WESE

WAVE ENERGY
IN SOUTHERN EUROPE

D4.3

Feasibility for the implementation of wave energy licensing based on a risk-based approach and adaptive management in Spain and Portugal

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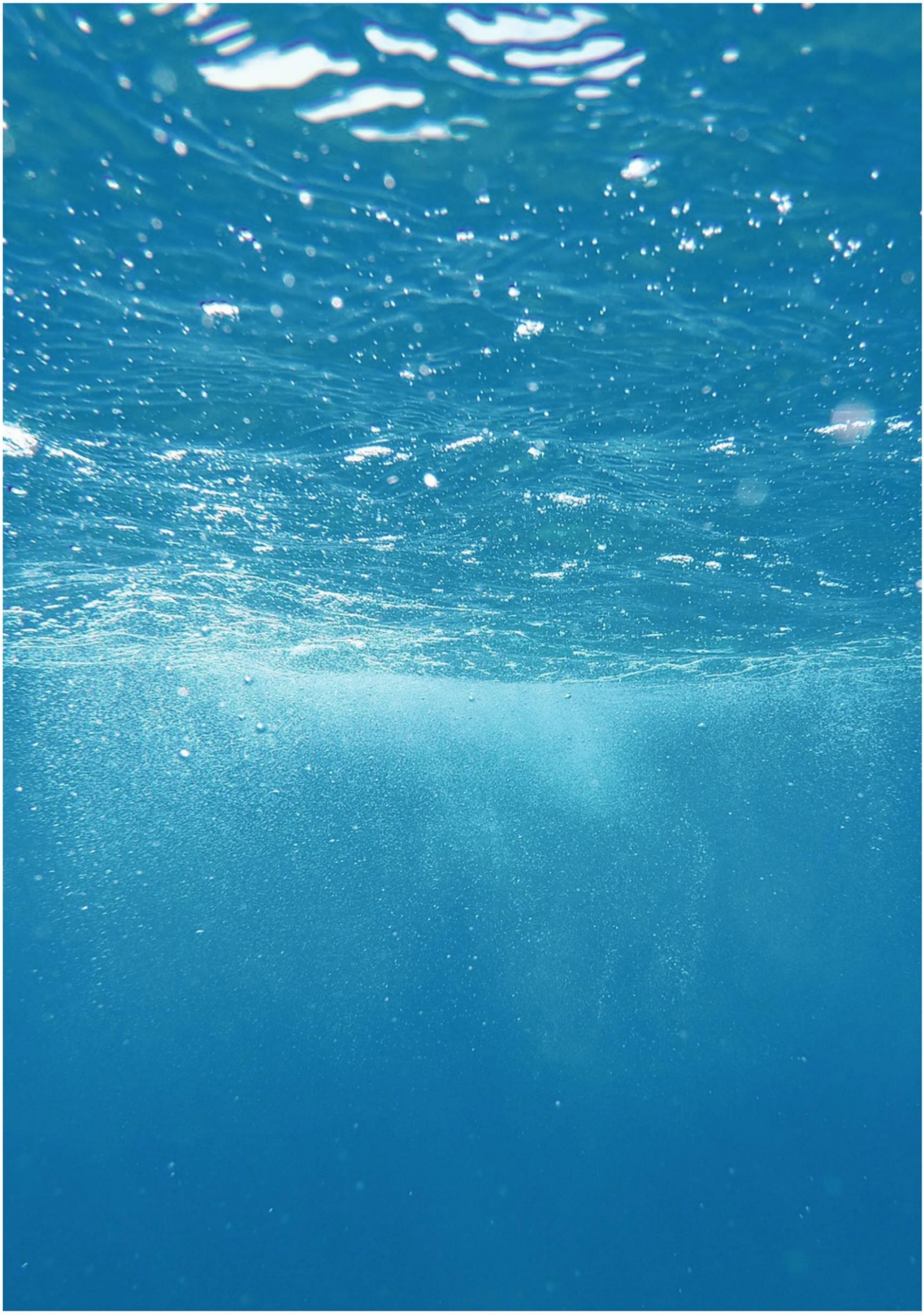

WP 4

Deliverable 4.3 Feasibility for the implementation of wave energy licensing based on a risk-based approach and adaptive management in Spain and Portugal

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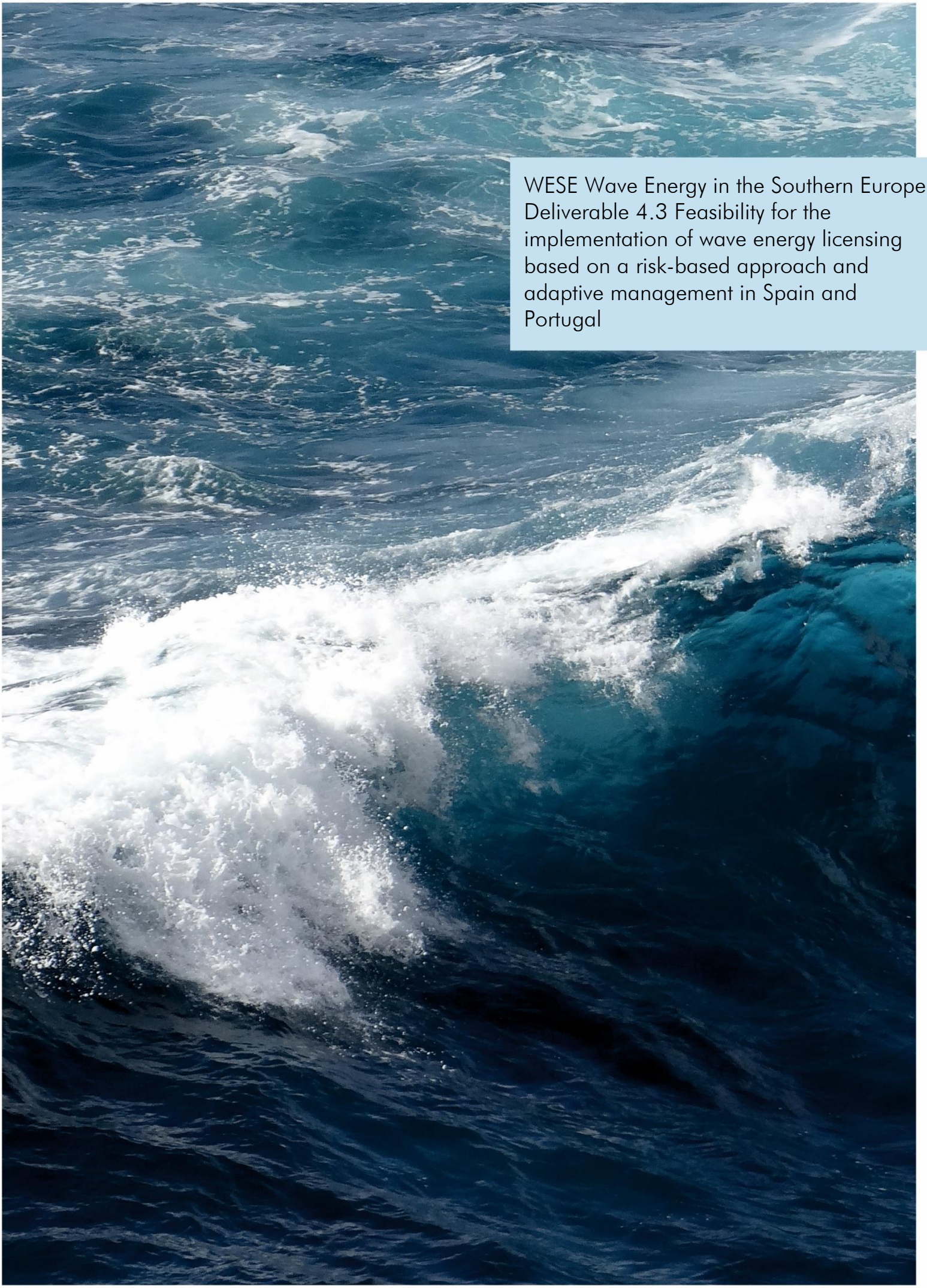


WESE Wave Energy in the Southern Europe Deliverable 4.3 Feasibility for the implementation of wave energy licensing based on a risk-based approach and adaptive management in Spain and Portugal

CONTENTS

1. ABBREVIATIONS AND ACRONYMS

AIncA	Environmental Appraisal
AM	Adaptive Management
APA	Environmental Portuguese Agency
CCDR	Commission of Coordination and Regional Development
DCAPE	Decision on the Environmental Compliance of the Detailed project design
DGEG	Directorate-General of Energy and Geology
DGEPM	Directorate General for Energy Policy and Mines
DGEQA	Directorate General for Environmental Quality and Assessment
DGPC	Directorate-General of Heritage and Culture
DGRM	Directorate-General of Natural Resources, Safety and Maritime Services
DGSCS	Directorate General for Sustainability of the Coast and the Sea
DIA	Environmental Impact Statement
DInCA	Environmental Appraisal Statement
DIP	Project Initiation Document
EE	Ecological Elements
EIA	Environmental Impact Assessment
EMN	National Maritime Space
ERA	Ecological Risk Assessment
HRA	Habitats Regulation Assessment
ICNF	Institute for the Conservation of Nature
ICT	Information and Communications Technologies
LBOGEM	Bases of Spatial Planning and Management of the National Maritime Space
METDC	Ministry for the Ecological Transition and Demographic Challenge
METDC	Ministry for Ecological Transition and Demographic Challenge
MITERD	Ministry for the Ecological Transition and the Demographic Challenge
MRE	Marine Renewable Energy
MSFD	Marine Strategy Framework Directive
MSP	Marine Spatial Planning
MTPD	Maritime-terrestrial public domain
OES	Ocean Energy Systems
PA	Port Authority
PBR	Potential Biological Removals
PNIEC	Integrated National Plan for Energy and Climate
POEM	Maritime Space Planning Plans
PVA	Environmental Surveillance Plans
RiCORE	Risk Based Consenting of Offshore Renewable Energy Projects
RJAIA	Legal System of the Environmental Impact Assessment

SDM	Survey, Deploy & Monitor
SEA	Strategic Environmental Assessment
TUPEM	Titles for the Private Spatial Use for the EMN
WEC	Wave Energy Converter
WFA	Windfloat Atlantic

2. WESE project synopsis

The Atlantic seaboard offers a vast marine renewable energy (MRE) resource which is still far from being exploited. These resources include offshore wind, wave and tidal. This industrial activity holds considerable potential for enhancing the diversity of energy sources, reducing greenhouse gas emissions, and stimulating and diversifying the economies of coastal communities. Therefore, the ocean energy development is one of the main pillars of the EU Blue Growth strategy. While the technological development of devices is growing fast, their potential environmental effects are not well-known. In a new industry like MRE, and wave energy in particular, there may be interactions between devices and marine organisms or habitats that regulators or stakeholders perceive as risky. In many instances, this perception of risk is due to the high degree of uncertainty that results from a paucity of data collected in the ocean. However, the possibility of real risk to marine organisms or habitats cannot be ignored; the lack of data continues to confound our ability to differentiate between real and perceived risks. Due to the present and future demand for marine resources and space, human activities in the marine environment are expected to increase, which will produce higher pressures on marine ecosystems, as well as competition and conflicts among marine users. This context continues to present challenges to permitting/consenting of commercial-scale development. Time-consuming procedures linked to uncertainty about project environmental impacts, the need to consult with numerous stakeholders and potential conflicts with other marine users appear to be the main obstacles to consenting WE projects. These are considered as non-technological barriers that could hinder the future development of, WE in EU and Spain and Portugal in particular were, for instance, consenting approaches remain fragmented and sequential. Consequently, and in accordance with the Ocean Energy Strategic Roadmap published in November 2016, the main aim of the project consists of overcoming these non-technological barriers through the following specific objectives:

- Development of environmental monitoring around wave energy converters (WECs) operating at sea, to analyse, share and improve the knowledge of the positive and negative environmental pressures and impacts of these technologies and consequently a better knowledge of real risks.
- The resulting data collection will be used to apply and improve existing modelling tools and contribute to the overall understanding of potential cumulative pressures and impacts of larger scale, and future, wave energy deployments.

- Development of efficient guidance for planning and consenting procedures in Spain and Portugal for wave energy projects, to better inform decision-makers and managers on environmental real risks and reduce environmental consenting uncertainty of ocean WE introducing the Risk Based Approach suggested by the RiCORE, a Horizon 2020 project, which underline the difficulties for developers with an existing fragmented and sequential consenting approaches in these countries.

- Development and implementation of innovative maritime spatial planning (MSP) Decision Support Tools (DSTs) for Portugal and Spain for site selection of WE projects. The final objective of such tools will be the identification and selection of suitable areas for WE development, as well as to support decision makers and developers during the licensing process. These DSTs will consider previous findings (both environmental and legal, found in RiCORE) and the new knowledge acquired in WESE in order to support the development of the risk-based approach mentioned in iii).

- Development of a Data Sharing Platform that will serve data providers, developers and regulators. This includes the partners of the project. WESE Data Platform will be made of a number of ICT services in order to have: (i) a single web access point to relevant data (either produced within the project or by others); (ii) Generation of OGC compliant requests to access data via command line (advanced users); (iii) a dedicated cloud server to store frequently used data or data that may not fit in existing Data Portals; (iv) synchronized biological data and environmental parameters in order to feed models automatically.

