SAFE WAVE

STREAMLINING THE ASSESSMENT OF ENVIRONMENTAL EFFECTS OF WAVE ENERGY

DELIVERABLE 4.5
Wider user experience

This Project is co-funded by the European Climate, Infrastructure and Environment Executive Agency (CINEA)

WP 4

Deliverable 4.5 Wider user experience

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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). 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 European Maritime and Fisheries Fund (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 sites 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, broad 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 tools (i.e. WEC-ERA[1] by Galparsoro et al., 2021[2] and VAPEM[3] tools) 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.

[1] https://aztidata.es/wec-era/;
[2] Galparsoro, I., M. Korta, I. Subirana, Á. Borja, I. Menchaca, O. Solaun, I. Muxika, G. Iglesias, J. Bald, 2021. A new framework and tool for ecological risk assessment of wave energy converters projects. Renewable and Sustainable Energy Reviews, 151: 111539
[3] https://aztidata.es/vapem/

Executive summary

The present document addresses the topic of a wider use of https://MARENDATA.EU (MARENDATA), beyond the framework of the SeaWAVE project. The vision for the MARENDATA platform is based on two core principles: the renewable energy industry requires complex environmental information to address the challenges of harnessing energy from the marine environment, and this information will be delivered through an established open platform that aggregates multiple sources of raw and secondary data to ensure users have access to meaningful insights. This information is provided in the form of charts, documents, videos, images, and reports with data ready for analysis. Throughout the project, efforts have been made to implement new features that enhance the user experience.

This vision helps to refine the mission of the service. Currently, the mission aims to establish a robust IT platform that links with existing and new data repositories, enables access to raw and secondary data, disseminates expert-reviewed data and knowledge, ensures sustainability despite financial constraints of individual projects, and reaches a broad audience within the industry.

1. Introduction

This report aims to provide a description of the new features included in https://MARENDATA.EU (MARENDATA) which are meant to widen its use. Several new features were designed to enhance the platform's functionality and user experience:

- Case studies: Relevant user stories were developed to guide new and existing users on the platform and to expand the available functionalities. These stories will be created using widely adopted requirement definition concepts, such as: "As a <role>, I want <goal/desire>, so that <benefit>." These were presented in detail in deliverable 4.4.
- Long-term wave and wind series and report analysis: a set of post-processed analyses and data representations were calculated according to the standards outlined in the technical specifications for wave energy resource assessment, for all test sites.
- Integration of MARENDATA into the PRIMRE Portal: MARENDATA, has been seamlessly integrated into the Portal and Repository for Information on Marine Renewable Energy (PRIMRE) available at https://primre.org/. A deep link was made available from the primary endpoint, directing users to a specific dataset.
- New logo for MARENDATA: The logo for the MARENDATA platform has been developed by the Communication team at WAVEC.
- Third party identity providers: Users now have the option to log in to MARENDATA using their existing Microsoft, Google, or Facebook accounts. This integration simplifies the login process, facilitating a smoother onboarding experience for new users.
- Messages and notifications: Notifying the user about the actions in progress.

These new features are anticipated to significantly enhance the efficiency and usability of MARENDATA. It is anticipated that they will deliver substantial benefits to existing and new platform users.

2. Case studies

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 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.

A list of case studies was available on the MARENDATA platform. Clicking on "Case studies" access the list of existing case studies (Figure 1).

