Review and discussion of common environmental legislation for ocean energy schemes

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Abstract

In Europe, there is a lack of appropriate legislation for environmental impact assessment specifically for ocean energy converter technologies. The review of the existing legislation at National level as well as the context of incoming European legislation can contribute to establish a common baseline for future environmental assessment legislation requirements in order to achieve compliance within European countries. In this paper the legislative requirements for ocean energy schemes in some European countries is reviewed and compared with those established in other countries such as United States of America and Canada, two countries where the number of ocean energy projects is high. In addition, a comparison is also made with environmental legislation developed to accommodate other technologies, namely offshore wind energy, in order to highlight potential legal gaps.

Keywords: ocean energy; legislation review; environmental impact assessment; common baseline.

Nomenclature

EIA = Environmental Impact Assessment
SEA = Strategic Environmental Assessment
WFD = Water Framework Directive
MSFD = Marine Strategy Framework Directive
MSP = Maritime Spatial Planning

1 Introduction

As the concepts of energy extraction technologies for currents, tides and waves in the oceans are maturing, few devices have been deployed and tested and even fewer environmental studies of these technologies have been carried out. There is a lack of appropriate legislation specifically for these projects and a need to establish some coherency in this field in order to promote an international standardization of environmental legislation requirements. Furthermore, the specifications of the Environmental Impact Assessment (EIA) of tidal and wave energy projects is not only a legislative requirement but also an assurance of the projects sustainability, a promoter of public acceptance and a benefit for industry, making the project more attractive to investors and governments who traditionally have seen environmental concerns as a barrier.

A common baseline for environmental legislation requirements could help in the establishment of future legislation so that no country could benefit from a more environmentally permissive legislative framework to deploy projects. If this is to occur, the first step to achieve compliance between environmental legislation requirements, within European countries, can be the review of the existing legislation at National level as well as the context of incoming legislation at the European level (Water Framework Directive and Future Marine Directive). The potential environmental impacts of the converters installation and operation should accompany this process according to the technical specifications of their concept. In addition, the evolution of the environmental legislation developed to accommodate other technologies namely offshore wind energy, can also play an important role to drive the process and prevent potential legal gaps.

The work that has been carried out in the EquiMar project (Equitable Testing and Evaluation of Marine Energy Extraction Devices in terms of Performance, Cost and Environmental Impact; https://www.wiki.ed.ac.uk/display/EquiMarwiki/EquiMar) covers the analysis mentioned above and its results are planned to be disseminated to the wider community. This paper aims to be a product for such dissemination and includes the results of the environmental legislation revision both in the European Commission and in some European countries where ocean energy schemes are operating (e.g. Denmark, Portugal, Spain and United Kingdom). A comparison with offshore wind legislation is also presented as well as the environmental legislation on marine energy

extraction in some other countries outside Europe (United States and Canada). Guidelines on the requirements for a common environmental legislation on ocean energy are suggested.

2 A review of existing legislation at European Union level

There are a number of international treaties and instruments which regulate some aspect related with environmental impact of energy activities. The development of legal instruments to regulate the environmental impacts of a given activity is normally based on the procedures for the Environmental Impact Assessment. These usually cover the range of the activity from the construction and deployment through the operational phase to final decommissioning.

EIA Directive

The concept of EIA, developed in United States in 1970 in the context of the National Environmental Policy Act (NEPA), has spread widely. In the European context, this concept is used in the Directive 85/337/EEC (so called the EIA Directive) on assessment of the effects of certain public and private projects on the environment. Amendments to the EIA Directive have been introduced (Directive 97/11/EC and Directive 2003/35/EC) and a consolidated version is currently available on the EU website [1]. The EIA Directive refers to other two Directives (Wild Birds Directive and Habitats Directive) on the nature conservation policy in the European Union (Table 1). All areas classified under these Directives form an ecological network known as Natura 2000.

