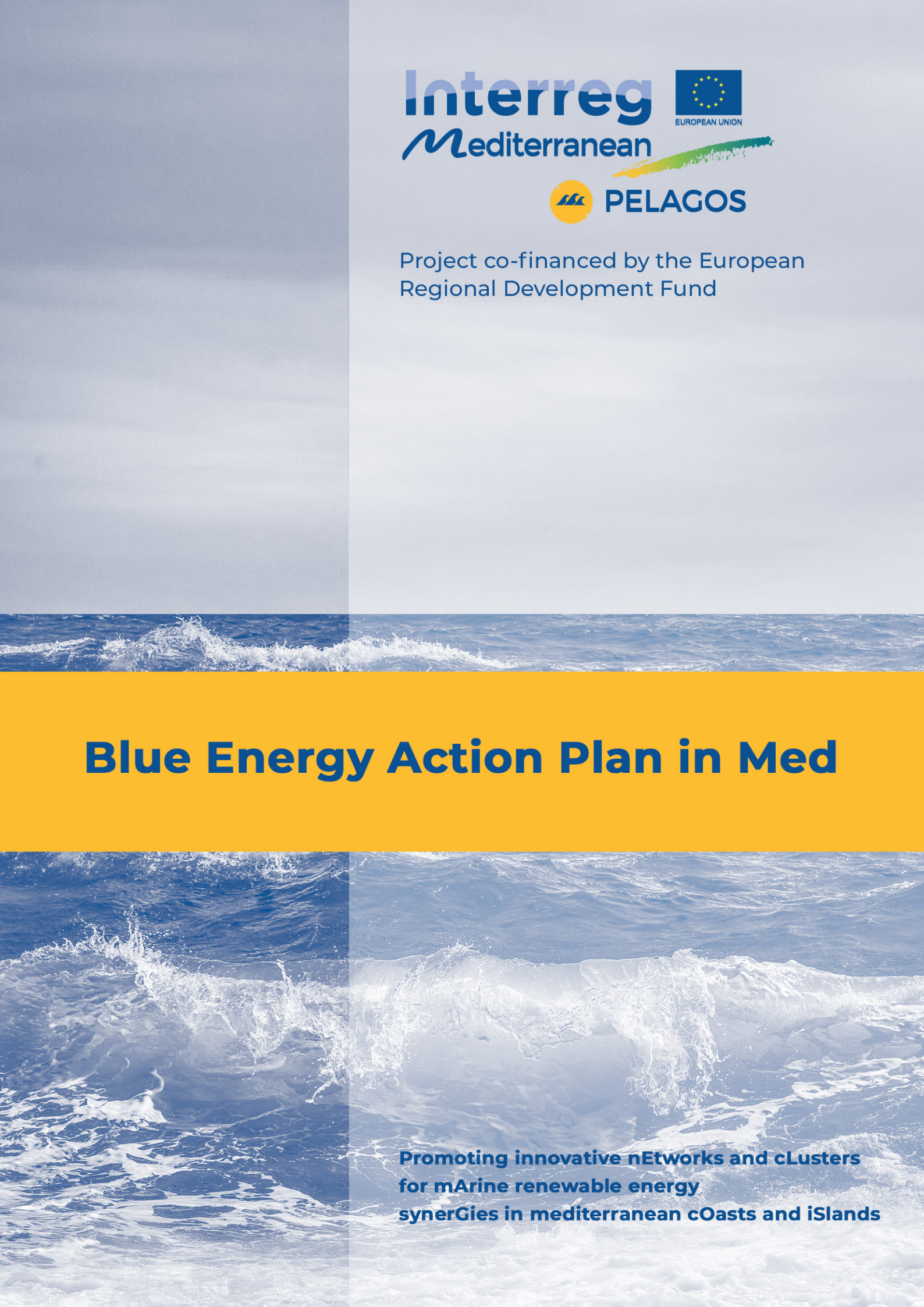

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Blue Energy Action Plan in Med

Promoting innovative nEtworks and cLusters for mArine renewable energy synerGies in mediterranean cOasts and iSlands