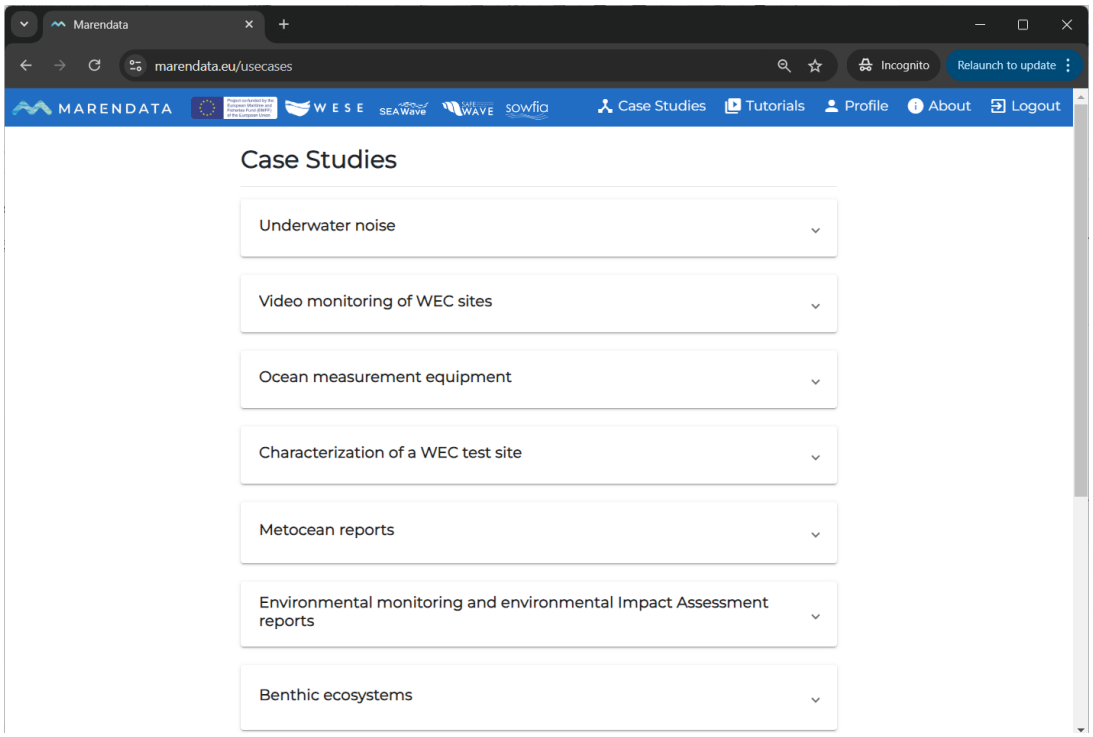

Figure 1. Case Studies in MARENDATA Platform.

3. Long-term wave and wind series and report analysis

3.1 Introduction

Using hindcast wave and wind hourly data from ERA5 (January 1, 1979, to December 31, 2020), a post-processed analysis and data representation were performed following the technical specifications for wave energy resource assessment by the International Electrotechnical Commission (IEC TS 63600-101, referred to as TS101).

3.2 Charts and reports

This dataset, sourced from the MARENDATA platform, can be extracted for all test sites (Figure 2). The post-processed analysis was summarized in a report available under "Download secondary data", in the "Multi-methods" section of "Waves".

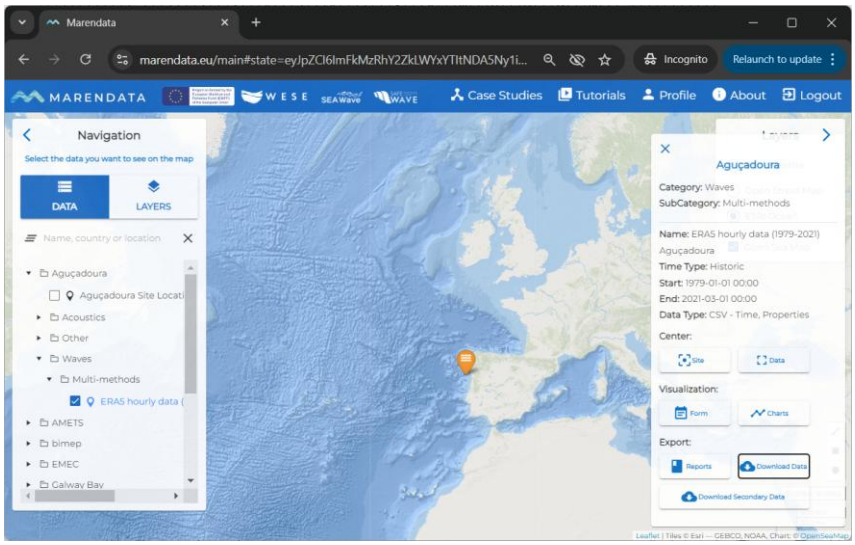

Figure 2. Download data in .csv format

Long-term time series can be displayed in the "Charts" option. Parameters for graphical representation, including significant wave height, mean wave direction, peak wave period, wind intensity, wind direction, energy period and wave power, were available from 01/01/1979 to 01/03/2021

(Figure 3). Scatter plots can also be created to compare different periods by selecting a specific time within the available data range (Figure 4).