3. Executive summary

Currently, although environmental risks associated with the deployment and operation of single MRE devices are very low, the uncertainties associated with commercial arrays will require investigation as larger arrays are deployed.

A risk-based approach to survey and consenting is an element of Adaptive Management (AM), which in turn is a structured process that enables learning by doing and adapting based on what is learned. This is an important process to implement when environmental impacts uncertainty exists, to better guide monitoring activities towards risks (and impacts) quantification. Building on work carried out for RiCORE project, this report presents an assessment to understand how an effective risk-based approach can be implemented during the licensing process and during the environmental monitoring follow up of a wave energy project in Portugal and Spain. The results of two workshops held with key stakeholders involved in the consenting process in both countries are presented to support this analysis. Outcomes show the implementation of a risk-based approach could be implemented on two levels: in the legal framework and in the licensing and post-installation operational procedures.

Advancing the use of risk-based approaches for MRE will require the development of mechanisms that minimize financial risks for developers, while assuring adequate protection of the marine environment and receptors, which may require investments by governments to gather data that will assist with large-scale planning and management of marine resources. Additionally, the adoption of such approach requires long term commitment and relies on strong relationships and clear communication from all parties.

4. Introduction

The consenting process of MRE projects has been considered as one of the main non-technological barriers to the development of the sector due to the current uncertainties regarding to the potential environmental impacts of these technologies on the marine environment, namely sensitive marine animals, habitats, and ecosystem processes. This scientific uncertainty is a sign that even robust baseline environmental data is unable to address all pre-deployment information gaps (Andrea Copping 2018).

Therefore, there is a need to develop and apply tools to overcome these non-technological hurdles. Adaptive Management (AM) enables projects to be deployed gradually, despite uncertainty, through a methodology that prevents undesired environmental impacts. A risk-based approach to survey and consenting is an element of AM, which in turn is a structured process that enables learning by doing and adapting based on what is learned. This is an important process to implement when environmental impacts uncertainty exists, to better guide monitoring activities towards risks (and impacts) quantification. Furthermore, AM is already a legal requirement under the EU's Marine Strategy Framework Directive to which regulators and decision-makers linked to marine environmental management are familiar with.

The report is structured as follows:

- Section 3 presents the objectives and methodology adopted.
- Section 4 describes the concept of AM, how it has been adopted in the MRE sector and introduces the precautionary principle.
- Section 5 provides the concepts of the risk-based approach and presents two examples of its implementation: The Survey Deploy and Monitor (SDM) policy and the risk retirement concept.
- Section 6 reviews the legal and consenting process of wave energy in Portugal and Spain.
- Section 7 describes in detail the workshops held in Portugal and Spain, including the context, objectives, agenda, participants, methodology and results and main conclusions and outputs.
- Section 8 presents a concluding analysis on the legal feasibility of integration of a risk-based approach in the environmental consenting of MRE.

4.1 Objectives

The main objective of the present Deliverable is to evaluate the feasibility for the implementation of a risk-based approach and AM in the environmental consenting procedures of wave energy projects in Spain and Portugal.

To meet this general objective, the following specific objectives are proposed:

a) Review the general concepts of risk-based approach and Adaptative Management (AM).

b) Review the legal consenting procedures in Spain and Portugal explained in Deliverable 4.2).

c) Review the Spanish and Portuguese stakeholders' insights of this feasibility.

4.2 Methodology

An assessment will be carried out to understand how an effective risk-based approach together with an AM process can be implemented during the licensing process and during the environmental monitoring follow up of a wave energy project. The work carried out previously in the RiCORE project will be valuable for this analysis and will be considered here. The interplay between both approaches will be evaluated as well as their possible implications in the efficiency of the current licensing strategies in Spain and Portugal. The wave energy projects under study in previous work packages (Mutriku, IDOM Marmok-A-5 and WaveRoller) will be used to demonstrate how these approaches may work in practice. This task will also identify the legal amendments that may be necessary to enable the adoption of a risk-based approach and the implementation of an AM process. Meetings with representative stakeholders of different groups (developers, regulators, environmental impact assessment practitioners) in Spain and Portugal were held, as well as a workshop in each country, to gather stakeholders' engagement, experience, opinion, and vision during this assessment.

Due to their experience, all partners of the proposal (both industrial and academic) have strong connections with the main consenting bodies in Spain and Portugal, as well as the main Technological Platforms on MRE in both countries who gather the main stakeholders in MRE. For this purpose, two workshops were organised, and regular meetings were held during the project with national key stakeholders identified in Deliverable 4.1. The aim of these workshops and meetings was to gather the experience of stakeholders and their contribution to the implementation of the suggested risk-based approach.

5. Adaptive management

5.1 General considerations

Adaptive Management (AM) was introduced in Deliverable 4.2 of the WESE project (Bald and Apolonia 2020) and will be described in more detail in the present section. AM can be defined as a systematic and iterative management process intended to reduce scientific uncertainty and associated consequences in terms of likelihood and magnitude of potential impact and improve management through rigorous monitoring and periodic review of management decisions in response to growing knowledge gained from monitoring data.

Consequently, AM does not presuppose that improved decisions will equate to less or more environmental risk, rather only that reduced uncertainties will lead to improved decision-making. It requires decision makers to manage the risk of unacceptable impacts occurring, whilst allowing changes in the environment to be monitored. Monitoring is designed to address specific scientific questions and contribute to the wider scientific knowledge base, which can be used to amend decisions, change monitoring focus, refine policy and improve consenting processes in light of new information.

On a procedural perspective, the AM process can be broken down into a six-step cycle (Andrea Copping and Hemery 2020):

- Conduct baseline monitoring, environmental assessment, and problem identification.
- Define measurable management objectives.
- Design management actions: project proposals and mitigation plans, compensation, habitat enhancement measures, and monitoring.
- Implement the project and conduct follow-up monitoring to collect data after the project has been deployed.
- Evaluate the monitoring results.
- Adjust/adapt the management and monitoring methods considering what has been learned from empirical observation

AM can be applied at several different scales, including at the project scale, where an AM approach is used to address scientific uncertainty and help inform future management decisions (e.g., implementation of mitigation measures) of an individual project, and at the planning scale, using data and outcomes from individual and

multiple projects to inform future regulations and development and management decisions. The data collected may be similar for assessing scientific uncertainty and informing management decisions at both scales, but the spatial and temporal extent of monitoring data collection and the analyses of the data at the two scales may differ (Hanna et al., 2016).

5.2 Precautionary principle

The precautionary principle is used as a preventive action in the face of uncertainty, shifting the burden of proof to the proponents of the activity, exploring a wide range of alternatives to possibly harmful actions, and increasing public participation in decision-making. Principle 15 of the Rio Declaration on Environment and Development (1992) requests that countries apply the precautionary principle to protect the environment. This states that where there are threats of serious or irreversible damage, a lack of dull scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation (United Nations 1992). The EIA Directive[1], Birds Directive[2] and Habitats Directive[3] have been drafted based on a strong influence of the precautionary principle. While application of the precautionary principle provides a rational approach to avoiding irreversible harm, its implementation through the mitigation hierarchy offers reduced flexibility for addressing scientific uncertainty and promoting iterative learning for future developments.

When applied together, AM and precautionary principle need to be carefully weighted. Although both are enshrined in the EU's Marine Strategy Framework Directive (MSFD)[4], these are two very diverse approaches. AM acknowledges that scientific uncertainty of the marine environment will always be incomplete and allows for management actions to be re-adjusted over time to take new scientific information and knowledge developed into account. On the contrast, the precautionary principle states that when uncertainty is high and there's potential for significant environmental impacts, regulators should act on the side of caution. Consequently, no efforts are made to reduce uncertainty nor improving decision making. AM and the precautionary principle are not opposite and may be implemented simultaneously to improve scientific understanding. The concept of precaution can be fulfilled in AM when management

[1] https://ec.europa.eu/environment/eia/eia-legalcontext.htm
[2] https://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm
[3] https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm
[4] https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

objectives defined by regulators and stakeholders are somewhat protective (Lièvre et al. 2016).

5.3 Adaptive Management in the MRE sector

As the MRE sector matures, it is crucial that technology developers, investors and regulators can address and cope with environmental uncertainties in a responsible, cost effective and holistic way, without hindering the progress of this emerging industry. The concept of AM can be used as an effective risk management tool towards decision-making process when the environmental effects are not well understood. The development of plans is time consuming and as they must be time and site specific. AM approach can provide opportunities for project development despite uncertainty and allows for knowledge base improvement for future project consideration.

AM is fundamental for reducing environmental risk in the sector. Key components include the following:

1. Early involvement of all stakeholders
2. Building and maintaining regulatory confidence
3. Utilizing science-based data collection
4. Engaging the local community
5. Initiating adaptive approach in the pre-application phase and continuing through project operation

AM implementation has enabled the deployment of several wave and tidal projects, contributed to the testing of monitoring technologies, and has helped answer some fundamental questions about the environmental interactions of single devices and small arrays. There are several case studies of successful AM implementation in MRE projects, such as the MeyGen tidal project (Scotland), the SeaGen tidal turbine (Northern Ireland) and the DeltaStream tidal turbine (Wales) (Andrea Copping and Hemery 2020). Meygen tidal energy project has applied an AM approach through a staged consenting process.

The first phase of development was implemented with only six turbines which were subject to a comprehensive monitoring program before the deployment of additional devices was granted in subsequent phases by Marine Scotland. Within the Seagen tidal turbine project, AM approach complemented the environmental monitoring plan of marine mammals through a continuous review of monitoring data and management measures by an independently chaired Scientific Steering Group. Finally, DeltaStream

tidal turbine project was licensed relying on a threshold-based approach to AM where acceptable collision thresholds were set using a potential biological removals (PBR) approach (A. Copping et al. 2016).

6. Risk-based approach

6.1 Concept

A risk-based approach is any approach that seeks to inform decision making through an understanding of the scientific uncertainties and associated consequences in terms of likelihood and magnitude of potential impact (Lièvre et al. 2016). In this sense, from the findings of the RiCORE project, the risk-based approaches are to be adopted to reduce scientific uncertainties associated with the consenting of MRE devices.

The identification and explicit incorporation of uncertainty into the assessment process distinguish Ecological Risk Assessment (ERA) from traditional Environmental Impact Assessment (EIA) (Bartell 2008).

ERA is increasingly seen as a way to integrate science, policy, and management to address the wide array of ecological impact assessment problems (Cenr 1999). ERA is a flexible process for organizing and analyzing data, assumptions, and uncertainties to evaluate the likelihood (probability) of adverse ecological effects that may have occurred or may occur as a result of exposure to one or more stressors related to human activities (Hope 2006).

According to Cormier et al. (2013) (adaptation of the ISO 31010), the risk assessment framework comprises four steps (Figure 1):

(i) the **risk identification** specifies the human pressure(s) of concern, which result in impacts to the environment and human well-being, the magnitude and the probability of occurrence of the pressure, and the effects on ecosystem elements (EE) (based on the sensitivity of each EE to each type of pressure)

(ii) the **characterization** highlights the likely impacts on EE

(iii) the **assessment** requires the interpretation of the results, the identification of most relevant pressures and the most critical EE that could be affected, and the evaluation of the total risk

(iv) the whole process ends with the hazard identification and the adoption of alternative **management measures** for hazard reduction or mitigation.

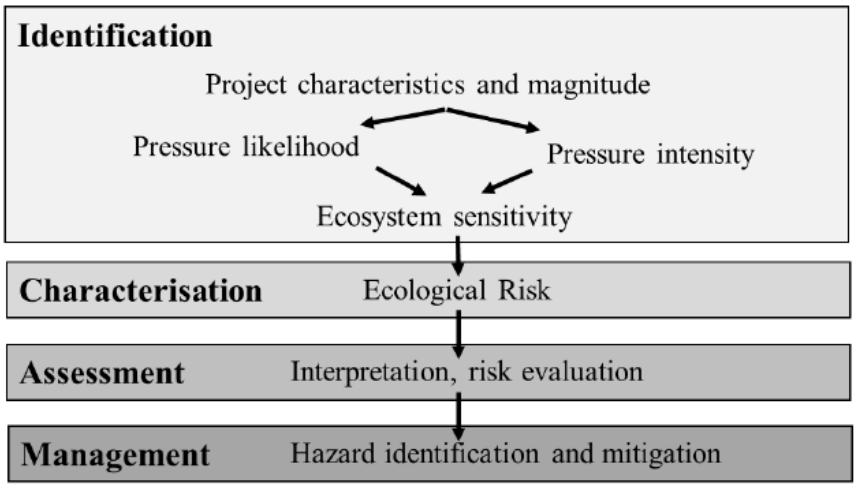


Figure 1. *General framework implemented for the ERA from* Galparsoro et al. (2020)

In the case of MRE, the risk identification comprises the estimation of the: (i) WEC project characteristics and magnitude, (ii) the probability of occurrence, (iii) the intensity of the pressure and the EE sensitivity to pressures (Stelzenmüller et al. 2015).

Some challenges facing ERA include the following (Bald et al. 2015):

- Integrating the concerns of stakeholders and risk managers with the scientific knowledge of risk assessors.
- Conducting risk assessments that encompass large areas and involve multiple stressors.
- Moving beyond effects on individual organisms and species to predicting changes in populations and ecosystems.
- Communicating ecological risks to stakeholders.