Although the EIA Directive has been reviewed, it does not specifically address wave and tidal energy projects. The EIA Directive outlines which project categories shall be made subject to an EIA, which procedure shall be followed and the content of the assessment. Project categories are split between Annex I for which EIA is compulsory and Annex II for which EIA is dependent on whether significant environmental effects may occur. Although a number of energy project categories are included in Annex I, wave and tidal energy projects could only be within Annex II under the category of "Energy industry: (a) Industrial installations for the production of electricity (...)". Projects outside Annex I may still be subject to EIA depending on their nature, size and location either in accordance with (nationally) pre-determined thresholds or on a case-by-case basis (Article 4 (2)). For such pre-determined thresholds or case-by-case examination, the developer should include the relevant selection criteria set out in Annex III of the Directive.

The proximity to the coast or to a site designated under Wild Birds or Habitats Directives will be significant factors in assessing the impact of the proposed activity and whether EIA is required [2]. The protected offshore habitats are those in Annex I of the Habitats Directive that occur beyond 12 nautical miles. Under this situation, there are at least three classified offshore Habitats: "Reefs", "Submerged sandbanks" and "Sub-marine structures made by leaking gases". It is important to note that several marine species, including the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*) and monk (*Monachus monachus*), common and grey (*Halichoerus grypus*) seals as well as some bird species are also listed in the Habitats Directive as species which presence should qualify sites for protection [3].

Instrument	Content
85/337/EEC EIA Directive	Requirement of an environmental impact assessment before building permission. Does not mention specifically marine energy technologies
92/043/EEC Habitats Directive	Requirement on the conservation of natural habitats and of wild fauna and flora; establishes the creation of Special Areas of Conservation (SACs are protected sites assigned under this Directive; the habitat types and species concerned are listed in the Annexes I and II
79/409/EEC Wild Birds Directive	Conservation of wild birds; establishes the creation of Special Protected Areas (SPAs are high level protected sites classified in agreement with this Directive; the species which are involved are listed in Annex I as well as additional regularly occurring migratory species).

Table 1: European legislation to be considered for environmental impact assessment of wave and tide energy schemes.

A report of the World Wildlife Fund ([4], [5]) identifies those sites that potentially qualify as reefs and submerged sandbanks in Northeast Atlantic and North Sea, in accordance with the Interpretation Manual and Requirements of the EU Habitats Directive [6]. The avoidance of environmentally sensitive areas and the location of the project further offshore are less likely to impact near shore currents and communities.

SEA Directive

The purpose of the Strategic Environment Assessment (SEA) Directive (2001/42/EC) is to ensure that significant environmental impacts of certain plans and programmes are identified and taken into account during their preparation and before their adoption. The main objective is to help integrate the environment into the preparation and adoption of plans and programmes liable to have significant effects on the environment, by subjecting them to a prior environmental assessment at the planning stage. It aims to extend the principles of the environmental impact assessment, carried out at the individual project level, to the decision making at the strategic level. It is intended that at this level the alternative approaches and their implications for the

environment can more easily and appropriately be considered.

Under the SEA Directive the authority responsible for the plan and programme will need to follow a specific procedure during the preparation of a SEA which includes the development of an environmental report that examines the significant effects of the proposed plan or programme, including reasonable alternatives, as well as other information listed in the Annex II of the Directive. The SEA content and level of detail should be decided after consultation of environment authorities, which should be identified by each Member State. The environment authority and the wider public must be informed at an early stage if they are to comment effectively on the draft plan or programme and accompanying report. The SEA Directive, requiring strategic environmental assessments and consultations at an early stage of certain plans and programs, may assist ocean energy developers in carrying out the EIA [3].

3 Incoming instruments at European Union level

Water Framework Directive

The European Water Framework Directive (WFD; 2000/60/EC) establishes an innovative approach for water management based on river basins, the natural geographical and hydrological units and sets specific deadlines for Member States to protect aquatic ecosystems. The directive addresses inland surface waters, transitional waters, coastal waters and groundwater cover by a given river basin. It establishes several innovative principles for water management, public participation in planning and the integration of economic approaches, including the recovery of the cost of water services [7]. In the context of ocean energy deployment, this Directive applies to transitional waters ("bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters") and coastal waters("surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side").