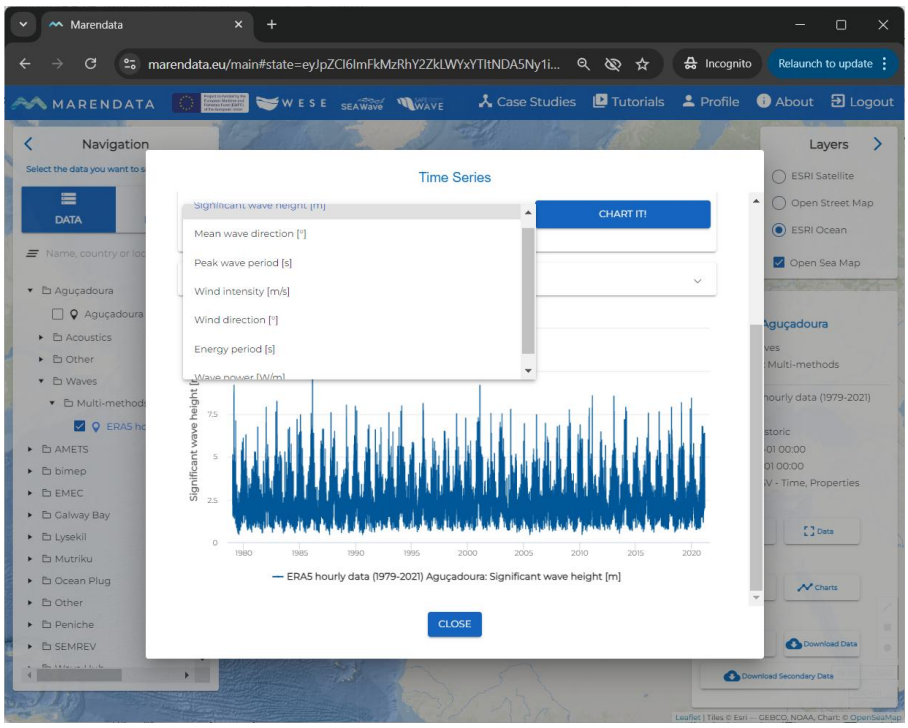

Figure 3. Time Series chart for hourly data from ERA5, for a test site.

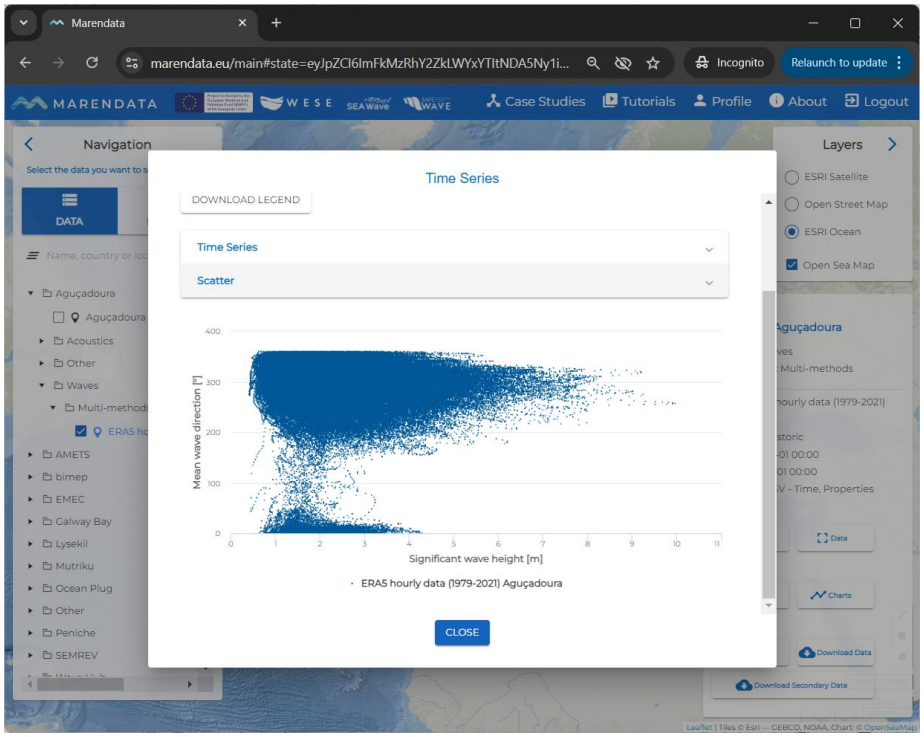

Figure 4. Scatter for significant wave height and mean wave direction, in Aguçadoura test site.