ERA can be used to allow developers to take responsibility for decisions on pre-application data gathering, to fully understand the rationale behind any proposed data collection and understand the costs and benefits of any survey work (Harman, Alsop, and Anderson 2004). It also allows developers to understand the risks of not collecting sufficient information to inform an adequate EIA and the subsequent restrictions which might result, in the form of mitigation measures and other license conditions (Sparling et al. 2015).

6.2 Survey, Deploy & Monitor (SDM) Policy

The SDM policy implemented by Marine Scotland is an example of a risk-based approach with respect to project consenting. Following the methodology suggested by the SDM policy, the assessment of the risk of a MRE development is based on the assessments of three parameters: environmental sensitivity, project scale, and technology risk. Each of these is categorized as High, Medium or Low-risk, and then summarized into a single project risk assessment (Figure 2).

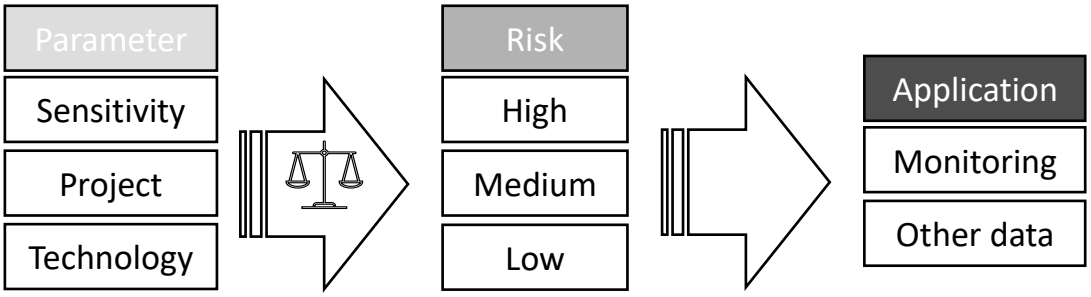


Figure 2. *SDM policy developed by Marine Scotland as an example of a risk-based approach.*

For each environmental sensitivity of concern at the location, a level of Low, Medium, and High-risk assessments will depend on the perceived importance of the location. For example, locations that are protected areas (for habitats or species) would score more highly than other areas.

For project scale, Bald et al. (2015), contributing to the further development of SDM policy guidance in the context of RICORE project, suggested a level of Low, Medium and High-risk depending on three project factors: generation capacity, area occupied by the project (including number of devices), and duration of the project.

For technology, the risk analysis needs to be done for each of the project stages, that is, construction, operation, and decommissioning, taking into account the technology category (wave, tidal or wind) and technology type (Tidal stream - Horizontal axis turbine, Oscillating Water Column…).

Bald et al. (2015) concluded that the application of this policy is appropriate to inform the consenting process, in relation to the perceived relative environmental risk posed by the development:

a) Proposals assessed as high risk or uncertainty a minimum of 2 years site characterization data would be necessary to support an application.

b) Proposals assessed as medium risk or uncertainty: require an approach intermediate to that of High and Low risk schemes. The initial presumption would be that 2 years of site characterization data would be required. However, if Marine Scotland considers after one year that the environmental risk is less than anticipated, or that the data gathered to date have been adequate to inform both the EIA and Habitats Regulation Assessment (HRA) processes, then they would be prepared to discuss relaxation of the requirements for further site characterization, on receptor-specific or hazard-specific bases.

c) Proposals assessed as low risk or uncertainty: require a 1 year of site characterization data (or equivalent) to inform an EIA, HRA (if this is required) and license application is required.

In relation to lower risk proposals, shorter periods of data collection as well as an adequate baseline data would facilitate earlier consenting decisions and more rapid build out of overall low risk projects. Moreover, selection of less sensitive locations can reduce the time taken to obtain the corresponding consent (OES 2016).

6.3 Risk retirement

The concept of "Risk Retirement" is another example of a risk-based approach with respect to project consenting which was developed by Ocean Energy Systems (OES), in the context of the OES-Environmental task (formerly known as Annex IV), developed by Copping et al., (2020).

The steps in the Risk Retirement process are the following (Figure 3):

1. Determine if a likely/plausible risk exists for a particular project.
2. Determine whether sufficient data exists to demonstrate the significance of the risk.
3. Collect additional data to determine whether the risk is significant.
4. Apply existing mitigation measures to determine whether the risk can be mitigated (if so, the risk can be retired); and
5. Test novel mitigation measures to determine whether the risk can be mitigated (if so, the risk can be retired).

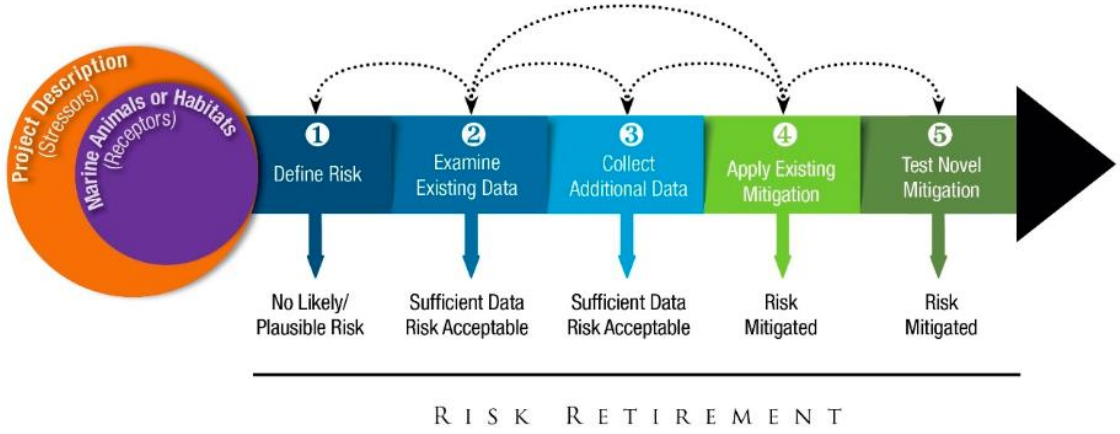


Figure 3. *Risk retirement pathway (taken from (Copping et al., 2020)). Starting from the left, the project must be described (stressors or pressures, orange circle), followed by identifying the presence of animals and habitats that may be at risk receptors, purple circle). Five stage gates follow that allow retirement of risk at each stage. The dotted lines and arrows above the pathway indicate the application of datasets from previously consented MRE projects and research studies that inform each step in the process and create feedback loops (data transferability).*

Following Risk Retirement pathway, those interactions that are not causing harm to the marine environment could be "retired," focusing the research and the monitoring studies toward higher priority interactions. In this sense, at each step in of the pathway, there is the opportunity to determine if the risk can be retired. Moreover, the Risk Retirement process helps to determine which interactions may need further data collection or mitigation applied to reduce the risks to an acceptable level, providing feedback among steps. If a risk from a proposed project cannot be mitigated or reduced, this risk-based approach might suggest that redesign or abandonment of the project is necessary. Between and among the five steps, there is a need to examine available data and mitigation measures, so sufficient data are needed for risk retirement. According to Copping et al. (2020), the Risk Retirement can increase understanding of the environmental effects, supporting more efficient consenting processes and reducing scientific uncertainty, assisting regulators in their determinations and inform developers and other stakeholders during the consenting process.

7. Legal considerations

This section presents a summary of D4.2 whose main objective was to review the current licensing process of wave energy in Portugal and Spain and to carry out a comparison between both Member States' consenting systems from a legal and consenting administration point of view.

7.1 Spain

The approval procedure for a marine energy project in Spain is based on the following legal instruments (Figure 4):

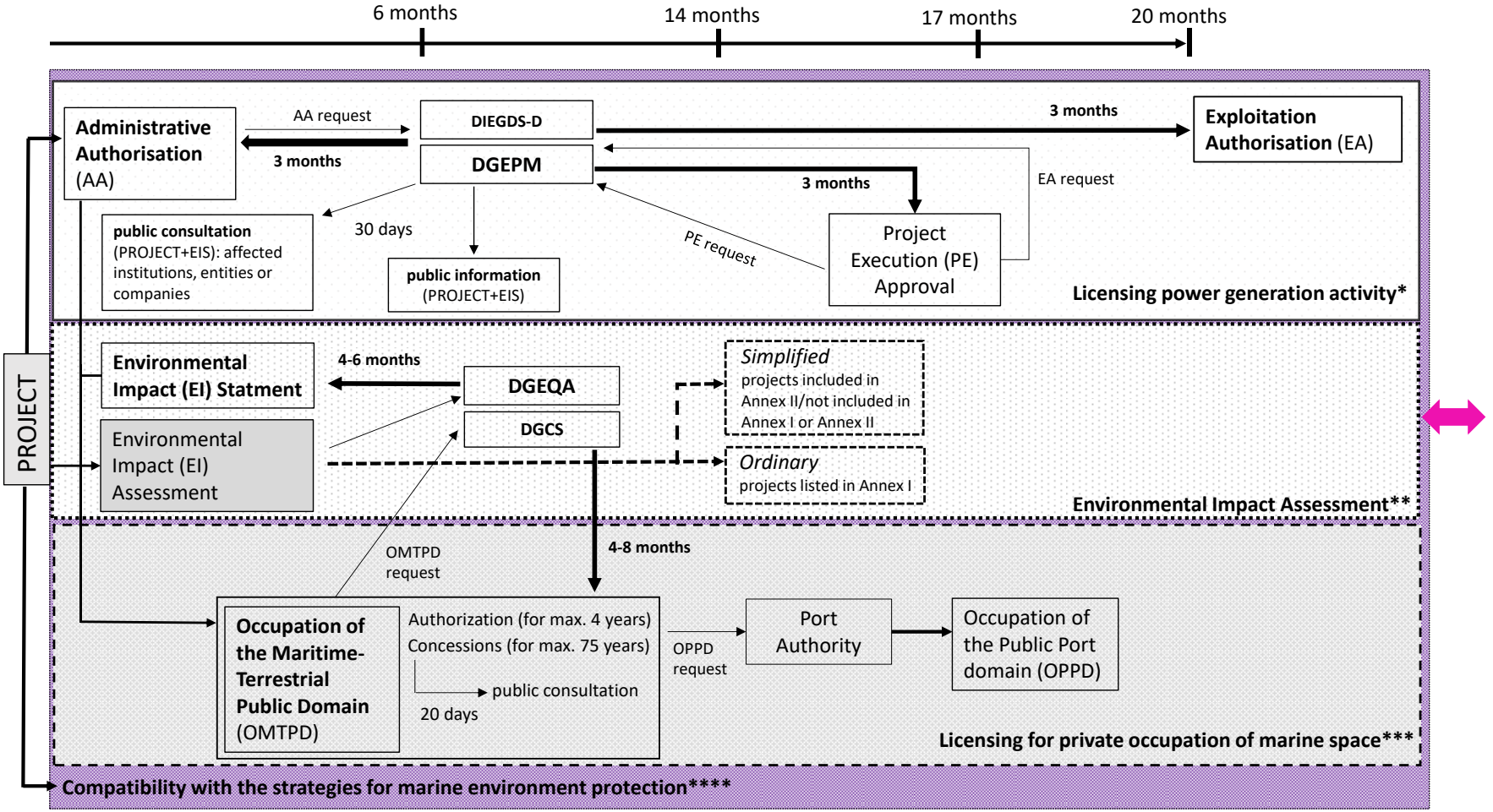
a) Licensing power generation activity: Royal Decree 1028/2007 establishes the administrative procedure for processing applications for electricity generating facilities in territorial waters. The competences over electricity production, transmission and distribution facilities are held by the General State Administration and shall be exercised by the **Directorate General for Energy Policy and Mines (DGEPM)** of the current Ministry for the Ecological Transition and Demographic Challenge (METDC), as the substantive body, to grant administrative authorization for the construction, extension, modification and closure of facilities, without prejudice to those expressly attributed to the Council of Ministers.

b) Licensing for private occupation of marine space: Law 2/2013, of 29 May, for protection and sustainable use of coasts. This law amends the previous Coastal Law of 1988. It provides the legal framework for occupation of the territorial sea, as well as governing issues affecting the fishing sector and safety conditions for maritime navigation. It is the responsibility of the Ministry for the Ecological Transition and Demographic Challenge (METDC), through the **Directorate General for Sustainability of the Coast and the Sea (DGSCS)**, to grant the authorizations and concessions for the occupation of the maritime-terrestrial public domain (MTPD) required for the installation of a marine electricity generation park. In the case of occupation of the public port domain, the competent **Port Authority (PA)** will grant the corresponding authorization or concession, in accordance with the provisions of the applicable sectorial legislation.

c) Environmental Impact Assessment: *Law 21/2013, of 9 December, of environmental assessment* establishes the EIA procedures for plans and programs, i.e. the so-called Strategic Environmental Assessment (SEA) and the EIA of projects. The Ministry for the Ecological Transition and Demographic Challenge (METDC), through the **Directorate General for Environmental Quality and Assessment (DGEQA)**, will act as the environmental body in the environmental assessments.