Under the WFD, Member States should aim to achieve "Good status" in all bodies of surface water and groundwater by 2015. "Good surface water status" means the status achieved by a surface water body when both ecological and chemical status is at least "good" (low levels of chemical pollution as well as a healthy ecosystem). Member States will have to address the factors harming water eco-systems and the quality elements that to be considered are set in Annex V of the Directive. At present, each Member State is supposed to be finalising the river basin management plan as well as the programme of measures (due on December 2009).

Since the WFD aims to achieve a good ecological and chemical status of the water, some of the potential negative impacts of marine energy projects can compromise these quality standards for a given water body. However, the extent to which such effects can apply is dependent on the dimensions of the operating area (number of devices) as well as on the area where they are located. To comply with this Directive, ocean energy projects should not contribute to the classification of the water body falling below the category "Good".

Another aspect that should be considered is the current uncertainty related with the effects of some of the potential environmental impacts of marine energy devices. Regarding the water chemical status evaluation, critical uncertainties exist about the chemical effects of the converters equipment: toxicity of the compounds, the quantity that will be released, the response of the natural (abiotic and biotic) receptors and the routes followed by the compounds. However, wherever possible the quality standards established under this Directive particularly those related with the discharge or release of priority substances (Annex X) in the water should be examined prior to the deployment of marine energy converters. Monitoring of the priority substances release during the converters installation and operating phases could also be part of the programme of measures to be established, under the WFD, to the concerned water body.

Marine Strategy Framework Directive

The Marine Strategy Framework Directive (MSFD; 2008/56/EC) constitutes the environmental pillar of the Union's Integrated Maritime Policy (IMP). It was adopted by the European Parliament in June 2008 and aims to protect the marine environment across Europe through the achievement of a "Good environmental status" of the marine waters by 2021 and to protect the resource upon which marine-related economic and social activities depend.

The MSFD shall apply to all marine "waters, the seabed and subsoil on the seaward side of the baseline from which the extent of territorial waters is measured extending to the outmost reach of the area where Member State has and/or exercises jurisdiction rights" (Article 3). This directive should also apply to all coastal waters, which are not addressed under the WFD or other Community legislation. "Good environmental status" should be achieved for marine European regions on the basis of geographical and environmental criteria (Article 3: "The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations").

Although Member States are still in the period of bringing into force the laws, regulations and administrative provisions necessary to comply with this Directive (which should happen by July 2010), it is clear that the MSFD aims to regulate human activities

in marine waters. The activities related with ocean energy deployment will certainly be included in this group.

Some of the negative environmental impacts of ocean energy farms are within the indicative pressures and impacts identified in the MSFD (Annex III) and can potentially interfere with the local "Good environmental status". However, clarification is needed on the reference values for some of the qualitative descriptors, e.g. the levels of underwater noise that cause adverse effects on the marine environment. In analogy with other European Directives, guidance documents on the application of MSFD are expected. Furthermore, difficulties in the application of this Directive can also arise from the uncertainties in some of the potential environmental impacts of marine energy devices such as those related with the risk of animals colliding with converters' moving parts, the effects of the converter's underwater noise on marine mammals and fish and the effects of electromagnetic fields from underwater cables on animal migration and foraging behaviour.

Maritime Spatial Planning

The Integrated Maritime Policy (IMP) for European Union and a detailed action plan were endorsed by the European Council on December 2007. About one year later (November 2008), and because Maritime Spatial Planning (MSP) is considered a key instrument for IMP, a communication from the European Commission on the common principles for Maritime Spatial Planning was released to help public authorities and stakeholders coordinate their actions and optimise the use of marine space to benefit both economic development and the marine environment. Maritime Spatial Planning is a tool for improved decision-making providing a framework for arbitrating between competing human activities and managing their impact on the marine environment. Its objective is to balance interests and achieve sustainable use of marine resources according to EU Sustainable Development Strategy. The plan for the marine areas should be based on the specificities of individual marine regions or sub-regions established under the Marine Strategy Framework Directive. The development of this plan is a process starting with data collection and stakeholder consultation. The subsequent stages of its implementation, enforcement, evaluation and revision should be developed under a participatory procedure involving all interested parties [8]. Although MSP is a very recent and new process, an increasing number of Member States are preparing to use it through the implementation of several projects. It is important to note that some of the projects in the energy sector (offshore wind energy in particular) have stimulated its development; consideration of maritime areas for such activities is already under consideration in several countries. This is probably what is going to happen with ocean energy too. There is also a need to link MSP with terrestrial spatial planning, for example with regard to the placement of onshore related infrastructure and the location of power cable emergence.