Title: Blue Energy Action Plan in MED
Programme: **MED INTERREG 2014-2020**
Priority Axis: **1. Promoting Mediterranean innovation capacities to develop smart and sustainable growth**
Objective: 1.1. **To increase transnational activity of innovative clusters and networks of key sectors of the MED area**
Project Title: **Promoting innovative nEtworks and cLusters for mArine renewable energy synerGies in mediterranean cOasts and iSlands**
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Interested to know more about PELAGOS initiative, visit our website:
https://pelagos.interreg-med.eu/

You can also apply to become a member of the Blue Energy Cluster in the Mediterranean, 456 actors from 7 European countries are already involved: *www.be-cluster.eu*"

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Glossary

BE: Blue energy

EU: European Union

GIS: Geographic information system

GW: Gigawatt

HVDC: High-voltage direct current transmission

ISWEC: Inertial Sea Wave Energy Converter

kW: Kilowatt

LCoE: Levelized Cost of Energy

MED: Mediterranean

MRE: Marine Renewable Energy

MSP: Marine spatial planning

MUP: Multi-use platforms

MW: Megawatt

ORBEC: Overtopping Breakwater for wave Energy Conversion

PBIs: Production-based incentives

R&D: Research and Development

R&I: Research and Innovation

RIS3: Regional Innovation Strategy (Smart Specialisation Strategy

SET PLAN: Strategic Energy Technology Plan

Purpose of this document

This document contains the Blue Energy Action Plan in Med developed in the framework of the PELAGOS project (D.4.3.1) in the Mediterranean area.

It intends to provide to policy and decision makers recommendations to support the development of Marine Renewable Energies (MRE) in the Mediterranean (MED) area. These recommendations and associated concrete actions are the result of a study and the long experiences and expertise of the PELAGOS project partners. The present Action Plan is based on national action plans (Croatia, Cyprus, Greece, Spain and Italy).

Executive summary

The Action plan intends to provide recommendations to support the development of Marine Renewable Energies (MRE) in the Mediterranean (MED) area. These recommendations are simply written advices prepared for the organisation that has the authority to make decisions regarding energy policies, whether that is a Ministry, a regional authority, a council, a committee or another body.

To implement it, concrete actions are also presented with their levels of priority. These recommendations and associated actions are the result of a study and of the long experience and expertise of the PELAGOS project partners as well as active exchanges between them.

The present Action Plan is based on 5 national action plans (Croatia, Cyprus, Greece, Spain, Italy) which have identified six key areas where progress is needed to achieve the MRE sector potential:

- Maritime Spatial Planning;
- Research and Innovation;
- Awareness raiding activities;
- Access to funding;
- Simplification of procedures;
- Grid connection.

The PELAGOS project partners propose 15 recommendations and prioritize 34 actions to implement by policy and decision makers willing to actively support the development of MRE in the MED area.

Sate of the art of Blue Energy in the Mediterranean

There is currently no commercial development of MRE in the MED despite the high potential impacts of MRE on socio-economic characteristics, the readiness level is low for most of the MED countries. The main reasons are that MRE sectors in the MED countries are at an early stage of development and R&D activities are expected. Nevertheless, **some of the MED countries perceived the development of MRE as strategic and impacting their economy with the creation of new companies and jobs.**

The Mediterranean Sea has specific natural conditions with lower wind, tide and current as well as greater depths, so, due to these factors, there are less sites for the exploitation of MRE with respect to other maritime areas such as the Atlantic or the North Sea. In addition, the development in MED will have to be done taking into consideration the level of maturity of other countries, which entered the MRE market 20 years before.

