



SAFE STREAMLINING THE ASSESSMENT OF ENVIRONMENTAL EFFECTS OF WAVE ENERGY WAVE

DELIVERABLE 4.4 Use cases and profiles



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WP 4

Deliverable 4.4 Use cases and profiles

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1. SAFE WAVE project synopsis

The European Atlantic Ocean offers a high potential for marine renewable energy (MRE), which is targeted to be at least 32% of the EU's gross final consumption by 2030 (European Commission, 2020)(European Commission, 2020). The European Commission is supporting the development of the ocean energy sector through an array of activities and policies: the Green Deal, the Energy Union, the Strategic Energy Technology Plan (SET-Plan) and the Sustainable Blue Economy Strategy. As part of the Green Deal, the Commission adopted the EU Offshore Renewable Energy Strategy (European Commission, 2020) which estimates to have an installed capacity of at least 60 GW of offshore wind and at least 1 GW of ocean energy by 2030, reaching 300 GW and 40 GW of installed capacity, respectively, moving the EU towards climate neutrality by 2050.

Another important policy initiative is the REPowerEU plan (European Commission, 2022) which the European Commission launched in response to Russia's invasion of Ukraine. REPowerEU plan aims to reduce the European dependence amongst Member States on Russian energy sources, substituting fossil fuels by accelerating Europe's clean energy transition to a more resilient energy system and a true Energy Union. In this context, higher renewable energy targets and additional investment, as well as introducing mechanisms to shorten and simplify the consenting processes (i.e., 'go-to' areas or suitable areas designated by a Member State for renewable energy production) will enable the EU to fully meet the REPowerEU objectives.

The nascent status of the Marine Renewable Energy (MRE) sector and Wave Energy (WE) in particular, yields many unknowns about its potential environmental pressures and impacts, some of them still far from being completely understood. Wave Energy Converters' (WECs) operation in the marine environment is still perceived by regulators and stakeholders as a risky activity, particularly for some groups of species and habitats.

The complexity of MRE licensing processes is also indicated as one of the main barriers to the sector development. The lack of clarity of procedures (arising from the lack of specific laws for this type of projects), the varied number of authorities to be consulted and the early stage of Marine Spatial Planning (MSP) implementation are examples of the issues identified to delay projects' permitting.

Finally, there is also a need to provide more information on the sector not only to regulators, developers, and other stakeholders but also to the general public. Information should be provided focusing on the ocean energy sector technical aspects, effects on the marine environment, role on local and regional socio-economic aspects and effects in a global scale as a sector producing clean energy and thus having a role in contributing to decarbonise human activities. Only with an informed society would be possible to carry out fruitful public debates on MRE implementation at the local level.

These non-technological barriers that could hinder the future development of WE in EU, are being addressed by the WESE project funded by EMFF in 2018. The present project builds on the results of the WESE project and aims to move forward through the following specific objectives:

1. Development of an **Environmental Research Demonstration Strategy** based on the collection, processing, modelling, analysis and sharing of environmental data collected in WE site from different European countries where WECs are currently operating (Mutriku power plant and BIMEP in Spain, Aguçadoura in Portugal and SEMREV in France); the SafeWAVE project aims to enhance the understanding of the negative, positive and negligible effects of WE projects. The SafeWAVE project will continue previous work, carried out under the WESE project, to increase the knowledge on priority research areas, enlarging the analysis to other types of sites, technologies, and countries. This will increase information robustness to better inform decision-makers and managers on real environmental risks, broaden the engagement with relevant stakeholders, related sectors, and the public at large and reduce environmental uncertainties in consenting of WE deployments across Europe.
2. Development of a **Consenting and Planning Strategy** through providing guidance to ocean energy developers and to public authorities tasked with consenting and licensing of WE projects in France and Ireland; this strategy will build on country-specific licensing guidance and on the application of the MSP decision support tool developed for Spain and Portugal in the framework of the WESE project; the results will complete guidance to ocean energy developers and public authorities for most of the EU countries in the Atlantic Arch.