4 A review of existing legislation at national level

The progress of ocean energy varied across several countries with the most advanced activities located in the UK and USA [9]. The recent policy developments concerning consenting procedures for demonstrations at sea in these countries and the public funding of an ocean testing facility (UK) are the main reasons to explain the high number of ocean projects in several development stages in these countries. Legal frameworks for ocean energy projects are still under construction and vary between countries. Data from 2006 [9] shows that among 26 countries, United Kingdom, United States, Portugal and Canada are examples of countries that have specific regulatory and administrative rules for permitting ocean energy projects. However, there are other countries where this type of legal requirement is not yet developed but the licensing process followed the procedures already defined for other renewable energy projects. A revision of the legal requirements for ocean energy project permitting is presented below.

Denmark

In an initial phase, the consent procedure of previous wave energy projects in Denmark [10] follow a one-stop-shop scheme (indicates that one authority takes the responsibility to "process" an application also covering legislative responsibilities / requirements of other authorities) which was also a procedure used for offshore wind energy projects. Since no official guidelines or administrative experiences exist, problems and challenges arose during the planning phase although the Danish Energy Authority proved to be very flexible during the approval process. In the case of the approval of the Wave Dragon prototype testing, the balance made at the end of the process, which lasted more than one year, showed that it was difficult to follow a one-stop-shop-procedure and that the responsibility for the whole procedure changed during the process (Table 2).

Since the prototype was considered a non-permanent R&D project with a relatively small size, the authorities decided that an EIA was not necessary. This decision was announced to the public and during a 4 week period the submission of protests against this decision was expected. No objections were expressed and therefore nor EIA nor a demand for public consultation were fulfilled. However, an evaluation of the potential impact of the project on the three diving duck species that had caused the EU Bird Protection Area designation was perform as requested by the regional county. In Denmark, a national strategy for ocean energy was planned but no specific policies or measures to support wave technology have been introduced other than the existing support available to all emerging renewable technologies [9].

Subject / Authority	Description / Notes
Use of sea territory / Coastal authorities	Consent given by relevant national and local authorities based on: location, EIA, consultation process and decommissioning
Electricity production / Danish Energy Authority (DEA)	DEA followed the consent procedure for offshore wind farms
Sea cables / DEA	The consent was given on the condition that cables without oil should be used
Connection to the local distribution grid / Local distribution network operator	A point of connection with charges was established based on a list price (the experience concerning wind offshore technology was valuable).
Safety-occupational health / Danish maritime authority	Permitting regarding occupational health (the plant would be used in a regular basis by scientific and technical staff). Existing regulations for offshore fish farms served as a basis.
Insurance / Insurance Company	Device insurance based on the evaluation of the construction (e.g. a CO_2 fire extinguishing device was installed in the control container and the container was sealed to protect the electronic equipment)

Table 2: Consent procedure followed in Denmark for the approval of the Wave Dragon prototype testing [10].

Portugal

In Portugal the legislation requirements for the implementation of ocean energy projects were initially regulated by the DL 254/99 (7th July), which established the requirements for the installation of equipment or infrastructures within the territorial sea and the Exclusive Economic Zone. The installation of such equipment and infrastructures also require approval from several Ministries: National Defence and Sea Affairs, Environment, Spatial Planning and Regional Development, Economy and Innovation, Agriculture and Fisheries, and Ministry of Public Works, Transport and Communications.