Despite that, the **Mediterranean has the potential to host different type of MRE and several large scale pilot projects are currently developed**. To achieve this potential**, incentive policies must be put in place**, notably through the launching of tenders to finance the construction of MRE parks. The Mediterranean industry will be able to develop specific technologies addressing the local context with, for example, floaters or anchors; and **avoid useless replication and waste of resources, if the Med countries currently developing pilot projects exchange their experiences with each other.**

The two most advanced MRE, adapted and developed in the Mediterranean area are:

Offshore Wind Energy, which is the fastest growing activity in the blue economy in Europe with a total installed capacity of 15.8 GW in 2017 and an estimation of 25 GW installed in 2020. Among it, the floating offshore wind energy is emerging. In 2019, the state of the art in Europe is the following:

France

- 4 pilot farms projects ongoing (1 on Atlantic and 3 on Mediterranean coasts) with a capacity of 24MW each, composed either of 3 turbines of 8 MW or 4 turbines of 6 MW. Commissioning expected for 2021. Objective to launch thereafter industrial farms of 500MW each which could start to be in operation by 2026-2028. For example, Occitanie Region plans to

have 3000 MW (6X500 MW) installed in 2050;
- 2 test floating offshore turbines (Floatgen and Eolink) already in operation;

Portugal

Installation in 2018 of a 25 MW wind farm consisting of WindFloat systems off Viana do Castelo (WindFloat prototype completed with success a five-year testing phase at the end of 2016). WindFloat Atlantic Park is scheduled for production in 2019;

Spain

- 2 pilot farms projects ongoing (on Atlantic coast) with a capacity of 5 and 25 MW and an expected commissioning in 2020;
- 1 test floating offshore turbine (DemoSATH) expected in operation in 2020.

Italy

- 1 fixed foundation offshore wind farm of 30 MW (10x3MW) is under construction. September 2019 is the expected date for completing the construction.

Wave Energy: During the last decade, progress has been made as regards wave energy development especially in Italy. Among all the technologies under development, few have completed their industrial roll-out. A full-scale demonstration project has been developed in Pantelleria, where a full-scale Inertial Sea Wave Energy Converter (ISWEC) prototype has been tested, and its environmental impacts have also been assessed. The rated power of ISWEC was 100 kW, and it was moored at 800 meters from the coast in a water depth of 35 meters. The principle of operation of ISWEC consists in the interaction of sea waves with the hull of the device and the gyroscopic system. The technology has been also recently tested in a smart grid hybrid system under development in the Adriatic Sea.

Another device for wave and tide energy harvesting is the H24-50KW machine. It is a small device that operates nearshore, completely submerged, and works seamlessly as wave and tidal unit. The machine was bought by Enel GP and recently the energy produced at the test site of Marina di Pisa was delivered into the Italian electricity grid.

Moreover, onshore devices for wave energy harvesting are also worth of notice (Overtopping BReakwater for wave Energy Conversion – OBREC[1] , Resonant Wave Energy Converter – REWEC, WaveSAX) although they are at a less mature state of development.

The current reference policies and strategies are targeting mostly renewable energies as a whole without making any distinction on the type of energy. There are very few policies specific to MRE at national levels. At regional level, the large majority of the smart specialisation strategies in the Mediterranean are targeting the development of renewable energies including marine ones.

The identified strategies are derived from European plans which clearly targets the development of MRE as strategic for the European Union. Seas and oceans are considered as drivers for the European economy and have great potential for innovation and growth. We can underline the following strategies and plans:

- **Blue Growth**: the long-term strategy to support sustainable growth in the marine and maritime sectors as a whole has a specific axis on Ocean and Offshore wind energies;
- **Climate & Energy package**: the 2020 package is a set of binding legislation to ensure the EU meets its climate and energy targets for the year 2020. The package sets three key targets:
  - 20% cut in greenhouse gase-missions (from 1990 levels);
  - 20% of EU energy from renewables;

[1] *Marine Renewable Energy in the Mediterranean Sea: Status and Perspectives_Energies 2017 Takvor H. Soukissian ID, Dimitra Denaxa 1, Flora Karathanasi, Aristides Prospathopoulos, Konstantinos Sarantakos, Athanasia Iona Konstantinos Georgantas 1and Spyridon Mavrakos.*

- 20% improvement in energy efficiency.

The targets were set by EU leaders in 2007 and enacted in legislation in 2009. They are also headline targets of the Europe 2020 strategy for smart, sustainable and inclusive growth. One of the domains concerns the development of renewable energies. The EU member countries have also taken on binding national targets for raising the share of renewables in their energy consumption by 2020, under the Renewable Energy Directive. These targets also vary, to reflect countries' different starting points for renewables production and ability to further increase it – from 10% in Malta to 49% in Sweden.