3. Development of a **Public Education and Engagement Strategy** to work collaboratively with coastal communities in France, Ireland, Portugal and Spain, to co-develop and demonstrate a framework for education and public engagement (EPE) of MRE enhancing ocean literacy and improving the quality of public debates.

2. Executive summary

The present document lists a number of use cases for different user profiles.

The data platform serves data providers, authorities, developers, researchers, and regulators, as well as the partners of the project, constituting different profiles, with different experiences using the platform. The Platform is under continuous improvement in order to have better data insights, new use cases, and improved dissemination to all types of stakeholders including the general public.

Data access in previous versions of the MARENDATA platform is free and therefore all authenticated users have direct access to all sets of data. This concept was used because all uploaded data had free access.

Relevant user stories were developed to guide authentication/authorization development and broaden the functionalities available for users of the platform. This will be developed using widely used requirement definition concepts like: "As a <role>, I want <goal/desire>, so that <benefit>".

3. Introduction

In the SAFEWAVE project, examples of case studies and profiles, in the marine energy industry, were developed to assist existing and new users of the platform, but also to guide further developments of the platform. These case studies aim to show possible actions and experiences that the platform allows to carry out and they reflect the use of the data. These were developed using widely used requirement definition concepts like: “As a <role>, I want <goal/desire>, so that <benefit>”.

Its objective is to show different features aimed at different user profiles, so that they can contribute to improving the needs of regular users and/or show the platform's skills to first-time users. After signing up on the platform, any user has access to the available data.

The platform is always in continuous improvement, in terms of features but also due to the increase in data availability. It is aimed at data providers, authorities, developers, researchers, students, and regulators, as well as the partners of the project or the public in general.

Below, is a list of case studies that reflect the experience of different user profiles when accessing the platform. These case studies will also be included for direct access in the platform.

4. Use cases and profiles

4.1 Underwater noise

Role	Consultant
Goal/desire	Evaluate acoustic data to support Environmental Impact Assessments
Benefit	<p>A set of acoustic surveys is available on the MARENDATA platform. This type of data is limited, rare and constitutes information of great importance for the assessment of the environmental impact.</p> <p>They can be a relevant contribution to examining the potential impacts associated with WECs infrastructure, as well as assessing the potential impacts of underwater noise. It is difficult to measure temporary to permanent behaviour disturbance due to noise perturbation, but since most hearing ranges of marine mammals are known, it is possible to make predictions about the impact on different species by measuring the noise of a sound source. As WEC's noise output varies under different wave conditions, noise should be measured for these various conditions. The following potential noise from WEC's developments are: (1) Installation/Decommissioning Noise Sources (Installation/removal of anchors; Piling/drilling; Construction traffic; Subsea cable/high pressure pipeline installation/removal) and (2) Operational Noise (Energy conversion mechanism; Mooring line vibration; Waves contacting the device; Maintenance/repair vessel traffic)</p>
Possible actions to carry out in the platform	<p>Search for "acoustics" in Navigation window</p> <p>Select the Test Site of interest</p> <p>Select the data set you need</p>
Example of extracted data	<p>Data set from Peniche:</p> <ul style="list-style-type: none"> • Category: Acoustics • SubCategory: Fixed Hydrophones • Name: Acoustic Transmission Losses fields from WaveRoller device • Time Type: Historic • Start: 2019-05-30 00:00 • End: 2019-05-30 00:00 • Data Type: NetCDF file • file name: "TL_field_WR.nc" • 41Mb <p>Deliverable from WESE project on Noise Monitoring:</p> <ul style="list-style-type: none"> • https://marendata.eu/assets/D2.3_wese.pdf

4.2 Management of marine litter data.

Role	Public administration officer
Goal/desire	Evaluate how monitoring and control of pollution levels can be done near wave energy converters
Benefit	<p>The MARENDATA platform has a set of remote underwater videos that were captured to evaluate and monitor the equipment implemented within the scope of the platform projects (for example, on the BIMEP and Peniche test sites). Other videos portray underwater life and the interaction of marine life with equipment, such as at the EMEC test site.</p> <p>These videos available on MARENDATA can be used to enable monitoring and control of pollution levels at test sites, supporting the link between monitoring programs and data management.</p>
Possible actions to carry out in the platform	<p>Search for "video" in Navigation window</p> <p>Select the Test Site of interest</p> <p>Select the data set you need</p>
Example of extracted data	<p>Data set from BiMEP:</p> <ul style="list-style-type: none"> • Category: Benthos • SubCategory: Video Transects/ROV • Name: Video recording in BiMEP - Connector • Time Type: Historic • Start: 2019-05-15 00:00 • End: 2019-05-22 00:00 • Data Type: YouTube video