The analysis report includes a statistical analysis of over 40 years of wave and wind data (Figure 5), consisting of a set of scatter plots, wind roses, and tables.

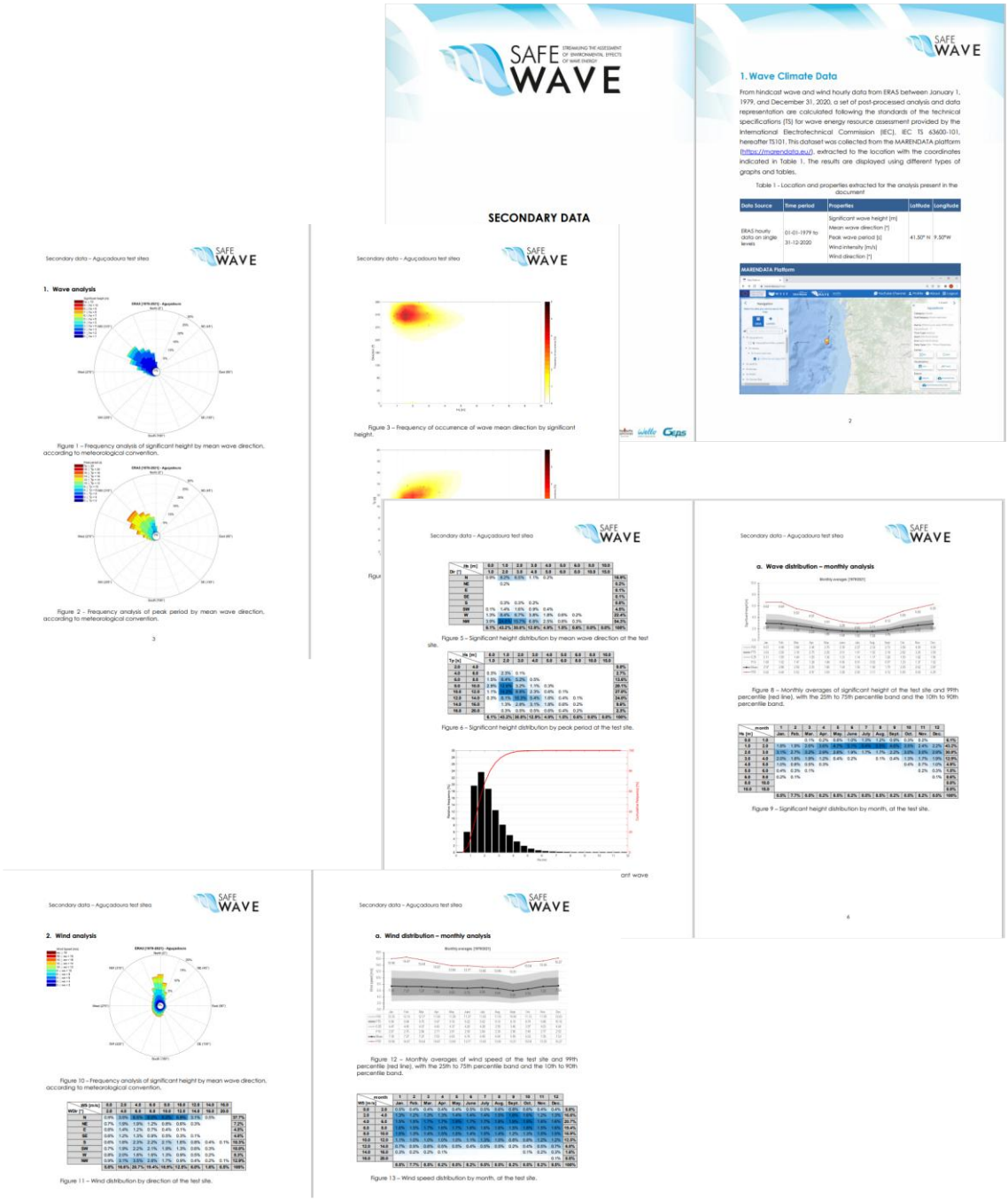

Figure 5. Report analysis.