The overall effect will enable the EU as a whole to reach its 32% target for 2020 (more than double the 2010 level of 9.8%) and a 10% share of renewables in the transport sector[2]. By 2030, a proportion of at least 27% of renewable energy in total energy consumption is expected. By 2050, the EU intends to reduce its emissions considerably, by 80 to 95% compared to 1990.

- **European Strategic Energy Technology Plan (SET PLAN)** aims to accelerate the development and deployment of low-carbon technologies. It seeks to improve new technologies and bring down costs by coordinating national research efforts and helping to finance projects.

[2] https://ec.europa.eu/energy/en/topics/renewable-energy

http://www.europarl.europa.eu/news/en/press-room/20181106IPR18315/energy-new-ambitious-targets-on-renewables-and-energy-efficiency

1. Recommendations for the development of Blue Energy in the Mediterranean area

1.1 Marine Spatial Planning

The offshore renewable energy is an emerging sector and it still demands for risky investments, therefore its clear and explicit inclusion in MSPs should be pursued in order to reduce on the long term the planning and licensing uncertainty, which is necessary to secure investments.

The integration of MRE in Maritime Spatial Plans is a common priority for all the technologies considered, and has to be considered as a major recommendation for future policies. Consequently, potential spatial conflicts with other maritime activities will be minimized. The adoption of technological tools to support the planning activities is also strongly recommended, as well as the identification, through MS plans of potential/prioritised areas for the development of MRE.

1.2 Research and Innovation

The overall objective of the Research & Innovation community in the BE sector is to meet the target of driving down the Levelized Cost of Energy (LCoE), while reinforcing the European industry position on a global stage.

The offshore wind sector is at a much more mature level than the ocean energy one, so specific targets are different for the two classes of technologies. The former has a quantitative target for LCoE of 5-7ct€/kWh by 2030 and the technological challenges mainly concern the development of floating devices, advanced anchoring and mooring systems, lowering of Operation and Maintenance costs. The latter has the quantitative target of 10/15 ct€/kWh in 2030 for tidal/wave technologies respectively, and the great challenge of reaching technological convergence. Both objectives can be achieved by greatly improving the yield, which ultimately depends on the volume of energy produced, performance, survivability and reliability of the prototypes at demonstration and pre-commercial stage. The above mentioned characteristics for a particular device may be verified only when it is placed in operation in the sea, and the operation of full-scale devices in relevant environment is a prerequisite to the commercialization. In this view cost-effective deployment of MREs should be encouraged, as well as the strengthening of natural laboratories for testing marine energy devices. The upgrade of low TRL technologies to more advanced levels should be supported in order to favour technological convergence

1.3 Awareness raising activities

A successful MRE development strategy in the Mediterranean Sea should look after for the settlement of qualitative targets clearly expressed in the Europe 2020 strategy structured to create new job offers and to deliver a sense of direction to the society. The relevant policies should deal with the problem of social acceptance of MRE projects. Therefore, with the contribution of governance support, the supply of highly educated citizens should be ensured. Informational campaigns and training platforms must be designed in an attempt to increase awareness about the benefits provided from MRE exploitation through education, campaigns and actual public engagement in MRE processes. A certain feedback through socio-economic surveys, during the design phase of MRE projects, along with public consultation procedures should also be adopted.

Finally, the introduction of the Blue growth strategy or the inclusion of it in other national strategies like RIS3 or similar is necessary. The bodies that are in charge to introduce the forthcoming RIS3 strategies, should establish communication with all relevant stakeholders related to the Blue economy in order to produce integrative and comprehensive documents.