4.3 Ocean measurement equipment.

Role	Test site manager
Goal/desire	Planning of monitoring campaign and equipment deployment
Benefit	<p>Measuring equipment allows the collection of data on existing conditions in the maritime space. In a measurement campaign, it is important to know the characteristic conditions of the study site, for reasons of safety of the equipment itself, but also to estimate the order of magnitude of the expected measurements.</p> <p>The MARENDATA platform has multiple datasets for the different test sites. An hourly wave and wind reanalysis dataset from 1979 to 2022 covering the global ocean is also available. Planning based on historical data available on the MARENDATA platform makes it possible to estimate security conditions, determine specific periods for carrying out the campaign, calculate the duration of the campaign, as well as estimate the necessary energy consumption of the equipment, if applicable.</p>
Possible actions to carry out in the platform	<p>Search for “waves” in Navigation window</p> <p>Select the Test Site of interest</p> <p>Select the data set you need</p>
Example of extracted data	<p>Data set from SEMREV:</p> <ul style="list-style-type: none"> • Category: Waves • SubCategory: Wave Buoy • Name: SEM-REV wave buoy data (Ménéham) • Time Type: Historic • Start: 2011-01-01 00:00 • End: 2011-12-31 00:00 • Data Type: CSV - Time, Properties • File: DMP_SOWFIA_SEM-REV_wavedata.csv • Size: 835 Kb <p>Using the feature “Charts” (in the lower right panel) it is possible to chart time series or scatter plots with selected data.</p>

4.4 Characterization of a WEC test site.

Role	Environmental expert
Goal/desire	Characterization of a WEC test site
Benefit	<p>The characterization of a certain location can be done with data available on MARENDATA. Although it is focused on test sites, and therefore most of its data is geographically limited around those areas, they may be representative of other sites.</p> <p>In addition, MARENDATA has a dataset of ERA5¹ reanalysis for an extensive period of years from 1979 to 2022. It is possible to easily extract the wind and wave parameters from anywhere in the world, namely, the properties of significant wave height, peak period, mean wave direction and wind intensity and direction.</p>
Possible actions to carry out in the platform	<p>Search for “benthos” in Navigation window</p> <p>Select the Test Site of interest</p> <p>Select the data set you need</p>
Example of extracted data	<p>Data set from AMETS:</p> <ul style="list-style-type: none"> • Category: Benthos • SubCategory: Multi-methods • Name: AMETS_Flora and Fauna_Subtidal Benthos • Time Type: Historic • Start: 2010-07-01 00:00 • End: 2010-11-30 00:00 • Data Type: Zip file with a pdf report • File: Flora_and_Fauna_Subtidal_Benthos.zip • Size: 646 Kb

¹ ERA5 is the fifth generation European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis for the global climate and weather. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics. This principle, called data assimilation, is based on the method used by numerical weather prediction centres, where every so many hours (12 hours at ECMWF) a previous forecast is combined with newly available observations in an optimal way to produce a new best estimate of the state of the atmosphere, called analysis, from which an updated, improved forecast is issued (<https://cds.climate.copernicus.eu>).