Furthermore, and considering the adoption of the EU Directive 2001/77/CE on electricity production from renewable sources, the DL 51/2004 (31st January) establishes the licensing process for renewable energy projects, including wave energy, and the obligation for an Environmental Impact Declaration produced by the regional development authority (CCDR; Comissão Coordenadora do Desenvolvimento Regional), the Nature Conservation and Biodiversity Institute (ICNB; Instituto da Conservação da Naturaza e Biodiversidade) and the Ministry of Spatial Planning and Environment. The DL also establishes the obligation for an Environmental Incidence Study if the project is not listed in the EIA DL (69/2000, 3rd May), which is the case of wave energy projects. The Environmental Incidence Study is a less demanding administrative instrument than the so called Environmental Impact Assessment and should contain the evaluation of the components presented in Table 3.

Legislation	Description
DL 51/2004	License process of electricity production from renewable energy sources including wave energy.
Joint decision 66/2005	Components to be described and evaluated in the Environmental Incidence Study for wave power projects: Gas emissions: that are going to be avoided with the electricity production; Seascape Geology and geomorphology Natural values: flora, fauna and natural habitats; Patrimony: archaeological, architectonical and ethnographical values; Noise: this analysis is dispensable when the projects are located far from 100m from houses; Soils: evaluation, identification and cartography of the soil occupation; Spatial classification Population: public acceptance of the project particularly the most affected social groups.
DL 5/2008	Legal framework for the utilization of the public natural marine resources. Establishes the geographical limits of the Portuguese Pilot Zone (PPZ). Creates a management entity for the PPZ as well as the license process of the project within it.

Table 3: Portuguese legislation on ocean energy permitting.

Spain

In Spain ocean energy projects are not listed as projects that should be subject to an EIA. However, the competent authority (usually the Environment Ministry) can ask for such assessment if it deems it necessary. At present, there are some EIAs being prepared for ocean energy projects that are to be located in coastal waters of the Basque country. Efforts have been made by public and private authorities in order to develop guidelines for EIA in the marine environment. A report developed in 2008 [11] informs about the EIA procedure in Spain and describes the information and best methodologies to be used in each stage of the EIA development.

United Kingdom

The consenting authorities in UK require a complete EIA for commercial deployments. For ocean energy projects there are a number of required licences under legislation presented in Table 4. To fulfil this legislation, developers should develop a proposal on the project with regard to its potential for environmental impact and navigation safety. UK already began (2007) a consultation exercise on the application of the EIA specifically to marine energy

devices which revises the existing range of applicable legislation with a view to streamline the licensing process [12]. For Scotland, regulation and legislation that covers ocean energy development is now devolved to Scottish Government and a Marine Bill for Scotland is currently being drafted. It is intended that the process should be streamlined, include Marine Spatial Planning and adopt a "one stop shop approach".

Legislation	Description / Notes
Food and Environmental Protection Act, FEPA (1989)	Licence relating to the proposed deposits on the seabed
Electricity Act (Section 36; 1989)	Governs marine energy converters generating over 1 MW
Coast Protection Act, CPA (Section 34; 1949)	Concerns safety and navigation issues as well as environmental issues
European Protected Species EPS	Licence may be required if deemed necessary by the environmental regulator
Lease from the Crown state	Within territorial waters the ownership of the seabed and, with the exception of coal, oil and gas, the UK's rights to explore and exploit the Continental Shelf are vested in the Crown Estate
Planning Authority permissions	To connect to the electrical grid

Table 4: United Kingdom legislation on ocean energy permitting [13].

United States

In the United States both federal and state agencies manage the installation of electrical facilities with state jurisdiction varying from state to state. This situation is similar to the layout in the European Union between EU and its members. While states jurisdiction goes up to three miles from shore (Submerged Lands Act), the federal government owns all lands beyond that to 12 nautical miles. However, under the Submerged Lands Act, the federal government reserves the right to develop water power in state waters as well. At present, there seems to be some overlap in supervision between federal and state government in the interaction with ocean energy developers. For example, the federal government supervises environmental impact assessments under the National Environmental Policy Act (NEPA) while approximately twenty states have their own little "NEPA" programs. In general, federal jurisdiction is expected when electricity crosses state boundaries, when federal lands and natural resources are used or affected or when the project site overlaps an endangered species habitat/migration corridor [14].