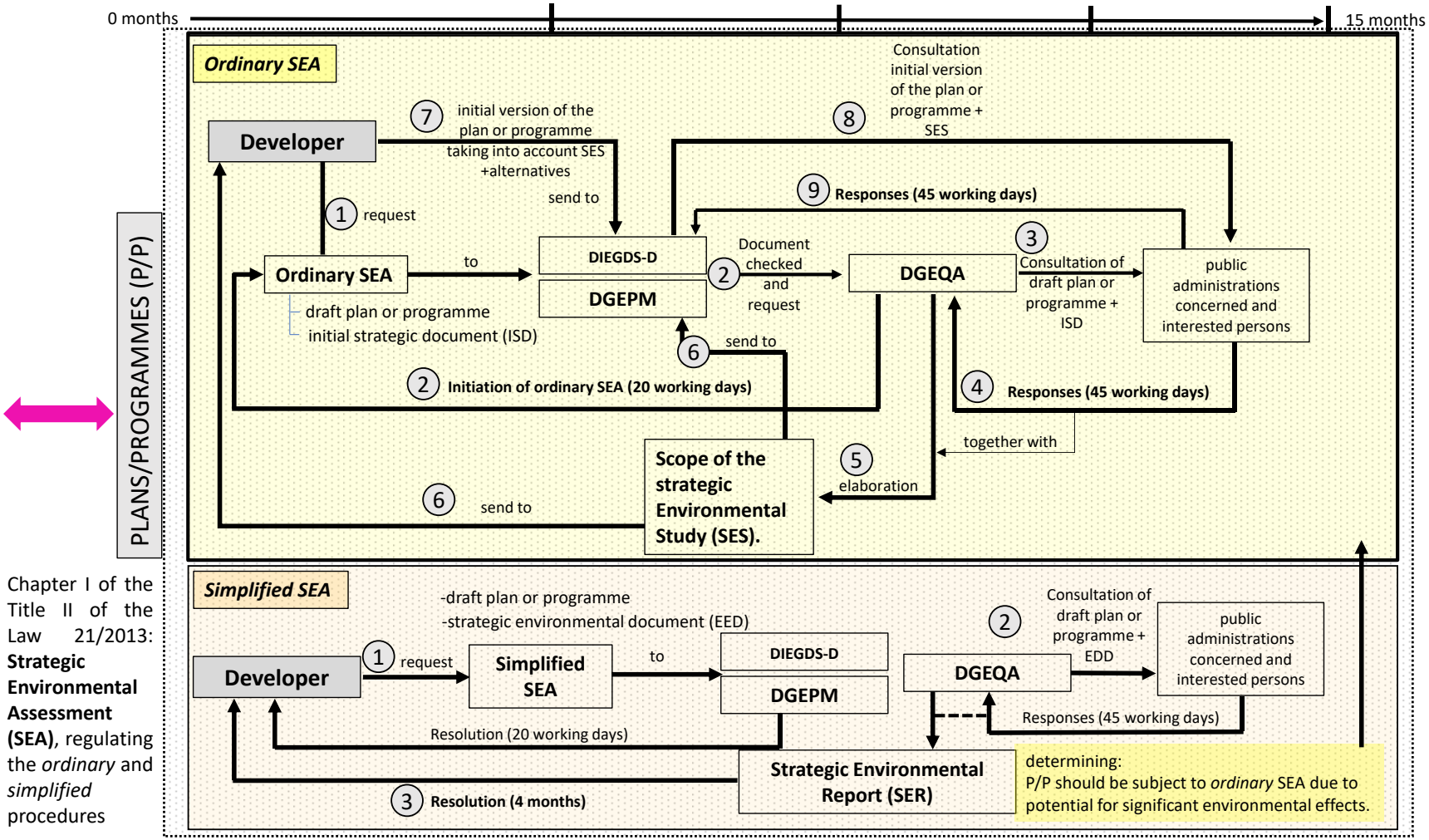
d) Compatibility with the strategies for marine environment protection: Royal Decree 79/2019 of 22 February regulating the compatibility report and establishing the criteria for compatibility with marine strategies. This RD develops the consenting procedure of compatibility reports to be issued by the Ministry for Ecological Transition and Demographic Challenge (METDC) regarding "the compatibility of the activity or spill with the corresponding marine strategy in accordance with the criteria to be established by regulation", required by article 3.3 of Law 41/2010, of 29 December, on the protection of the marine environment.

The procedure that is regulated by the legislative texts is framed within the framework defined by the Integrated National Plan for Energy and Climate (PNIEC) 2021-2030 and the Maritime Space Planning Plans (POEM) in response to Royal Decree 363 / 2017, of April 8, which establishes a framework for planning maritime space. Both plans are currently under development and will be key instruments that will define the objectives and planning of future marine energy developments.



** Royal Decree (RD) 1028/2007; **Law 21/2013; ***Coast Law 1988 amended by Law 2/2013; ****RD 79/2019*

Figure 4. *Summary of the consenting process in Spain (for projects). DGEPM: Directorate General for Energy Policy and Mining. DIEGDS-D: Department or Division of Industry and Energy of the Government Delegations or Sub-Delegations of the province. DGEQA: Directorate General for Environmental Quality and Assessment. DGCS: Directorate General for the Coast and Sea.*



Chapter I of the Title II of the Law 21/2013: **Strategic Environmental Assessment (SEA)**, regulating the *ordinary* and *simplified* procedures

Figure 4 (cont). *Summary of the consenting process in Spain (for programmes). DGEPM: Directorate General for Energy Policy and Mining. DIEGDS-D: Department or Division of Industry and Energy of the Government Delegations or Sub-Delegations of the province. DGEQA: Directorate General for Environmental Quality and Assessment. DGCS: Directorate General for the Coast and Sea.*

7.2 Portugal

One of the most relevant regulations in the consenting process of Portugal is the recently updated Decree Law 76/2019, which sets the legal regime applicable to the exercise of electricity production, transport, distribution and marketing activities and the organisation of electricity markets. Project developers must obtain the following six consents before installing a project (Table 1): i) concession, license or authorisation for the private use of marine space (TUPEM); ii) Reserve capacity; iii) Production license; iv) Exploration license; v) accessory facilities onshore and vi) EIA. A developer can apply for all licenses at the same time, however, the procedure to obtain each of these licenses is sequential and there are legally prescribed time frames for each step of the procedure.

For projects with a power capacity up to 10 MW, DGEG is the authority in charge of licensing electricity production linking with other authorities for specific permits: the Directorate General for Natural Resources, Safety and Maritime Services (DGRM) for the TUPEM, CCDRs or APA for the environmental license and local city hall for onshore facilities.

The reserve capacity is a title issued by the grid operator (EDP Distribuição), with the requested power capacity on behalf of the applicant and encompasses a production license and an operation license. Obtaining the capacity reserve title is a necessary but not enough condition of the licensing process. After guaranteeing a reserve capacity in the grid, the applicant must submit the Production License application followed by an Exploration License application, to DGEG.

The procedure to obtain the TUPEM will depend on the designation of the use in the area where the project is to be installed, which is established in the Situation Plan, the instrument setting the baseline for the national MSP. If the area to be used by the project is already designated for renewable energy production, the application for obtaining TUPEM is carried out directly by DGRM. If the area to be used by the project is not designated for MRE production activity, the developer may propose the amendment of its designation by submitting an Allocation Plan, which, if approved, automatically changes the Situation Plan through Council Minister´s Resolution.

Consultation is usually required as part of the legal licensing process. It is usually made after the DIA is delivered to the authorities for approval. Advices are asked by the licensing authority to several statutory consultees namely Institute of Nature Conservation, port authorities and several public authorities responsible for marine

resources management. There are informal consultation activities implemented by the developers during the licensing process.

Regarding the licensing process in test centers in Portugal, the regulation applied for the Portuguese Pilot Zone, Ocean Plug (included in the MSP), differs completely from the parallel processing that developers have to go through as there is a desire to trial a one-stop-shop approach.

7.2.1 Environmental Impact Assessment

The EIA Directive has been amended by the Directive 2014/52/EU, which was transposed to Portuguese EIA legal system (RJAIA) through DL 152-B/2017. This amendment aims at improving the environmental assessment of projects through procedure simplification. Among other amendments, the new EIA Directive includes the establishment of mitigation measures as well as monitoring programs.

Both the issuance of the TUPEM and production license requires a favourable or conditionally favourable DIA and, when required, a favourable or conditionally favourable Decision on the Environmental Compliance of the Detailed project design (DCAPE) or, if applicable, a favourable or conditionally favourable Environmental Appraisal Statement (DIncA).

Since the scoping phase is not mandatory, the EIA procedure starts with a screening phase to decide whether the project is subject to an EIA. If an MRE project is listed under Annex II of RJAIA, a full EIA is required, and APA is the licensing authority. In the case of MRE projects not listed under Annex II of RJAIA, i.e., with a capacity below 50 MW (or below 20 MW when located in sensitive areas) or wind farm projects with less than 20 wind turbines (or less than 10 wind turbines when located in sensitive areas) a case-by-case screening procedure is carried out.

As per the recent amendment of DL 215-B/2012 through DL 76/2019, the Environmental Appraisal (AIncA) procedure undergone some changes. The revoked article stated that MRE projects not covered in the RJAIA and to be located within areas belonging to REN, Natura 2000 Network sites or Protected Areas, were subject to an AIncA procedure. The added articles state that MRE projects not covered in the RJAIA are subject to an AIncA procedure only if located within Natura 2000 Network.

If the project is not subject to an AIA or EA, the developer may proceed in the licensing procedure provided a favourable advice on the project installation on the proposed location is submitted to the regional authority (CCDR).

Strategic Environmental Assessment (SEA) is mandatory for the Situation Plan, for which was already performed and published in 2018.

7.2.2 Marine Spatial Planning

The MSP is used as a decision-making tool. The MSF Directive was transposed into Portuguese law in DL 38/2015 (amended by the DL 139/2015), laying down the basis for the Planning and Management of the National Maritime Space (LBOGEM). It defines the legal framework that allows for the implementation of MSPs in the whole national maritime space, from the baselines until the extended continental shelf (beyond 200 nm). The MSP system consists of a set of instruments developed under two complementary action levels:

1) Strategic instruments of the planning and management policy, from which the National Strategy for the Ocean 2013-2020 stands out and

2) Two legally binding (on public and private entities) MSP instruments: Situation Plan and Allocation Plan.

A preliminary baseline for the SP has been developed under the POEM, which has therefore established the situation reference for the MSP in the continent subdivision. DGRM is responsible for the coordination of the MSP. The Allocation Plans are submitted to EIA, whereas a SEA is mandatory for the SP. In 2019, the National Maritime Spatial Plan (PSOEM) was approved establishing the licensing regime for private use of the maritime space including marine renewable energies.

Table 1. *Characteristics of the licensing process.*

Parameter	Relevant applicable laws	Licensing Authority	Name of document
Private use marine space	DL 38/2015 (amended by DL 139/2015) – transposes Directive 2014/89/EU and develops Act 17/2014 which sets forth the LBOGEM	DGNRSMS	TPSU
Water Resources Use	DL 226-A/2007 (amended by Act 44/2012) DL 108/2010 (amended by DL 136/2013)	EPA	TUWR

Energy Production	DL 172/2006 (6th amendment through DL 215-B/2012 and 11th amendment through DL 76/2019) Ordinance 243/2013 (amended by Ordinance 133/2015)	DGEG – power capacity up to 10 MW Secretary of State of Energy – power capacity higher than 10 MW	License on power production and grid connection
Accessory facilities onshore	DL 555/99 (amended by DL 136/2014) - RJUE	Local planning authority	Planning Permission
EIA	DL 151-B/2013 (amended by DL 152-B/2017) – transposes Directive 2014/52/EU	EPA – location in sensitive area DGEG – project not located in sensitive area) CCDR – EA	EIA/EA

8. Stakeholder insights - Workshops

8.1 Context

Stakeholder's experience can bring valuable insights on the current challenges faced in the licensing process and on potential paths to overcome these barriers. The planning of two workshops, one with Portuguese and another with Spanish key stakeholders, aimed to gather their experience and their contribution to the implementation of the suggested risk-based approach.

Due to the current health crisis caused by COVID-19, both workshops were held through video call (Microsoft Teams). Each had a duration of 120 minutes and were conducted in Portuguese and Spanish, respectively. Potential participants were chosen based on the WESE's stakeholder database built under Task 4.1(Galparsoro et al. 2019). Although the objective is common to both workshops, the methodology, targeted audience, and key objectives followed a distinct approach to adapt to each country's picture. Hence, this section provides a detailed description of each event as well as key takeaways from each working group.

The outcomes from both workshops will be considered in Task 4.4 of WESE project, which encompasses the development of a technical guide of recommendations within the framework of the WESE project as a tool to overcome the barriers associated with uncertainty in the consenting processes in both countries.

8.2 Portuguese workshop

The Portuguese workshop was held on the 23rd June 2020 and entitled 'Marine Renewable Energy: how to manage risk in the environmental licensing process?'.

8.2.1 Objectives

The workshop aimed to discuss, with relevant stakeholders, the current licensing procedures and future best practices towards efficiency improvement and the development of the MRE sector in Portugal. One of the mechanisms being proposed to reduce the impact of uncertainty on environmental licensing is based on adaptive risk-based management. Thus, this workshop investigated three main aspects:

1) Identification of barriers to the environmental licensing process.
2) Discussion on the feasibility of implementing an AM and risk-based approach in the environmental licensing process

3) Contribution to the development of a set of recommendations on the use of AM in environmental licensing.