4.5 Metocean reports and in supporting the development of offshore renewable energy projects.

Role	Maritime energy expert
Goal/desire	Making of metocean reports to support the development of offshore renewable energy projects
Benefit	<p>As someone involved in the development of metocean reports to support the development of offshore renewable energy projects, I am interested in having access to long-term hourly hindcast data (wave and wind) for a given site of my choice, as well as static bathymetry information. As such, I am interested in having easily downloadable data. Ideally, I would like to be able to select an area by selecting a point in a map. In respect to parameters, I am interested in:</p> <ul style="list-style-type: none"> • Significant wave height (Hs) • Peak Period (Tp) • Wave direction (°) • Wind speed at 10 m (m/s) • Wind direction at 10 m (°)
Possible actions to carry out in the platform	<p>A data set from ERA5 with the above mentioned parameters, for any oceanic point in the world, can be extracted by:</p> <ul style="list-style-type: none"> • Selecting on the Navigation panel: Other/Waves/None/ ERA5 hourly data on single levels from 1979 to present • On the lower right panel clicking on "Report" • Dragging the green marker on the map and clicking the "OK" button • Filling in the start and end date (multiple requests can be made but with maximum periods of 10 years on each order) and then clicking "Download". • When it finished, open the downloaded excel file and check the data in the "Historic" sheet. <p>On the MARENDATA platform it is also possible to locate a particular test site and verify all data sources already collected for that location. To select a particular test site, search for <TestSite> in Navigation window.</p> <p>According to the available data, it can view it in video format, time series graph, scatter plot, or downloaded immediately in several formats (e.g. *.pdf, *.tiff, *.xlsx, .shp).</p>
Example of extracted data	<p>Data set from ERA5:</p> <ul style="list-style-type: none"> • Category: Waves • SubCategory: None • Name: ERA5 hourly data on single levels from 1979 to present • Start: <date defined in the interface> • End: <date defined in the interface>

	<ul style="list-style-type: none">• Data Type: Excel file• File: SowfiaDownloadHistoricReport_XXXXXX.xlsx• Size: <variable>
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4.6 Environmental monitoring and environmental Impact Assessment reports

Role	Environmental expert
Goal/desire	To prepare environmental monitoring and environmental Impact Assessment reports
Benefit	To prepare environmental monitoring and environmental Impact Assessment reports for marine energy sites, it would be useful to have data on demand for specific areas. This can include oceanographic data like significant wave height, water temperature and current speed. Data could be presented as graphs for easy visualization, but also as excel files to allow for a more specific data analysis.
Possible actions to carry out in the platform	Search for “current” in Navigation window Select the Test Site of interest Select the data set you need
Examples of extracted data	<p>Data set from BiMEP:</p> <ul style="list-style-type: none"> • Category: Waves • SubCategory: Multi-methods • Name: BiMEP wave current 2019 • Time Type: Historic • Start: 2019-01-01 00:00 • End: 2019-11-08 00:00 • Data Type: Zip file with a excel • File: BIMEP_2019_waves_sfc_currents.zip • Size: 787 Kb <p>Data set from Ocean Plug:</p> <ul style="list-style-type: none"> • Category: Currents • SubCategory: ADCP • Name: MONICAN - Ocean Buoy - Currents Position 3 • Time Type: Historic • Start: 2010-03-23 00:00 • End: 2010-08-07 00:00 • Data Type: CSV - Time, Properties • File: Curr_BoiaOceanica2010mar23-2010ago06.csv • Size: 530 Kb <p>Using the feature “Charts” (in the lower right panel) it is possible to chart time series or scatter plots with selected data.</p>

4.7 Benthic ecosystems

Role	Biologist
Goal/desire	Analyse the behaviour of the species and characteristics species of test site.
Benefit	The MARENDATA platform provides a set five-minute YouTube videos showing baited microfauna in EMEC test site (1). This source helps having an insight of the bigger organisms feeding on the substrate. The list of abundance of species is a useful complement to the videos, as it identifies all the species' names present in the videos (2).
Possible actions to carry out in the platform	Search for (1) "videos" or (2) "species" in Navigation window" Select the Test Site of interest Select the data set you need
Example of extracted data	<p>(1) Data set from EMEC:</p> <ul style="list-style-type: none"> • Category: Benthos • SubCategory: Other Video/Photographs • Name: Baited video (WECPI5W2) • Time Type: Historic • Start: 2019-08-12 00:00 • End: 2019-09-13 00:00 • Data Type: YouTube video <p>(2) Data set from EMEC:</p> <ul style="list-style-type: none"> • Category: Benthos • SubCategory: Other Video/Photographs • Name: Species list and abundance for baited videos • Time Type: Historic • Start: 2019-08-12 00:00 • End: 2019-09-13 00:00 • Data Type: Zip file with a txt file • File: BRUV_species_and_relative_abundance_2019.zip • Size: 1 Kb