Although there is no central licensing agency to direct the many agencies involved in ocean energy projects, the Federal Energy Regulatory Commission (FERC) has tried to assert jurisdiction over all projects, citing them as "power houses" within federal waters under the Federal Power Act [17].

The FERC licence application process is an extensive technical process. However, FERC decided to establish a preliminary permit or a "temporal exemption" to developers of demonstration projects to allow them to experiment with the technology, as long as they do not generate electricity for commercial purposes. This is because it was recognized that the application process required technology data that could only be gathered from demonstration, otherwise representing a regulatory barrier to development.

The preliminary permit is issued for up to three years but does not authorize construction since states maintain control over construction of new generation and transmission by issuing certificates of public necessity and convenience. The Minerals Management Service (MMS) has recently been assigned jurisdiction over ocean energy resource use, and is currently in the rulemaking process, attempting to define the regulations and process for ocean energy permitting.

To protect against any potential adverse impacts, the preliminary permit should contain a provision allowing FERC to shut down or remove the project if the operation unacceptably affects the surrounding environment and additional mitigation measures should be included. As mentioned before the process for sitting ocean energy converters varies from state to state and each one has its own distinctive rules and regulations. Nevertheless, common site permitting issues include: 1) Energy transmission (new transmission lines and interconnections); 2) Resource assessments (logical place for such an installation); 3) Permitting processes (agencies involved); 4) Study of the population(s) affected (creation of local jobs, community benefits, hazards, public acceptance/opposition, etc); 5) Resource rights (ocean waves in this case, wind in the case of wind energy); 6) Environmental laws.

Jurisdiction	Responsibilities
State	- EIA - Siting (varies from state to state – sometimes siting regulation is local instead of state-headed) - Safety: construction and maintenance - Laying of transmission cables
Federal	- Environmental assessment if project overlaps endangered species habitat - Interstate transmission - Approval of wholesale electricity rates

Table 5: Responsibilities of state and federal jurisdiction on offshore energy projects [14].

Canada

The deployment and operation of ocean energy projects in Canada (mainly tidal energy projects) are approved and monitored by a series of federal and provincial environmental agencies and associated laws (Table 6). For environmental issues, three main authorization procedures have to be developed. The first refers to the Canadian Environmental Assessment Act which establishes the obligation to carry out an

environmental assessment for ocean energy projects under one of the following different types [15]:

Permit/Agency	Intent or requirement
EIA / Fisheries and Ocean Canada	Section 35 of the Fisheries Act (habitat protection) states that alteration of habitat requires authorization from Minister; EIA required
Fish Habitat Protection / Canadian Environmental Assessment Agency	Administers the Canadian Environmental Assessment Act. Tidal energy project under 5 MW will likely need a screening level EA. Projects over 5 MW will require Comprehensive Study
Navigable Waters Protection Division Authorization / Transport Canada	Authorization required for construction of works in/over/through inland and coastal navigable waterways
Marine Protected Areas / Fisheries and Oceans Canada	Authorized under the Oceans Act; currently none in New Brunswick, Musquash Estuary, Bay of Fundy designated as area of interest in 2000
Marine Wildlife Areas / Environment Canada	Extend from 12 to 200 nautical miles offshore, not yet designated
National Marine Conservation Areas (NMCA) / Parks Canada	The only NMCAs are located in Quebec and Ontario
National Energy Board (NEB) license / National Energy Board	NEB has jurisdiction only if electricity would be exported out of Canada or if federal cabinet explicitly gives NEB jurisdiction over a project
Species At Risk Act / Canadian Wildlife Service of Environment Canada, Fisheries and Oceans Canada and/or parks Canada	To prevent wildlife species from becoming extinct, to provide for the recovery of wildlife species that are becoming extinct, endangered or threatened as a result of human activity and to manage species of special concern

Table 6: Responsibilities of Canadian state and federal jurisdiction on offshore energy projects [15].

