This section of the protocol is closely related to section 6 below "Guidance on monitoring methodologies".

4 POTENTIAL IMPACTS AND MITIGATION OPTIONS

This section of the protocol will present the list of the potential impacts (environmental and socio-economic) described so far to be related with wave and tidal energy schemes. The options to minimize or mitigate those impacts will be listed as well. As far as possible, the protocol will address impacts of single devices and potential impacts of large scale projects (farms) as well as the mitigation measures that can be applied during the project phases. The possible environmental benefits gained during the project deployment will also be considered and information gaps and issues for future research will be identified. Some of the principles that should be taken into account in the environmental impacts identification step were already identified and are listed below:

- The likely physical constraints of a particular device design on marine biota must be identified and, where appropriate, minimized at the design phase;
- The generic and critical uncertainties of the device's environmental effects that require further basic research should be identified;
- The list of the potential environmental and socio-economic impacts in a specific site should be prioritized ;
- Life Cycle Analysis should follow the standardized process established by the International Organization for Standardization (ISO, 14000);
- The selection of mitigation measures should give priority to avoidance of impacts, then minimization and finally restoration.

5 TOOLS FOR IDENTIFICATION AND EVALUATION OF IMPACTS (INCLUDING RISK ASSESSMENT)

A number of tools and methodologies have been identified and developed to conduct environmental assessments. Some of them (e.g. checklists and Geographical Information Systems), can be used in several EIA steps. Results of other methods or techniques can be integrated or added to the environmental assessment (e.g. Environmental Risk Assessment and Life Cycle Assessment).

This section of the protocol will list and briefly describe the most suitable tools and methodologies to be applied in the environmental assessment using, wherever possible, examples of its application on marine renewable projects. The list of tools and methodologies concern the most sensitive components to the potential impacts of ocean energy projects referred in the previous section.

6 GUIDANCE ON MONITORING METHODOLOGIES

This section of the protocol will address the purposes of the environmental monitoring considering monitoring planning, monitoring considerations during project phases (installation, operation, decommissioning and post-decommisioning). A number of principles concerning environmental monitoring of the devices have already been identified. The protocols:

- Should quantify the presence and extent of key impacts of the device deployment and supporting activities on the identified environmental sensitive issues;
- Should take into account the natural temporal and special variability of the site;
- Should be performed throughout device installation, operation decommissioning and post-decommissioning periods during prototype sea-trials and commercial operation scales in line with recommendations from regulators and current state of knowledge regarding specific potential impacts;
- The monitoring plan should follow an adaptive management process in order to identify and respond to uncertainties regarding the project's effects;
- Should incorporate a monitoring plan that:
    - Follows an adaptive management process in order to identify and respond to uncertainties regarding the project's effects;
    - Provides a rationale for the type, number and duration of measurements according to the key environmental aspects identified in the baseline survey; where possible, reference protocols or methods/ instrumentation should be used;
- Should utilise any appropriate established data gathering protocols; as for the baseline survey, wherever possible should address issues of variability (seasonal and inter-annual) in order to evaluate potential environmental effects;
- Should perform an assessment on the interference of multiple devices on the receiving environment to establish appropriate array spacing and assist the design of the final deployment arrangement;
- Should consider data analysis techniques before data collection procedures are chosen
- Should make results available to stakeholders and, wherever possible, to other developers;
- Should provide a context for the use of numerical and statistical models in the quantification.

7 PUBLIC PARTICIPATION

This section of the protocol will provide a context for the public participation in the environmental assessment of a marine renewable project. Guidance for the identification of the target audience will be presented as well as the most suitable techniques that can be used to approach the public in general. The possible conflicts are going to be identified and the way to incorporate the results of the public participation in the decision making will be discussed.

8 CONCLUSIONS

The protocols to be produced will be a balanced approach between scientific, legislative and industry interests in order to optimize effort. Since the industry is still in an early stage and few case studies are available, there is still a large degree of uncertainty regarding what environmental impacts will result from deployments. The protocols that will be delivered should therefore be considered as guidance or best practice according to the experience available to date. Where possible, information gaps will be identified in order to enable the protocols to evolve as understanding of impacts improves. The concept of adaptive management, which is stressed throughout the document, also encourages the methodologies to be modified / improved as knowledge progresses.

9 REFERENCES

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