4.8 Benthos colonization in offshore structures Lysekil

Role	Marine ecologist
Goal/desire	Study the colonization of blue mussels on offshore buoys
Benefit	A study of the Colonization of blue mussels on offshore buoys is available in the MARENDATA platform. This study looks at the colonization of the blue mussel, <i>M. edulis</i> on artificial substrates varies highly with wave exposure, which reflects on the size and biomass of blue mussels. The growth of these mussels is also due to the lack of predation such as starfish as they are sensitive to wave exposure and thus keep away from mussel assemblages. Additionally, there is a better colonization of blue mussels on exposed buoys due to fewer parasite infestations thanks to dilution in offshore transports. They concluded that power parks built further than 10 km offshore, where the wave climate is severe, will carry smaller and fewer mussel assemblages. If further parks are built more offshore, there will be a lower concentration of mussel larvae due to dilution during offshore dispersal and intense predation.
Possible actions to carry out in the platform	Search for “blue mussels” in Navigation window Select the Test Site of interest Select the data set you need
Example of extracted data	Data set from Lysekil: <ul style="list-style-type: none"> • Category: Benthos • SubCategory: Biofouling Studies • Name: Colonization of blue mussels (<i>Mytilus Edulis</i>) on offshore wave power installations • Time Type: Historic • Start: 2005-07-18 00:00 • End: 2006-07-05 00:00 • Data Type: Zip file with a pdf report • File: Colonisation_of_blue_mussels.zip • Size: 443 Kb

4.9 Impact of the energy devices in the migratory path of bird species.

Role	Environmental expert
Goal/desire	To study the possible interference of offshore energy sites on birds' migratory paths
Benefit	<p>Migratory paths have always been important to study when it comes to building energy parks whether it is on land, on the coast or offshore. The environmental assessment must consider birds' migrations to adjust the location of their installations.</p> <p>A document available in MARENDATA platform provides sampling of biological communities of sea birds and marine mammals in the Portuguese Pilot Zone (PZ) for the implementation of offshore Renewable Energies. They assessed the general potential (positive and negative, see below) impacts of actions and development phases of offshore renewable energy projects on birds and marine mammals. The study does not separate resident and migratory birds. They concluded that Portugal is an important route passage for migratory birds as they fly between breeding grounds in Northern Europe and wintering grounds in Western Africa or the South Atlantic, although many breeding birds from Northern Europe are also found on the Portuguese coast during winter time. They noticed that the barrier effect has a different impact on breeding or migratory birds. In fact, migratory birds must face the obstacle only twice a year, whereas for the others, it is a daily challenge, which will add energy costs to their feeding trips. Instead, there might not be significant additional energy costs for migratory birds, especially for species capable of long-distance migration. Additionally, perturbation on habitats and collisions probability increase during winter and migration season.</p>
Possible actions to carry out in the platform	<p>Search for "birds" in Navigation window</p> <p>Select the Test Site of interest</p> <p>Select the data set you need</p>
Example of extracted data	<p>Data set from Ocean Plug:</p> <ul style="list-style-type: none"> • Category: Birds • SubCategory: Boat Survey • Name: OceanPlug - Sea birds and marine mammals baseline report • Time Type: Historic • Start: 2011-05-31 00:00 • End: 2011-05-20 00:00 • Data Type: PDF • File: Relatorio_aves_mamiferos_marinhos_ZPP_vf_2011-09-22.pdf • Size: 1 931 Kb

4.10 Platform usability and support tools.

Role	Student
Goal/desire	Understand the platform features
Description	To assist in exploring the MARENDATA platform, videos were created that show some features of the platform. A link was added on the MARENDATA platform directed to the MARENDATA video channel, where the user can access all available videos.
Possible actions to carry out in the platform	Select “YouTube Channel” on the top bar
Example of extracted data	Video: Marendata charts