8.2.1.1 Agenda

09:00 – 09:10	**Welcome**
09:10 – 09:20	**Context** • WESE project • Environmental licensing in Portugal • Risk management in the licensing process • Workshop objectives
09:20 –10:00	**Discussion I: Criteria and information available for environmental assessment**
10:00 –10:15	Coffee break
10:15 – 10:55	**Discussion II: Environmental risk analysis and legal procedures**
10:55 – 11:00	Wrap up

8.2.1.2 Participants

The workshop targeted regulatory entities involved in the environmental licensing procedure of MRE projects in Portugal. A total of 11 representatives of the following 6 entities attended the online event (Figure 5):

1) Directorate General for Energy and Geology (**DGEG** – Direcção-Geral de Energia e Geologia)
2) Directorate-General for Cultural Heritage (**DGPC** - Direcção-Geral do Património Cultural)
3) Directorate-General for Natural Resources, Safety and Maritime Services (**DGRM** – Direcção-Geral de Recursos Naturais, Segurança e Serviços Marítimos)
4) Institute for Nature Conservation and Forests (**ICNF** – Instituto da Conservação da Natureza e das Florestas)
5) Lisboa and Vale do Tejo Portugal Regional Coordination and Development Commission (**CCDR N** – Comissão de Coordenação e Desenvolvimento Regional do Norte)

6) Norte Portugal Regional Coordination and Development Commission (**CCDR-LVT** - Comissão de Coordenação e Desenvolvimento Regional de Lisboa e Vale do Tejo)

Unfortunately, the Portuguese Environmental Agency (**APA** - Agência Portuguesa do Ambiente) couldn't attend the workshop.

Figure 5. *Participants in the Portuguese workshop*

8.2.2 Methodology

Along with the invitation to participate in the workshop, support material was shared with potential attendees, as preparation for the discussion. Topics covered included a summary of the environmental licensing in Portugal (already covered in detail in *D4.2 - Review of consenting processes for wave energy in Spain and Portugal focusing on risk-based approach and Adaptive Management*), and two examples of an approach based on risk management SDM policy and risk retirement approach.

As shown in the agenda, the workshop was structured in three parts, to accommodate an introduction to the workshop context, main topics covered and objectives, and two moments of discussion. A set of questions were presented to encourage participation in each session (Table 2).

Table 2. *Guiding questions for working group discussions.*

Discussion I: Criteria and information available for environmental assessment
1. What criteria do you use to evaluate projects and frame the technical advice?
2. Is the information sent by the proponent enough?
3. What are the main information gaps?
4. Do you already use risk assessment in the analysis of projects?
Discussion II: Environmental risk analysis and legal procedures
5. If there is a lack of information, how do you deal with the situation to support the decision?
6. Is there room to propose a risk analysis procedure in the current licensing process?
7. How could this procedure be implemented? (e.g., good practice guide, legal document with regular review)

8.2.3 Results

Overall, the discussion was productive and insightful. Attendees were participative, exposing different perspectives and opinions in a clear and transparent way. The discussion followed an appropriate pace. An effort was made to answer the guiding questions shown in Table 2 in each of the working group sessions.

The workshop started with a brief introduction where the WavEC team explained the objectives of the session

8.2.3.1 Criteria and information available for environmental assessment

The WavEC team set the floor by mentioning this first discussion aimed at covering topics such as how the lack of information is felt by the regulatory bodies, with focus on the requests that are submitted, and whether they feel the need to complete the information submitted by the proponent (which should already follow the prerequisites described in legislation regarding EIA). In addition, participants were asked how frequently they, as an entity, request additional information from proponents and the reason why these completeness issues arise.

Representatives from CCDR N shared their experience with two MRE projects explaining the main challenge they faced was in framing them in the current legislation. Windfloat project, in Povoa do Varzim, and Windfloat Atlantic (WFA), in Viana do Castelo, didn't fit the EIA regime in terms of capacity (the devices' capacities were both below the thresholds set out in the RJAIA), nor the EA regime that existed at the time.

It was stressed that proponents frequently face funding constraints. Sea operations are costly, therefore monitoring activities for small scale projects are usually either excluded or focus only one or two elements which doesn't allow for an integral impact analysis. Furthermore, proponents do not always understand information requests.

CCDR N referred that proponents of innovative projects are uncertain of what they plan to implement. Both Windfloat and WFA projects were introduced in an embryonic phase. The proponents themselves are not familiar with the procedures and information requests, and therefore do not communicate certain important steps to the administration. DGPC added to this by mentioning that communication flaws between the proponent and the EIA authority are also a result of confidentiality issues and project dynamic characteristic of innovative projects. ICNF also mentioned the recurring secrecy issues regarding the WaveRoller project in Peniche that ICNF faces. According to them, the proponent shares only strictly necessary data and frequently does so on a last-minute basis. On this matter, DGRM, stated that often they are informed about the beginning of operations by other DGRM service structures other than the direction of environmental and sustainability services, such as the navigation office. They consider that technology developers must pay close attention when complying with the conditions included in an EIA or TUPEM and alerting entities when they are expected to carry out certain operations. Although he agrees that operating in the EMN is complex and challenging, they also believe that creating chains of communication is crucial to have all stakeholders involved in the development of a given project.

CCDR N explained there was a general uncertainty amongst all entities involved regarding the scope and parameters that should be monitored in the first project. This barrier was however overcome in the second project because of the experience acquired previously.

Regarding criteria, ICNF stated that there's a need to be more prospective when issuing opinions. Given the potential of the Portuguese coastline, there is a risk of having several micro projects disseminated throughout the territory. Whereas each one may not pose major impacts at any level (species, ecology, physical dynamics, local

socio-economy, archeology, etc.), adding all them up will certainly pose major issues, especially social impacts. DGRM had a somewhat diverging opinion on this topic since they see the land connection points to transport energy as a hindering factor to the dispersion of MRE projects along the Portuguese coastline while there is still no alternative to using the energy produced in any other way.

CCDR N also mentioned another issue the entities struggle with when dealing with the EA legal regime: the deadline for request of additional elements is too short, giving little time for the entities to analyze and identify with detail which type of data is missing.

DGPC, briefly introduced the existence of a guidance with procedures that archeologists must follow on the parameter patrimony within the scope of EIA and TUPEM issuance. As a result, proponents frequently follow strictly the guidance and the administration doesn't request for further information event if needed considering the project specificities. Projects to be deployed in Scotland, for example, include initial survey work to characterize the environment. He noted a significant difference in the procedures post risk analysis, as Scotland has a standardized methodology with a set of defined procedures in case of detection of archaeological remains or heritage assets that were not known a priori. In Portugal, this situation turns out to be volatile vis-à-vis the service provider that performs the archaeological monitoring work.

8.2.3.2 Environmental risk analysis and legal procedures

The second working group session aimed at finding solutions for the challenges discussed previously with focus on the adoption of a risk-based approach, as introduced in the opening session. In particular, how to proceed in the face of weakly substantiated information on potential impacts, on the grounds of monitoring and assessment. The team wanted to discuss how, before project deployment, the proponent should proceed in order to provide comprehensive information to validate the assessment, so to avoid e.g., a heavy load of monitoring activities during project operation. Secondly, the team wanted to understand how we can include the risk analysis in order to facilitate the licensing procedure. In other words, how, instead of focusing on the impacts' quantification, we could identify the most relevant and exclude the least relevant monitoring elements. Finally, how, during pre-installation licensing phase, both regulators and proponents should proceed in order to bring confidence to the overall project operation phase.

CCDR N explained that the significant legal void, together with several uncertainties from both the proponents and the administration was 'filled' by an order issued in 2012 by the Ministry of Environment with the procedure framing. This allowed for a

permission to carry out an EA being granted to the Windfloat project. WFA specifically was only subject to EA because the process took place before the changes resulting from DL 76/2019. Prior to this change, projects could be subject to EA as long as they were not part of the RJAIA but were located in an ecological reserve. In this case, the cable was in an ecological reserve, so it could be subject to an EA. Otherwise, there would be no suitable legal environmental framework. After adapting the regime, the next step was on scope definition involving the proponent, CCCDR N and consulted entities. After all entities were familiar with the project, there was an initial request for elements to the proponent. Some issues arose in the information provided because the proponent tended to compare the project with onshore wind farms regarding potential impacts.

ICNF recalled a similar experience with the WaveRoller project in Peniche, which was only subject to EA and subsequent monitoring activities because of the terrestrial part of the subsea cable.

Regarding the WFA, legislation itself posed barriers regarding EA because, initially, there was no confirmation as to whether the project could be assessed in scoping phase or in execution phase. CCDR N and the Ministry had to find a way to carry out the assessment in project design phase due to the early phase in project development. This conditioned the EIA itself, i.e., the type of data to be presented initially and at a later stage (with greater knowledge of the deployment area).

According to CCDR N, there is an urgent need for specific legislation in the scope of RJAIA that fits this type of projects, i.e., with a different capacity threshold that complements the already existing 50MW threshold. RF also suggested these projects must be subject to EIA. CCDR N feels the need for more communication about the status of the project. With that information I hands, they are able to position themselves and get started with a series of actions that have to be formally verified. Improving communication with the public in general, especially with the fishing community, is crucial. During the Windfloat project, a concern on the potential negative environmental impacts was spread along the community. Therefore, CCDR N thinks that public consultation are windows of opportunity to raise awareness and clarify doubts and create communication channels between the various agents involved in the process. On this matter, CCDR N mentioned the potential socio-economic impacts that can hinder project deployment such as conflict of use of the space with the fishing community as well as the negative public perception caused by lack of information.

Within the scope of Windfloat and Windfloat Atlantic projects, CCDR N felt the need for a tool or a manual that provided guidance on the process.

CCDR LVT referred that a risk analysis underlines every EIA regarding legal framework and procedures, although not directly related to the risk-based approach itself: 'I think the environmental assessment has more similarities to a risk management analysis than the EIA itself when it comes to critical factors for decision making in early stages of the project. Within the scope of CCDR LVT, which does not have a close contact with MRE projects and no in-depth expertise, the risk management translates into the assessment of impacts and their significance, i.e., by attributing a magnitude, significance and durability to each risk, a risk analysis is being conducted. Although the analysis often focuses on a specific environmental factor, the final decision always considers all factors involved allowing for an integrated analysis which is one of the main characteristics of a risk-based approach.

DGRM intervenes in these processes in two ways: in the EIA when subject to this procedure, and in the issuing of TUPEM. According to them, the lack of knowledge about the ocean, from living communities to geology and topography, calls for the need of a continuous risk assessment approach, either complementarily or in a way that the legislation probably does not directly provide. Regarding the request for TUPEM, to which all the entities participating in the workshop have the chance to contribute to, ask for additional elements and provide their opinion which will later be integrated in the title. Sometimes, the legislation deadlines are too tight so DGRM has flexibility when receiving late advices that the team considers have relevant information to influence the final decision.

DGRM representative was asked whether there should be more integration of the work for TUPEM's request with the request for analysis on a case-by-case basis for the environmental licensing procedure given the current change in legislation. He stated that more important than that is to see if there are any steps that can be reduced to save time to the operator. An EIA that includes elements in the sea and in land, can be much more comprehensive than the title, which is more specific. Furthermore, entities consulted can differ significantly. So, these are issues that must be weighted when attempting for greater integration.

According to DGRM, a high degree of trust is deposited in the MRE operators upon deployment as there is little monitoring of operations by the regulatory entities in projects deployed in offshore waters. Therefore, the Government, and the public administration in particular, have no way to ensure the operator is implementing the

monitoring plan. ICNF argued that although there is a dependency on the reliability of information provided by the proponent, regulators can't fall 'hostages' and need to work out a solution, e.g., by using monitoring systems and tools that allow for validation of data provided.

CCDR LVT representative views a risk analysis as comprising two distinct stages: a marine spatial planning stage followed by an analysis focusing on the project and its licensing. Regarding connection to land, conflict of uses with other marine activities and designated areas (e.g., marine protected areas). This analysis would afterwards be employed when drawing monitoring activities during planning phase. Therefore, risks as well as potential and preferred areas would be assessed a priori, hence benefiting the project and minimizing potential environmental impacts. Assessment costs would be reduced because monitoring would be already focusing on a narrower area identified initially. Attention should be equally paid in implementing a risk analysis also in the MSP and management process and not just in the licensing procedure.

DGRM reacted to CCDR's comments by explaining the Situation Plan (SP) was subject to a Strategic Environmental Assessment (SEA), with contribution from all entities present. Therefore, the areas identified with potential for MRE deployment were consented by all relevant stakeholders which means a risk analysis was already carried out at MSP level. Nevertheless, he stated an additional case by case risk analysis could be carried out during TUPEM issuance.

CCDR N agreed that any project subject to an EIA or EA was to some extent already subject to a risk analysis although she acknowledges the approach might not be the one under discussion. In any case, there is already a context for a risk-based approach to be integrated in the current EIA framework. For example, the risk of an oil spill is already integrated in the EIA, and mitigation measures are defined. However, other risks for which a procedure is still not defined would benefit from this methodology as long as procedures are not duplicated. According to their views, a risk-based approach should be integrated in the existing procedure so that this data is considered when issuing the permit.