1) Screening: is a systematic documented assessment of the environmental effects of a proposed project. The screening will determine whether or not the proposed project is federally supported and therefore enable the project to proceed; 2) Comprehensive study: is a more intensive and rigorous Environmental Assessment required for large-scale, complex and environmental sensitive projects. Comprehensive studies require an EA decision from the federal Minister of the Environment as well as compulsory public participation; 3) Mediation: is an Environmental Assessment when there are only a few interested parties and all them are willing to participate in a consensus negotiation. If the issues of concern are resolved the mediator must prepare a report to the responsible authority and the Minister of the Environment who, then, makes it public; 4) Review panel: this approach of Environmental Assessment has to be followed when a project is likely to have significant adverse environmental effects. This approach should also be appointed when the public concerns warrant such a review. A review panel application is exclusively ordered by the Minister of Environment and a report shall be prepared and submitted by the review panel.

An authorization is also required under the federal Fisheries Act (FA) regarding the potential effects on fish habitats (harmful alteration, disruption or destruction) defined as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes". The FA also states that there is no permission to deposit a harmful substance into water containing fish and requires an authorization (Section 35 FA) for works or undertakings in or around water where fish habitat may be negatively affected [15].

There are several other legal instruments which should be taken in to account in the approval process of an ocean energy project in Canada. Under the Canada's Oceans Act, the establishment of Marine Protected Areas (MPA) to conserve and protect unique habitats, endangered or threatened marine species and their habitats, commercial and non-commercial fishery resources and their habitats, marine areas of high biodiversity or biological productivity and any other marine resource or habitat requiring special protection, resulted in five marine protected areas. The Species At Risk Act (SARA; 2003) intends to "prevent wildlife species from becoming extinct, to provide for the recovery of wildlife species that are becoming extinct, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened". Under this Act, critical habitats are identified and the Minister of Fisheries and Oceans may only authorize activities in these areas if the proposed marine activity is incidental and a number of pre-conditions are met [15].

Marine Wildlife Areas (MWA) and National Marine Conservation Areas (NMCA) are also protected areas in Canadian waters where ocean energy activities can be limited. MWA are protected areas in Canada are marine protected areas under the authority of Environment Canada administered by the Canadian Wildlife Service (CWS) which focuses on wildlife habitat protection. NMCA are areas managed for sustainable use containing smaller zones of high protection which include seabed and water column above it and also wetlands, estuaries, islands and other coastal lands.

5 Environmental assessment legislation in other technologies (offshore wind)

It is reasonable to admit that the process for permitting an ocean energy farm should be similar to the process for offshore wind installations. This is because both installations have many underwater components that may interfere with marine life. However a key difference between the two technologies is the above water visibility of offshore

wind turbines which is a potential obstacle for public acceptance. Furthermore, and unlike ocean energy, offshore wind farms must meet airspace legal requirements [14]. In this section the evaluation of the legal requirements for offshore wind energy are evaluated for some of the countries where it is already a reality.

United Kingdom

The consent procedure for wind offshore in United Kingdom follows a pre-qualification procedure in which developers are checked on their financial standing as well as on their offshore and wind turbine expertise. The qualified developers can make a bid for a chosen location and it is recommended to stay within the areas designated by SEA. The lowest bids get an Agreement of Lease from Crown Estate. An EIA has to be carried out and the consent can only be attained after public notice and consultation process. To support the developers, Department of Trade and Industry (DTI) has set up a one-shop-stop in the form of Offshore Renewables Consents Unit (ORCU) to aid with the consent applications [16].

The Netherlands

For the installation of an offshore wind farm in Netherlands the permit procedure starts with a developer sending his project initiative to the Ministry for Transport, Public Works and Water Management. The response includes guidelines for the permit request and the developer initiative is made public. The permit submission, established under the Public Works and Water Management Act (WBr), should contain the plans for construction, the plans for decommissioning and an EIA. For parks outside the 12 miles zone an Environmental Impact Assessment is required only for the areas where impacts are considered significant. The time and location choice is determined by the developer in his consent application [16].