4.11 Available data is on the platform

Role	General public
Goal/desire	To assess what data is available in platform
Description	The list of information available on each test site can be consulted by opening the data source tree for each test site. More information and details can be found in the project documents available on MARENDATA.
Possible actions to carry out in the platform	Select one of the projects on the top bar
Example of extracted data	Data set from Sowfia project: <ul style="list-style-type: none"> • Deliverables: WP2 Catalogue of Wave Energy Test Centres • Link: https://marendata.eu/assets/D2.1_Catalogue_of_Wave_Energy_Test_Centres.pdf

5. Case studies in MARENDATA

The case studies above mentioned will be made available on the MARENDATA platform. Clicking on “Case studies” access the list of existing case studies (Figure 1).

This feature of the platform is planned to evolve as users give feedback and there is a need to update or add new use cases.

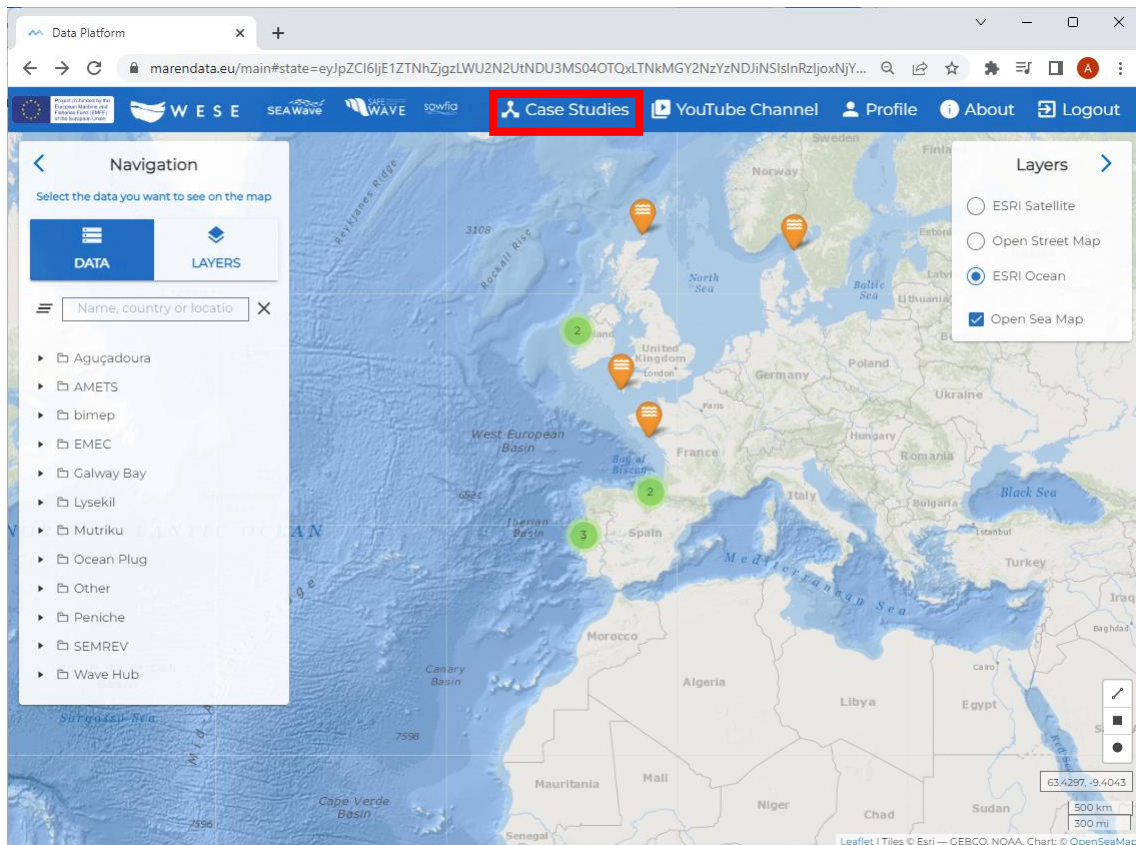


Figure 1. Case Studies in MARENDATA Platform.