It was mentioned that there's a need for more comprehensive communication between regulatory bodies involved in the process, and that the SEA results are indeed a good starting point to start quantifying impacts in those dedicated areas. When asked on how to assess areas excluded from the Situation Plan, DGRM explained that a project (either public or private) to be implemented in a given area not yet included in the PS need to be first subject to an AP. Since AP is considered a project, this given project

will follow the RJAIA legal framework, hence will be subjected to an EIA procedure before being included in the PS.

WavEC team asked whether the participants would be interested in elaborating a joint document (without any legal bond) describing how a risk-based approach could be a useful tool regulators can consult when issuing the advice. This could take the form of a best practices guide with recommendations for its implementation. To CCDR N, although guidelines are usually useful, they tend to be used in a broad way which results in situations where proponents are too dependent on them to be able to adapt the procedure to issues specific to each project and which the guideline cannot cover. Proponents do not feel comfortable when implementing measures that the guideline doesn't contemplate. However, MRE, as an innovative sector, could still benefit from such document which could use lessons learned from previous projects deployed in Portugal. Information regarding experience and results derived from regulators, promoters and other consultees could help future deployments. This information should be more oriented to projects looking at reaching commercial scale because the first experimental phase of the project can give critical inputs for the following stages. In CCDR N's case lessons learned from the Windfloat project's monitoring activities were employed in the WFA project. The guidance could be particularly valuable for projects that will not be subject to any environmental regime in project design phase but in execution phase instead considering the lack of time for additional elements request as mentioned previously.

CCDR LVT reinforced the existing risk analysis carried out for projects subject to EIA and believe it would be easy to adapt this procedure towards the adoption of a risk-based approach. They agreed with the elaboration of a guidance and proposed an update of the section dedicated to EIA in the document WavEC prepared in 2016. The document should act as a practical guide providing benchmarks for assessment, as opposed to a set of rules to be strictly followed to allow for adjustment depending on project and location specifications. CCDR LVT also reminded the group on the existence of the scoping phase in the EIA process which is not mandatory according to the RJAIA but that would play a crucial role in prioritizing the relevant elements that need assessment since an early stage of the project.

WavEC team asked the participants whether it would make sense and would potentially benefit the regulatory bodies to make that a mandatory process, as it already happens in Scotland. CCDR LVT and CCDR N stated it is a topic that has been under discussion for several years already and the increase in costs and time have been the reason dictating the decision to maintain it as a facultative stage. From her point of view, the

scoping phase should be mandatory for certain project typologies. DGRM reminded that data acquisition is highly budget and time dependent in the MRE sector so there should be a sensitivity as to the constraints of information requested from each project. Additionally, he stressed the precautions needed when transposing an administrative procedure from land to sea. In the case of our EMN (National Maritime Space), a planning system with dynamic and evolutive features was created as opposed to the same procedure in land which is assessed consistently.

From CCDRN's view, although the scoping phase is a very important stage which has been underestimated, some projects don't need to go through this process. The decision to carry out the scoping phase depends on the maturity of the team, proponents, and the administration itself. So, she does not believe turning it into a legally mandatory stage is the most adequate procedure.

Participants agreed it has been a learning experience for all and showed availability to contribute to the elaboration of a best practices' guideline on the adoption of a risk-based approach in the environmental licensing procedure.

8.3 Spanish workshop

Spanish working group was held in 24th of June in 2020. It was untitled "Is it possible to integrate the adaptive risk-based management approach in the approval procedures for marine renewable energy projects in Spain?"

8.3.1 Objectives

The main objectives of this working group were:

• Discussion about the barriers in the environmental approval procedures for marine energy with the Spanish regulatory authorities and with other agents involved in the authorization process in Spain.

• Discussion about the legal feasibility of implementing adaptive risk-based management approach as a mechanism to overcome this non-technological barrier associated with the uncertainty of possible environmental impacts in marine energy projects.

On the other hand, this working session contributed to the communication among the various agents involved in the marine energy project approval process, which includes project developers and promoters, policy regulators, consenting and surveying service providers (including technology providers, Environment Impact assessment

practitioners, consenting and surveying consultants), energy companies, academic experts (both in science and policy).

Moreover, the results of this work session contributed to the Prior Public Consultation process for the preparation of the Roadmap for the development of Offshore Wind and Marine Energies in Spain within the framework of the PNIEC 2021-2030.

8.3.1.1 Agenda

The workshop was structured in three different parts: firstly, the introduction, consisted of a brief presentation of the WESE project, the description about the approval procedures for marine energy projects in Spain, and about the concepts associated with adaptive risk-based management approach; secondly, the discussion consisted on some questions formulated to the participants stimulated by the AZTI team; thirdly, the summary and the main conclusions of the working session.

The workshop had a duration of 120 minutes, with the following agenda:

11:00 – 11:05 **Welcome**

11:05 – 11:35 **Introduction**

- Introduction to the WESE project
- The approval procedure for marine renewable energy projects in Spain
- Introduction to adaptive risk-based management approach
- Objectives of the workshop and methodology

11:35 –12:15 **Discussion I:** Legal feasibility of the implementation of adaptive risk-based management in the environmental authorization process of marine renewable energy projects in Spain.

- Introduction
- Discussion about the first block of questions

12:15 –12:30 **Coffee break**

12:30 – 13:10 **Discussion II:** Legal feasibility of the implementation of adaptive risk-based management in the environmental authorization process of marine renewable energy projects in Spain.

- Introduction
- Discussion about the second block of questions

13:10 – 13:20 **Conclusions and summary of the working session**

8.3.1.2 *Participants*

The working group was attended by 27 participants, main actors in the authorization process for renewable marine energy in Spain, corresponding to the competent Administration and representatives of the Spanish MRE industry: 7 environmental conservation and protection managers, 13 marine researchers, 1 energy manager, 4 energy commercial users, 1 engineering commercial users and 1 environmental legislation expert (Table 3).

8.3.2 Methodology

Together with the invitation to participate in the working group, *a set of questions* were sent to the participants as a basis for the discussion:

- What do you think is the main barrier in the environmental approval procedures for MRE projects in Spain?
- Do you perceive the uncertainty about environmental impacts as a barrier in these procedures?
- How do you manage this uncertainty when justifying the decision taken?
- Which are, in general, the main information and/or existing gaps of knowledge for this type of project?
- Do you consider that the implementation of adaptive risk-based management approach is feasible in the authorization procedure for the development of MRE projects in Spain? Where in the authorization procedure do you think it could be implemented?
- How could it be implemented (legal document, good practice guide, etc.)?

Each participant could answer each question in real time as a post-it or virtual notes through a link to https://ideaboardz.com platform which was shared with them in the chat of Microsoft Teams (Figure 6).

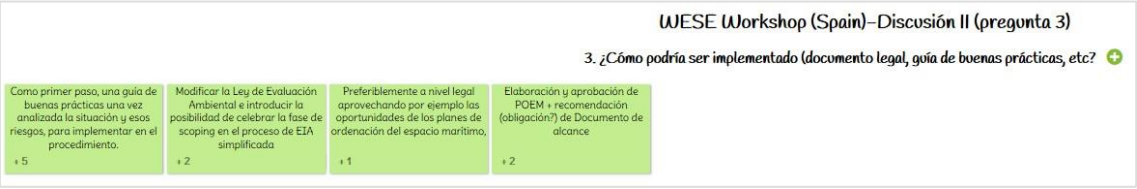


Figure 6. *Viewing of the responses on the https://ideaboardz.com platform.*

Table 3.*List of participants*.

	Group	Sector	Organization
1	Public authority	Conservation / protection	MITERD including representatives from: • Directorate of Sustainability of the Coast and the Sea / Sub-Directorate of Sea Protection • DG Energy Policy and Mines • Subdirectorate General of MTPD • Biodiversity Directorate
2	Public authority	Energy management	IDAE
3	Scientific Community / Consulting	Research	PLOCAN
4	Public entity	Research	BIMEP
5	Public entity	Research	CENER-CIEMAT Foundation
6	Public entity	Energy management	Ente Vasco de la Energía (EVE)
7	Industry	Others	AYTASA
8	Industry	Energy production	APPA Renewables
9	Industry	Energy production	Basque Country Energy Cluster

	Group	Sector	Organization
10	Industry	Energy production	EDP Renewables
11	Industry	Engineering	IDOM
12	Scientific Community / Consulting	Research	IHC
13	Scientific Community / Consulting	Research	IEO
14	Scientific Community / Consulting	Research	University of Las Palmas de Gran Canaria
15	Scientific Community / Consulting	Research	Naval and Ocean Engineering Polytechnic University of Madrid
16	Scientific Community / Consulting	Research	Environmental Physics Laboratory, University of Vigo

In addition, each response was viewed by all participants in the https://ideaboardz.com platform, indicating their degree of agreement with their anonymous vote. After a few minutes, when enough responses were displayed for each block of questions, there was room for discussion.

Together with the invitation to participate in the working group, complementary documents (with a brief introduction to the administrative procedure for the approval of MRE projects in Spain, as well as key concepts subject of discussion- adaptive risk-based management approach) were sent to all participants. The aim of this *supplementary material* was to provide, prior to the workshop, a minimum knowledge about the topics to be discussed in the working session (information included in section 7: Risk-based approach). Once the working group was finished, a *survey* was sent to all attendees to find out their *degree of satisfaction*.

8.3.3 Results

The answers, the number of votes for each answer, as well as the comments given by the attendees to the questions asked in the previous section are shown below.

8.3.3.1 Criteria and information available for environmental assessment

- *What do you think is the main barrier in the environmental approval procedures for MRE projects in Spain?*

Table 4 shows the answers and the number of votes collected for each response in relation to the question: *What do you think is the main barrier in environmental approval procedures for MRE projects in Spain?*

As it is shown in Table 5, the lack of knowledge of the real impact of marine energy technologies was perceived as one of the main barriers, since it represented a total of 15 votes out of 37 (Table 4).

In relation to this first question, from BIMEP, they pointed out that, due to the ignorance of the possible impacts, to cover so much uncertainty, in the installation of the small prototypes, very exhaustive studies are carried out to precisely clear the doubts about possible impacts. He pointed to the excessive cost of any study before and during operational phase, especially for single device projects.

Table 4. *Answers and number of votes collected for each response in relation to the question:* What do you think is the main barrier in environmental approval procedures for MRE projects in Spain?

What do you think is the main barrier in the environmental approval procedures for MRE projects in Spain?	*Votes*
Lack of knowledge of the impacts	*10*
Bureaucracy	*7*
Uncertainty with new technologies / Lack of knowledge of technology and its real impacts	*4*
Energy regulations are out of date compared to current projects	*3*
Excessive times	*2*
Number of entities involved	*2*
Lack of planning at the national level that organizes and distributes uses	*2*
Excessive cost of previous studies	*1*
Lack of Meta-Oceanic research	*1*
Lack of information (including information on the ecosystem values in the area where the project is planned)	*1*
Overlapping of competences among administrations, in relation to the global process, including the environmental process	*1*
Conflicts with local interests	*1*
Disproportion between the real impact of a small pilot project and the prior and operational monitoring results	*1*
Wind and waves projects are in different stages of development. The procedures are the same or very similar	*1*
Usually, the administration does not comply with the deadlines established	*0*
TOTAL	*37*

Table 5. *Answers and number of votes collected for each response in relation to the question:* What do you think is the main barrier in environmental approval procedures for MRE projects in Spain? *in relation to the uncertainty to the environmental impacts of marine energies.*

What do you think is the main barrier in the environmental approval procedures for MRE projects in Spain?	*Votes*
Lack of knowledge of the impacts	*10*
Uncertainty with new technologies / Lack of knowledge of technology and its real impacts	*4*
Disproportion between the real impact of a small pilot project and the prior and operational monitoring results	*1*

From the CENER-CIEMAT Foundation, they underlined the work carried out in Horns Rev and Nysted, prior to the installation of the offshore wind farm, by the Ministry of the Environment and all the agents involved. The environment impact assessment lasted from 2002 to 2006, firstly in the construction phase and then in the operational phase. They accepted that there were very expensive and time-intensive works but emphasized the importance of these previous studies as a scientific basis of knowledge. In this study, it was found that there were two critically endangered species, but since it was an offshore wind farm with pivots anchored to the bottom, reefs were generated around the pivots and these two species recovered.

The second most important barrier observed (a total of 15 votes out of 37) was the bureaucracy of the procedure together with the overlapping of competences among administrations, excessive times and the number of entities involved, outdated regulations and non-compliance with deadlines by the competent administration (Table 6).

Table 6. *Answers and number of votes collected for each response in relation to the question:* What do you think is the main barrier in environmental approval procedures for MRE projects in Spain? *in relation to the bureaucracy of the environmental procedure.*

What do you think is the main barrier in the environmental approval procedures for MRE projects in Spain?	*Votes*
Bureaucracy	*7*
Energy regulations are out of date compared to current projects	*3*
Excessive times	*2*
Number of entities involved	*2*
Overlapping of competences among administrations, in relation to the global process, including the environmental process	*1*
Usually, the administration does not comply with the deadlines established	*0*

In this context, a discussion in relation to the problem of overlapping competencies and bureaucracy took place. From MITERD, they understand that the distribution of competencies among administrations is clear, another different problem is bureaucracy. They added that there are numerous agents involved because of this distribution of competencies on the coast and at sea, many administrations according to the territories, at the State, at regional, at local level ... with their processing deadlines and processes, so it takes to excessive bureaucracy.