1.4 Access to funding

To develop Marine Renewable Energies in the Mediterranean, substantial and stable public investment is required to commercialize the industry with the objective to reach a production cost in between €50 to €60 per MWh to be competitive with the other current sources of energies (nuclear, terrestrial renewables (solar/ wind)). The public commitment will stimulate private investment and foster a long term investors' confidence for the future of marine energy industry in MED. The countries in which investments were first and most important (Germany, Netherland, Denmark, the UK and more recently France) have changed their legislation to facilitate investment in offshore wind farms. This change is mainly about the risk reduction of investors (energy specialists) who respond to the call for tenders. This risk reduction is based on the fact that the Public authorities give the tender specifications full knowledge of the initial states (soil, wind, environment, etc.). Thus investors do not take a margin for risks. As MRE are at different stages of development, those investments are expected to finance from the early stage devices, to pilots, large scale demonstrators and commercial farms installation (To give benchmarks: in France, the cost of each pilot of 24 MW is more than M€ 220. The state subsidy is nearly M€ 75). They are also required to de-risk the technologies that will be deployed at a commercial stage. In most of the European countries where MRE are currently developed/ under development, national public calls for projects were launched (England, France, Germany and Portugal). Time will be finally necessary to decrease the production price as the experience curve (Boston Consulting Group) demonstrates: "company's unit production costs would fall by a predictable amount—typically 20 to 30 percent in real terms—for each doubling of "experience," or accumulated production volume".

1.5 Simplification of procedures

There is an overall lack of knowledge about regulatory processes to be followed to get authorization to develop a MRE project. In addition, the procedures are in most of the MED countries complex, it prevents from developing various initiatives, which would contribute to the emergence of a strong economic sector in the MED area. The procedures to implement MRE pilots (connected or not to the grid) and get the authorisations such as permit, license, or other forms of permission should be simplified, explained and promoted to MRE projects developers.

1.6 Grid connection

MRE production requires a transmission infrastructure for the connection of the offshore generated electricity to the onshore electricity network, including onshore and offshore sub-stations and cabling between offshore platforms and onshore substations. Selection of sites with existent components of the required electricity network (e.g., an onshore substation) can mitigate costs and facilitate the integration of a MRE project. Nevertheless, the available electricity grid connection in the Mediterranean basin is very limited. A map of the existing electricity grid connection in the Mediterranean can be found in https://www.entsoe.eu/data/map/. The grid connection issue is of most importance especially for non-interconnected islands, as e.g., the majority of the Greek islands. Therefore, there is need to accelerate the grid construction in order to support clean islands sustainable solutions, reduce their dependency on fuel imports and mitigate climate change. As a step forward, and due to MRE intermittency, there is also need for efficient power grids including smart grids that are able to preserve the balance between the power supply and demand. Relevant progress can be greatly facilitated, at least at the regional level, by applying joint actions and procedures when developing infrastructures relevant to MRE projects.

In addition, there is a necessity to adapt the existing networks to the specificities of MREs. Existing energy networks are traditionally organized in “star form” from power plants to consumers. MRE networks should be meshed from distributed energies. Those heavy investments should be funded by the energy network operator therefore they determine an impact on the price of MRE.

2. Road map

	Recommendations	Actions	Priority
MARINE SPATIAL PLANNING	Minimization of potential spatial conflicts with other maritime activities	▪ Promote the use of multi-use platforms (MUP) to enhance synergies among different sectors (e.g. energy, aquaculture); ▪ Adopt policies of multi-use space where MRE installations may coexist with other maritime activities in MSPs; ▪ Promote suitable temporal and spatial allocation of maritime space access permission among different activities.	***
	Development of technological tools (e.g. web portal) to support MSP	▪ Include preliminary detailed sea monitoring and analysis (habitat mapping, evaluation of BE potential, analysis of potential conflicts/synergies with other activities); ▪ Promote the development of Geographic Information System (GIS) based tools for data managing and decision making through multi-objective optimization procedures for the best selection of BE deployment areas.	***
	Use of MSP to actively contribute to meet the decarbonisation targets	▪ Assessment of the MREs potential and quantification of its potential share in the energy mix to meet the EU obligations in decarbonisation targets (especially for islands).	**
	Identification of potential/prioritised areas for the development of MRE in the BE	▪ Identification of areas suitable for real environment testing facilities for new devices (see also R&I).	***
RESEARCH AND INNOVATION	Encouraging cost-effective deployment of MREs	• Support Technology development aimed to reduce operation costs of MRE farms. For example, development of fewer large sized turbines and infrastructures with the same project capacity/ design tools (biofouling, behaviour of structure/ components in fatigue). • Support the development of new technologies for floating wind turbines (floaters, anchors) capable to operate in deep waters and/or far from shore. • Support to the development of energy storage (Hydrogen) • Co-location of MRE infrastructures (Floating Wind Turbines, Wave Energy Converters, Solar panels). Substructure technologies supporting the new schemes	***