Denmark

In Denmark, whereas the utilization of wind on land territory is primarily subject to the general planning requirements on locations of plants in the landscape, a special licence system is required for the utilization of wind offshore [17]. The Danish State has the exclusive rights to the utilization of offshore wind but combined with a special licence system as set in the Electricity Supply Act. The Danish Energy Authority (DEA) is the main contact point in the established one-stop-shop permitting procedure for offshore wind projects. The DEA handles the consent procedure having the authority to award all licences and permits, for which it consults the other involved departments. However, there are limitations with respect to area and time and if the activity is assumed to have significant impact on the environment. Permission should only be granted on the basis of an EIA (EIA is described in Executive Order Nº 815 of 28 August 2000) [2]). The permitting procedure in Denmark involves a pre-qualification round based on its financial, legal and technical qualifications after which the chosen developers could place a tender offer. The successful applicant receives, from the DEA, the permits to survey the area, install the offshore farm and exploit wind energy but still has to do an EIA and await public consultation process after submission the complete application with the EIA [16].

6 Discussion of a common baseline for EIA legislation on ocean energy projects

It is reasonable to presume that the European regulation referred to above will be updated as the wave and tidal energy industry develops similarly to what occurred with the offshore wind industry. In the future, EIAs based on European Directives will certainly be an essential element in the approval process of large scale ocean energy schemes.

At present, although legislation on ocean energy projects is unclear in some countries, there are others where it has already been implemented. Since it is assumed that ocean energy is a “clean energy”, the legal requirements for a complete EIA may be less demanding (e.g. Portugal), may not be required (e.g. Denmark) or, in some countries, required for commercial deployments (e.g. United Kingdom). Since the impacts of a project are strongly dependent on the characteristics of the device and the location, the emphasis of environmental assessment may be tailored to the specific project as in the protocol established in the Canadian legislation. A first analysis based on the characteristics of the project and its location can help to streamline the environmental assessment to be conducted. Several methodologies can be used in this screening procedure most of them based on check lists and matrices. There is a need for assessment tools and models to be developed and for regulations to allow their incorporation into procedures as they become available. Another important aspect of the EIA methodology, which is also identified in most legislation regarding EIA in the European Union, its Member States and/or other countries, is the scoping procedure. This step should be used to decide of the extent of the environmental assessment. Categories for environmental assessment “intensity” can be established in order to establish an appropriate reporting on the specific environmental impacts of the project. The two steps referred above are important for future legislation on ocean energy projects since there are three potential types of device schemes (project’s scale): single units, small arrays of single devices and larger farms. These types indicate different categories of environmental impacts which can correspond to different levels of environmental assessment.

Public participation is also an issue included in most of the current legislation on ocean energy projects. This process should occur during the scoping procedure and it is essential to promote a consensus about the environmental questions through the public understanding on the effects / impacts of the activity.

Information on the project should be made available for public consultation. All the relevant authorities, institutions, departments and organizations related with the activity should participate with the general public in this process. At this stage, public participation in the EIA can be very important; a lack of information usually has a negative impact on acceptance. The results of the public participation should be considered at the time of the EIA category selection. Independently of the depth of the analysis, the EIA that is going to be carried out should at least include: 1) Project description; 2) Baseline characterization (reference condition); 3) Impact identification and valuation; 4) Mitigation measures; 5) Monitoring plan. The last 3 parts, Impacts, Mitigation and Monitoring should be carried out for each of the different phases of the project: Installation, Deployment and Decommissioning since different activities and consequent impacts occur within each.

For both practical and legal purposes and in order to streamline and focus the process there is also a need to define the relevant impacts that should be considered in the analysis as well as the correspondent baseline descriptors which are going to be used for comparison during impacts valuation. The list of potential impacts to be evaluated should be prioritised with care and updated in the light of ongoing research. There are some generic, critical uncertainties of the device impacts on the environment that require further basic research. These uncertainties that are currently perceived to be of high priority include: underwater noise, marine animal collision risk and electromagnetic fields from underwater cables during operation as well as the very intense noise from pile driving operations during construction of some types of devices. The legal framework should be designed to cover impact uncertainties and allow for amendment of protocols as and when the uncertainties are resolved. This approach is known as Adaptive Management and should be incorporated in the legal framework of ocean energy schemes.

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