In this sense, from the University of Vigo, they pointed out that the approval of Royal Decree 1028/2007 was quite controversial. This Royal Decree brought several positive conflicts of jurisdiction, promoted by Galicia Government and by the Canary Islands Government against the Constitutional Court understanding that the Spanish Government was invading their autonomic competences. Moreover, Spanish Government and regional competences may overlap and concur in the same space. In this sense, the Spanish Government may compromise, in certain cases, certain regional interests. Hence, using different channels, such as reports and consultations, the opinion of the coastal autonomous communities in the final decision of the requirement must be integrated. It was also recalled that the approval of the Strategic Study of the Coast for the installation of wind farms on the coast was also controversial and it reached the Supreme Court. It was concluded that it is very important to achieve adequate and effective cooperation and coordination between the Spanish Government and the Autonomous Communities.

Thirdly, it was pointed out that there is a need to carry out marine spatial planning of future marine energy developments, and its absence was identified as an important barrier for the development of this industry (Table 7).

Table 7. *Answers and number of votes collected for each response in relation to the question:* What do you think is the main barrier in environmental approval procedures for MRE projects in Spain? *in relation to the lack of marine spatial planning of MRE projects.*

What do you think is the main barrier in the environmental approval procedures for MRE projects in Spain?	*Votes*
Lack of planning at the national level that organizes and distributes uses	*2*
Conflicts with local interests	*1*

Finally, the last two barriers that were pointed out are related to the lack of previous studies that provide information on the natural and physical values of the selected sites for the development of future marine energy projects (Table 8).

Table 8. *Answers and number of votes collected for each response in relation to the question:* What do you think is the main barrier in environmental approval procedures for MRE projects in Spain? *in relation to the need for providing information on the natural and physical values of the selected sites for the development of future marine energy projects.*

What do you think is the main barrier in the environmental approval procedures for MRE projects in Spain?	*Votes*
Lack of Meta-Oceanic research	*1*
Lack of information (including information on the ecosystem values in the area where the project is planned)	*1*

- *Do you perceive the uncertainty about environmental impacts as a barrier in the environmental approval procedures?*

In relation to this question, the answer was unanimous: the uncertainty about environmental impacts is perceived as a barrier in environmental approval procedures (Table 9).

Table 9. *Answers and number of votes collected for each response in relation to the question: Do you perceive the uncertainty about environmental impacts as a barrier in the environmental approval procedures?*

Do you perceive the uncertainty about environmental impacts as a barrier in the environmental approval procedures	*Votes*
Yes	*20*
No	*0*

- *How do you manage this uncertainty when justifying the decision taken?*

Table 10 shows the answers and the number of votes collected for each response in relation to the question, How do you manage this uncertainty when justifying the decision taken?

Table 10. *Answers and number of votes collected for each response in relation to the question: How do you manage this uncertainty when justifying the decision taken?*

How do you manage this uncertainty when justifying the decision taken?	*Votes*
Principle of precaution, if there is doubt, preservation	*7*
Considering the previous scientific documentation if there is one. If not, monitoring during exploitation.	*4*
Monitoring more ecosystem components than necessary "just in case"	*3*
Conservative criteria (extra charge)	*3*
Looking for dialogue with the environmental authority + IPD (initial project document)	*2*
Previous environmental information should be requested, preliminary studies that improve knowledge and possible risks	*1*

TOTAL	*20*

In relation to this question, in general, a certain consensus was observed on the importance of having a good base of prior environmental knowledge of the project site, as well as the technical and economic implications associated with the application of a precautionary principle:

From University of Vigo, it was pointed out the importance of the "scoping" phase or the scoping document of the environmental studies to be carried out as a key element in the procedure. In this sense, thanks to prior consultation to the competent authorities about the main concerns and about the necessary studies, further delays in the procedure would be avoided. From EDP, it was insisted on the same issue, considering that the scoping phase in the simplified procedure should be mandatory. From the MITERD, also agreed in the previous analysis, highlighting the wide variety of information received. According to MITERD when the initial information is more complete, the subsequent analysis of the project is much easier: the compilation needs to be good, not necessarily dense.

A second point that was commented in relation to this question was the convenience of focusing the necessary prior information at higher levels, that is, at the level of Strategic Environmental Assessment and Planning:

From Aytasa, it was pointed out that, in order to reduce the uncertainty of the general impacts, the most important studies should be done at the Strategic Environmental Assessment level, since it is the first environmental figure that attends the impacts generated by a generic installation. If the larger studies on the impacts generated by any installation are included in this environmental figure, the whole process would improve. The SEA would include the most generic and complete studies about the general impacts of any marine energy project, this is, the environmental assessment of any marine projects could refer to the characteristics of a project in a specific location.

Bimep agreed with Aytasa, insisting on the idea that the barrier is related to how to face this uncertainty. The precautionary principle is considered adequate, but the uncertainty caused by 5 devices must be distinguished from the uncertainty caused by one device. Therefore, the application of the precautionary principle seems a better solution to face the uncertainty of 5 devices than only one device.

From MITERD, from the experience in previous works, it was suggested to look at the Strategic Environmental Study of the Spanish Coast for the installation of marine wind farms, and at the POEM. Both documents try to identify a series of compatibility criteria

of the different uses or activities, for the identification of areas of importance for biodiversity, protected areas or areas of special importance for biodiversity, integrating these criteria when identifying zones for possible uses. It was added that focusing on specific zones for the environmental analysis would reduce the uncertainty. In this way, integrating in the first phases of planning which areas are incompatible with specific activities would reduce the uncertainty for all the agents involved: promoters, administration, etc.

From AZTI, it was pointed out the importance of including environmental assessment at the POEM level, that is, including environmental impacts at the planning level.

From MITERD, it was agreement in relation to POEMs, spatial planning can help us to manage the uncertainty and to reduce risks, even with lack of information. It was acknowledged that it is not possible to have a detailed knowledge about all marine habitats and the detail distribution of all species before starting a project, but there is knowledge regarding the most valuable biodiversity areas, relevant areas for fishing and fundamental areas for navigation. The information at the planning level is very valuable for identifying the most suitable areas for the development of these projects, regardless of whether the environmental study corresponding to the project is prepared.

From MITERD it was pointed out that, from his experience related to the concession of the occupation of the MTPD, the POEMs will be vital for the assignment of the occupation title deeds (and their duration), and consequently, introducing the environmental component here would be the most appropriate place.

- *Which are, in general, the main information and/or existing gaps of knowledge for this type of project?*

The main knowledge or information for MRE projects that should be available is related to the following: grid connection, resource itself (wind, waves), information associated with the POEM, the Project Initiation Document (DIP) and the EIA, the relation between external variables and the impacts of the project and the previous experience of the promoters (Table 11).

Table 11. *Main knowledge or information for this type of projects*

Main knowledge or information for this type of projects	*Votes*
Grid connection	*2*

Resource: wind, wave	*1*
POEM + Project Initiation Document + Environmentl Impact Assessment	*1*
Relation between external variables and the impacts of the project	*0*
Promoters with previous experience	*0*

The most important lack of knowledge identified by participants are in relation to the environmental impacts on the marine environment of this type of projects, as well as the potential synergistic and cumulative effects with other marine facilities or other marine uses (Table 12).

Table 12. *Lack of knowledge for this type of projects.*

Tabla 10. Lack of knowledge for this type of projects	*Votes*
Marine environmental impacts	*5*
Potential synergistic and cumulative effects with other marine facilities	*5*
Historical data on environmental impacts of other projects	*3*
Long-term impacts, and considering the restoration of the area after the useful life of these facilities	*1*
New sharing-use infrastructures i.e. marine renewables and aquaculture	*0*

8.3.3.2 Environmental risk analysis and legal procedures

- ***Do you consider that the implementation of adaptive risk-based management approach is feasible in the authorization procedure for the development of MRE projects in Spain? Where in the authorization process do you think it could be implemented?***

Maybe due to the lack of knowledge about what the adaptive risk-based management approach proposes, most of the attendees did not know how to answer this question (Table 13).

Table 13. *Answers and number of votes collected for each response in relation to the question: Do you consider that the implementation of adaptive risk-based management approach is feasible in the authorization procedure for the development of MRE projects in Spain?*

Do you consider that the implementation of adaptive risk-based management approach is feasible in the authorization procedure for the development of MRE	*Votes*

projects in Spain?	
Unknown/no answer	*10*
Yes	*4*
It is difficult	*1*
No	*0*

In relation to this question, from MITERD it was indicated that the adaptive risk-based management approach is integrated in the Environmental Surveillance Plans (PVA), during installation and operational phase, this is, collecting information about the real environmental impacts. From their experience, it was confirmed that no files arrive with the results of the PVA: in the operational phase, the impacts could be identified, however, there is no tool for suspending activity once the project is underway. A priori, she also considers that requesting a lot of input data could be a barrier, because the deadlines would be extended which does not interest to the promoter.

From AZTI it was suggested that the adaptive risk-based management approach could be a strategy at the national level, even in the context of the PNIEC, to support or grant resources to promoters to cover those monitoring studies that reduce the uncertainty regarding the environmental impacts. In this sense, WESE project has been financed by European Union to reduce the gaps of knowledge of certain impacts and to make this knowledge available to the different agents.

From MITERD it was confirmed that they do not usually receive any data from the PVAs when the project is in the operational phase and consequently there is no learning phase. Almost all the files that arrive are in relation to prototypes, so it is difficult to extrapolate those results to commercial projects, with a magnitude of industrial exploitation. At this point, AZTI answered to MITERD that in the Work Package 3 of the WESE project, it has been monitored around prototypes of wave energy in the operational phase, and based on these monitoring results, a simulation will be carried out about a device on an industrial scale (with different numbers and sizes of devices).

Bimep explained that test site (in Basque Country) has implemented already an AM which imposes a series of conditions, and depending on the results of the PVA, the granted environmental authorization could be modified. This is acceptable in a test site, but in a commercial wind farm it would be more difficult to assume it.

Regarding the question about where in the authorization process the adaptive risk-based management approach could be implemented, some of the responses and

comments agreed that this tool should be implemented in the early stages of the environmental processing (Table 14).

Thus, from University of Vigo is in favour of placing special emphasis on Marine Spatial Planning and Strategic Environmental Assessment, as well as avoiding a relaxation in environmental requirements. In this sense, Santiago considered that the Spanish legal system provides special protection to the MTPD, giving greater caution on this point.

Table 14. *Answers and number of votes collected for each response in relation to the question: Where in the authorization process do you think it could be implemented?*

Where in the authorization process do you think it could be implemented?	*Votes*
Unknown/no answer	*2*
"We should be more specific, indicating the points we would like to change with respect to the current environmental authorization procedure"	*1*
In the marine spatial planning and in the strategic environmental assessment	*2*
"If I understand the concept of GA, I think it is very useful when preparing the documentation at the beginning of the process"	*0*
The (legal) possibilities should be discussed with the competent authorities in the environmental assessment procedure	*0*

From MITERD it was pointed out that the best moment to implement the AM is from the beginning, at the beginning of the project, and in cases with the MTPD concession granted. It was stressed that Bimep and PLOCAN should be the places where AM takes place, in pilot projects and at research level, to study environmental impacts.

From IHC, it was answered the question rephrasing it: "At which stage of the introduction of offshore energy do you think AM could be implemented?". Contrary, from MITERD it was suggested that AM could be implemented in pre-commercial projects (up to 50 MW), not in BIMEP and PLOCAN test site, because they already have their permits and environmental studies.

From EDP Renewables it was indicated that the first risk analysis approach is very close to AM in relation to POEMs. It was added that the initial project document should be mandatory including a risk analysis, a brief explanation describing what the project is about. In this sense, the administrative authorities, based on this initial risk analysis, indicate what to be included in the EIA. In this context, he thinks that the Scottish model is far away and demands to give to the POEMs and the DIP more importance.

- *How could the adaptive risk-based management approach be implemented (legal document, good practice guide, etc.)?*

Table 15 shows the answers and the number of votes collected for each response in relation to the question: How could the adaptive risk-based management approach be implemented (legal document, guide to good practices, etc.)? There was an agreement about being implemented as a good practice guide, this is, as a good starting point for pilot projects or as first experiences. Subsequently, the degree of its application would be evaluated and finally, its implementation in the Spanish legislative procedure could be evaluated.

AZTI explained that the objective of the work package 4 of WESE project is to develop a good practice guide, collecting opinions and ideas from this working group, and to make a proposal, together with the conclusions of the working group carried out in Portugal.

Table 15. *Answers and number of votes collected for each response in relation to the question: How could it be implemented (legal document, good practice guide, etc.)?*

How could it be implemented (legal document, good practice guide, etc.)?	*Votes*
As a first step, a good practice guide, once the situation and those risks have been analysed, to be implemented in the procedure	*5*
Modifying the Environmental Assessment Law and introducing the possibility of integrating the scoping phase in the simplified EIA process	*2*
Preparation and approval of POEM + recommendation (obligation?) of Scope Document	*2*
Preferably at the legal level, giving, for example, the opportunity to be included in the maritime spatial planning	*1*

From MITERD, it was added that it is important for developers to express their interest in scoping, but there is no need to modify the simplified procedure because she understands that the projects submitted to the simplified procedure do not imply significant impacts, and if so, they would go to the ordinary procedure, where there is already a scoping phase. For this reason, she concluded that the simplified procedure is useful. From MITERD, it was asked to the rest of the participants the following question: "Have the projects authorized in Spain been included in the simplified or in ordinary procedure?