	Recommendations	Actions	Priority
		associated with deeper waters to be innovatively design with materials and geometries that simplify manufacturing and installation operations. • Support R&I projects aimed to lower manufacturing and/or installation and/or maintenance costs by adopting new materials and new design concepts; • Support R&I projects for the development of multi-use platform; • Use of HVDC (high-voltage direct current transmission) grids that has much lower losses and improves the availability of the power. (https://cordis.europa.eu/news/rcn/129564/en)	
	Strengthening of natural laboratories for testing marine energy devices	• Reinforce the role of existent natural laboratories for the testing of systems in operational environment; • Promote the realization of a network of natural laboratories with same standards, for an optimal use of the resources; • Adopt simplified procedures for short term deployment at sea of devices for testing/experimental purposes.	***
	Support the upgrade of low TRL technologies to more advanced levels	• Support demonstration projects to accelerate the development of the sector; • Support projects and activities in numerical modelling aimed to simulate the hydrodynamic properties of the new concepts in realistic operative conditions; • Support the development of adequate informatics systems apt to gather, store and manage all the information obtained during tests in indoor laboratories, in natural laboratories, measurement campaigns in order to enhance the sharing and exploitation of the huge amount of data already available (Big Data, Data Mining).	***
AWARENESS RAISING ACTIVITIES	Introduce the MRE concepts and advantages at the educational community and the public	• Increase awareness about the benefits provided from MRE exploitation through education, campaigns and public engagement in MRE processes	***
	Introduce the MRE concepts and advantages at the regional and governmental authorities	• Introduction of the strategy for a Blue growth or inclusion of this concept in other national strategies like RIS3 or similar. The Ministry in charge for introducing RIS3 strategy for 2021-2027, should establish communication with all relevant stakeholders related to the Blue economy in order to produce an integrative, comprehensive document	***

	Recommendations	Actions	Priority
	Develop tools and methods for information dissemination and awareness raising support	• Study and improve the acceptability of MRE project through an enhanced knowledge of their environmental interactions and a throughout multidisciplinary evaluation including socio-economic dimension	***
		• Identification of the public attitude before the initiation of the project using software platforms that are able to simulate various views and evaluate public reactions in order to minimize future public oppositions.	***
ACCESS TO FUNDING	Support non-mature MRE projects development	▪ Creation of dedicated funding instrument for non-mature MRE to finance R&D, demonstrator	***
	Build an incentive policies and mechanisms	• Part of the tax on energy paid by the consumers to finance MRE development • Tax rebates plan for MRE projects, granting of loans from banks.	***
		• Issuance of power purchase agreements in order to avoid high upfront capital costs, systemic risks, complexity in designing and permitting processes • Introduction of production-based incentives (PBIs) which exploits the electricity generated from offshore renewable energy sources	***
SIMPLIFICATION OF PROCEDURES	Accelerate the processes to develop a MRE project	• Development of "one-stop-shops" to facilitate and accelerate the administrative processes, with a single organization responsible for providing guidance through the administrative, planning and consenting process.	***
	Increase awareness on how to develop MRE projects	• Communicate in a clear and precise way the procedures and documents required to obtain needed permission for MRE projects	***
GRID CONNECTION	Re-engineering of the electricity services industry	• Adaptation of the existing networks to the specificities of MREs	***
		• Acceleration of grid construction/joint actions/infrastructures for the non-interconnected Mediterranean islands	***
		• Support clean islands sustainable solutions to reduce their dependency on imports	***

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