Bimep answered that as a test site, initially, the processing of the environmental impact for the use of the wave energy was carried out through the simplified procedure, and later, for the use of the marine wind energy, the processing of the environmental impact was updated to ordinary procedure.

From University of Vigo, it was pointed out the importance of the scoping phase: the opinion of the administrative authorities from the beginning, delimiting, and configuring the content of the environmental impact study and integrating the existing concerns around to the environmental effects can help to avoid unnecessary delays in the processing of the project.

8.4 Conclusions from the workshops

Overall, although Portuguese and Spanish workshops followed different structures and stakeholders target, the conclusions drawn are similar for both, therefore, the relevant outputs for the discussion are grouped in the following main subjects.

In relation to the **environmental approval procedures for MRE projects**, the participants of the working groups identified the **following barriers**:

• Uncertainty and lack of knowledge regarding the environmental impacts associated with marine energy projects as well as the potential synergistic and cumulative effects with other marine facilities or other marine uses, and consequently, the excessive cost of the studies necessary to gather information.

• Short deadline for request for additional information and elements in the environmental assessment legal regime.

• Excessive bureaucracy: high number of agents involved, excessive times, etc.• Absence of marine spatial planning at the state level in Spain. In Portugal, although MSP is already being put in practice, there is a concern it might not be properly implemented.

• Lack of previous studies that provide information on the natural and physical values of the selected sites. Funding constraints that force the exclusion of costly monitoring activities in small scale projects was one of the main reasons pointed.

• Framing projects in the current EIA legislation, as felt with two MRE projects deployed in Portugal. In the case of Windfloat and WFA projects, it was only through the occupation of ecological reserve areas by the cable on land that they were subject to an EIA, specifically a EA. However, the current EIA diploma does not explicitly contemplate these new technologies. Only projects occupying areas classified within

the scope of nature conservation will be subject to EA. So, these two projects wouldn't be subject to any form of EIA had they been licensed after the changes in legislation. Consequently, there will be even less lessons learned from pilot projects which is expected to impact and hinder the future approval of commercial projects due to insufficient data to base decisions on.

• Proponents are often uncertain and unfamiliar with procedures and information requests which leads to lack of completeness in data submission to the entities.

• Lack of communication between proponents and regulatory entities, resulting from uncertainty given the early stages of the project and confidentiality issues, as it has been felt within the WaveRoller project in Portugal.

Regarding the **management of the uncertainty when justifying the decision taken** in the environmental approval procedures, it was generally observed:

• Some agreement on the importance of having a good base of environmental knowledge of the project site, and on the technical and economic implications, associated with the application of a precautionary principle.

• The convenience of focusing this need of prior information at higher levels, that is, at the level of Strategic Environmental Assessment and Planning.

Regarding the **possibility of implementing the adaptive risk-based management approach in the authorization procedure** for the development of marine energies, and the question regarding in which part of the procedure and how to implement it:

• Most Portuguese regulatory bodies already implement some form of risk analysis when issuing decisions given the current lack of information on potential environmental impacts. Furthermore, a risk analysis underlines every EIA in the Portuguese legal framework, which already establishes a context for the integration of a risk-based approach. The risk management translates into the assessment of impacts and their significance, i.e., by attributing a magnitude, significance and durability to each risk, a risk analysis is being conducted. A risk-based approach should be integrated in the existing procedure so that this data is considered when issuing the permit.

• Some consider a risk analysis as comprising two distinct stages: a marine spatial planning stage, which is already happening in Portugal considering the Situation Plan was subject to an SEA, followed by an analysis focusing on the project and its licensing. The SEA results are therefore a good starting point to start quantifying impacts in those dedicated areas, which leads to cost reduction in monitoring activities a posteriori.

• Some of the responses and comments agreed that this tool should be implemented in the early stages of the environmental processing, at the strategic and planning level.

• Some feel the scoping phase, although a facultative stage in both Portuguese and Spanish legislations, provides a key role in prioritizing the relevant elements that need assessment since an early stage of the project. However, making it mandatory would incur in more costs and time so there should be a degree of sensitivity in this matter and the decision should be taken on a case-by-case basis as some projects don't need to go through the process.

• The lack of knowledge about the ocean calls for the need of a continuous risk assessment approach.

• There was a general agreement about the benefits of the elaboration of a join document or guide on best practices for pilot projects. Subsequently, the degree of its application would be evaluated and finally, its implementation in the Portuguese and Spanish legislative procedure could be assessed.

• In the Portuguese context, there is a feel or urgency in adapting the current environmental assessment legislation to fit this type of projects.

9. Legal feasibility of integration of a risk-based approach and adaptative management in the environmental consenting procedures of wave energy development

Risk based approaches are starting to being applied to a few pilot MRE projects, but this procedure will likely be required when dealing with uncertainties associated with commercial projects. Building on previous work carried out under the RiCORE project, literature review on the consenting process in Portugal and Spain and outcomes from the workshops planned with Portuguese and Spanish stakeholders, this section will provide insights on the feasibility of integrating a risk-based approach in the consenting procedures of MRE. The analysis is presented on two levels of integration: in the legal framework and on an operational level.

9.1 Risk-based approach in environmental and legal framework

As it was mention in Section 6, all plans must be subjected to a SEA (Directive 2001/42/EC5) as a planning tool that involves an overarching environmental assessment of an area, at the earliest possible stage in decision-making (Wright 2013). Together with the EIA, they are mandatory requirements globally used to assess, manage, and mitigate the impacts of the projects on the environment (Directive 2014/52/EU), so there is an imperative to demonstrate that they can effectively identify risky projects (Andrea Copping et al. 2015; O'Hagan and Lewis 2011; González, Gleeson, and McCarthy 2019).

According to Wright (2013), "a key benefit of SEA in the context of MRE is that a SEA can establish some baseline data and/or assist with device siting, developers will have to spend less time and capital developing detailed EIAs and forging a process for project approval".

In the same way, conflicts and uncertainty in the marine space can be overcome through the implementation of legal instruments such as MSP (which is already in place in Portugal). Nevertheless, there are always location specific issues and uncertainties that these general instruments cannot address.

Hence, there is a need to anticipate the development of MRE by assessing the potential environmental risks to minimize the impacts. Determining the risk for each potential

[5] Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

interaction between a component of an MRE and each vulnerable group of species, habitats, or ecosystem components constitutes an approach which can help regulators reducing uncertainties and contributing to decision making (A. E. Copping et al. 2020).

Considering the outcomes from the workshops with Portuguese and Spanish stakeholders (Section 7.4), as a first step, this risk-based approach could be implemented as guidance documents that specify the circumstances under which a risk-based approach is acceptable and establish mandatory elements of risk-based plans.

In this sense, according to the conclusions from the workshops, the risk-based approach could be integrated in the early stages of legal framework in both countries, this is, at strategic or planning scale (i.e., SEA or MSP). The integration of a risk based approach in the MSP for site selection of wave energy developments could be a key element in the implementation of this approach in the consenting procedures. The decision support tools that are being developed under WP5 fits with this possibility since the risk-based approach is one of the criteria of the suitability analysis of new sites for wave energy projects development. It could be expected that the wave energy projects proposed to be developed in the suitable areas identified by these decision support tools of MSP under this risk-based approach will suffer a more straightforward consenting procedure.

Before the complete integration of the risk-based approach in environmental and legal framework, the degree of its application and the legislative procedure should be evaluated with the Portuguese and Spanish regulatory authorities and with other agents involved in the authorization process in both countries.

9.2 Risk-based approach during licensing and post-deployment monitoring

There is a tendency to assess each risk individually, therefore paying special attention in prioritising an integrated risk analysis is crucial. A proper integration of a risk-based approach should be done by both regulators and technology developers from the pre-application stage and throughout the operation phase. Therefore, on an operational level, a risk-based approach can be applied in the pre-consenting phase i.e., during the licensing process and during post-deployment, i.e., during the environmental monitoring follow-up.

Given the early stage of the sector, licensing permits are issued with a large margin of uncertainty and decision are gradually adjusted based on experience resulting from

other projects previously licensed. Therefore, introducing a risk analysis in the **licensing process or pre-consenting phases** can be useful when there is significant uncertainty or lack of data and knowledge gaps on a certain set of impacts. It can contribute to lowering the risk associated with several projects by allowing small scale projects to be deployed under a structured approach with embedded mitigation and monitoring. It allows stakeholders to collaborate and develop a responsible approach to environmental monitoring. This process seeks to balance the need for accurate data collection with cost constraints faced by an emerging industry.

Applying a method such as the SDM policy can avoid excessive costs associated with long timeframes associated in multi-stakeholder procedures and ensures information generated will in fact address the uncertainties at stake (Masterton 2014). Furthermore, having in the one-stop-shop administration, a team with expertise in the different fields associated with consenting in the marine environment is crucial to design fit-for-purpose post-consent monitoring programmes since technical expertise is applied in house in initial phases (MMO 2014).

By informing site characterisation survey requirements in the pre-consenting phase (detailed description of the SDM policy in Section 6.2), the SDM policy has the potential to facilitate earlier consenting decisions by demonstrating that decision-making regarding pre-consent survey efforts is risk-based and proportionate to the risk profile of development (Bennet 2016). Pre-consent site characterisation surveys under SDM do not reduce uncertainty for future projects but it enables this to be achieved through AM and risk-based approaches. Following these procedures, once the project is approved, AM approaches can then focus efforts on the design of post-consent monitoring programmes (Lièvre et al. 2016).

In a **post-deployment phase**, a risk-based approach should be implemented through a staged approval process or through the delivery of conditional licenses (McDonald and Styles 2014). In both cases, regulatory frameworks must suggest fit for purpose monitoring programs, i.e., technology and site-specific plans that tackle the relevant receptors. Applying an AM during project development allows a risk-based management to be implemented throughout the project entire life cycle. If a staged approval is not feasible, delivering a conditional license with management objectives and monitoring and mitigation measures as a condition is an alternative. In this case, the AM is mainly initiated by developers. Project requirements can therefore be reduced, and it tends to happen when monitoring focuses on an impact mechanisms (e.g., noise) instead of an impact (e.g., effect of noise in marine mammals) (Lièvre et al. 2016).

9.3 Challenges and solutions

Although it offers some flexibility to consent and deployment of MRE projects despite uncertainty, a risk-based strategy and AM may face significant challenges:

1) Financial risks integrating a risk-based approach involves further research to reduce uncertainty which in turn increases the associated time frames. This in turn results in a costly process that creates significant financial uncertainty for project developers. This challenge could potentially be overcome through public financing of different European MRE research projects such as WESE, SAFEWAVE, whose aim is to reduce this uncertainty, by helping the industry and project developers (as results in Section 7.3.3.2 show).

2) Availability of monitoring methodologies – The success of risk-based approaches is dependent on the availability of monitoring methodologies. Uncertainties regarding pre-identified environmental must be reduced either considering changes against a baseline or by improving the confidence associated with assessment and modelling frameworks. Without effective post-consent monitoring methodologies, it is not possible to detect changes in marine ecosystems and to propose responsive management decisions. Furthermore, monitoring approaches must be question-driven, and the questions must be directly connected to thresholds to avoid unacceptable impacts. In practice, designing monitoring that informs and works with thresholds may be extremely challenging; it requires the ability to confidently measure and monitor the appropriate metrics of concern with the required levels of accuracy and precision to inform management decisions.

3) Lack of legislation and regulations requiring this approach in most countries – e.g., the implementation of SDM approach might not be possible in countries that don't possess data comprehensive enough to characterise the marine environment sensitivities to a similar degree. However, a risk-based approach to decide which type of information is needed can still be applied against technology risk and project scale when in the absence of enough baseline data. AM and risk-based approaches in the post-deployment phase should not be hampered by this lack of data on environmental sensitivities and constraints. Instead, countries should look into adapting these approaches by e.g., including site characterisation programmes in an initial phase to improve scientific knowledge by reducing uncertainties for those involved in MRE project development and consenting.

4) Institutional arrangements, this is, the fragmentation of consenting authority across multiple consenting agencies – this burden can be overcome by adopting streamlined consenting processes such as SDM policy i.e., creation and operation of a "one-stop-shop" approach to consenting where there is a single point of contact for dealing with consents.

5) Adaptation of the EIA-SEA and MPS legislation:

    a. Risk Based Approach could be implemented or introduced in the SEA and in the MSP legislation through the development of Decision Support Tools that considers this risk analysis in the suitability evaluation of a site for wave energy development. Then, all the specific projects pending from this planification and proposed in a suitable site should suffer a more straightforward consenting EIA procedure (with a shorter time for license consecution and with a less demanding environmental data and information requirements).

    b. AM could make into force in the post-deployment phase of the EIA consenting procedure. Make into force the implementation of the AM approach in the monitoring proposals of the Environmental Impact Studies (EIS) and make the environmental licenses conditional, that is, the license could be revoked if the results of the suggested monitoring campaigns of the EIS are not presented to the environmental authority.

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