4. New logo for MARENDATA

The new logo for MARENDATA was designed by WavEC and is available in both colour and grayscale versions (Figure 6).

Details of the logo design:

- The logo draws inspiration from the dynamics of the sea.
- An "M" is shaped like a wave, with the "M" of MARENDATA surrounded by waves.
- The colours are inspired by the sea, featuring shades of blue and aqua green.
- Expressive lettering is used to highlight the name.

Figure 6. MARENDATA logo.

5. Third party identity providers

Users now have the option to log in to MARENDATA using their existing Microsoft, Google, or Facebook accounts (Figure 7). This integration simplifies the login process, facilitating a smoother onboarding experience for new users.

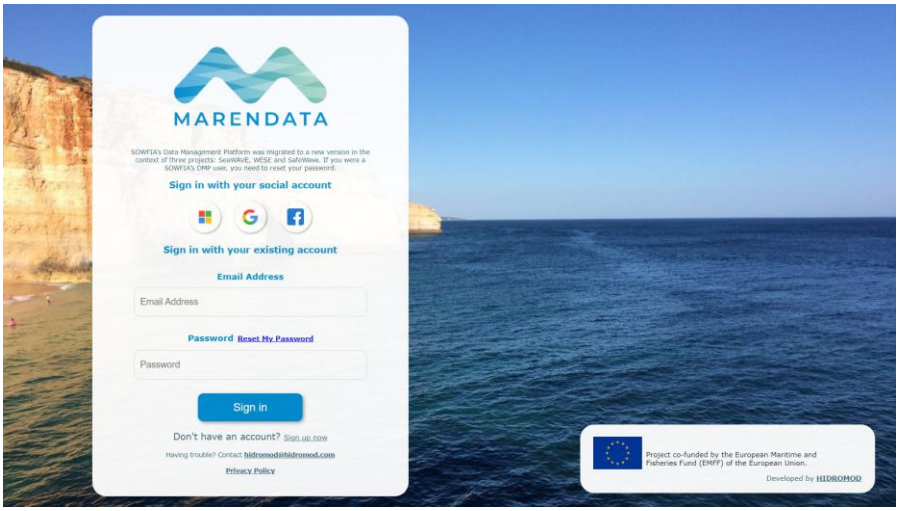

Figure 7. Login in MARENDATA Platform.

The third-party identity providers (IDP) manage user identities and authentication process on behalf of MARENDATA. Instead of requiring users to create and manage a separate account with their own username and password, a third-party IDP allows MARENDATA users to use their existing credentials from a trusted source to access the platform.

This is very important for a streamlined user experience as users can access multiple services with a single set of credentials, eliminating the need to remember and manage multiple passwords. This streamlined experience enhances user convenience and reduces friction, likely leading to higher user adoption and satisfaction with the platform.

Enhanced security is also addressed as third-party IDPs employ robust security measures, such as multi-factor authentication (MFA) and encryption, to protect user identities and data. By centralizing authentication processes, IDPs can better monitor and mitigate security threats, reducing the risk of unauthorized access and data breaches.

Other features that come with third-party IDPs, like audit trails and reporting capabilities, may eventually help comply with regulatory requirements, such as GDPR[4], by demonstrating control over user authentication and data access.

The chosen third-party IDPs were Microsoft, Google and Facebook (main features in Table 1). Leveraging these third-party identity providers can significantly enhance the security, usability, and scalability of MARENDATA, ultimately fostering trust and confidence among users.

Table 1. Main features of IDP providers

IDP provider	Main features
Microsoft	Microsoft's identity service, Azure Active Directory (Azure AD), is widely used by enterprises for managing user identities and access to Microsoft services, as well as third-party applications. Azure AD supports single sign-on (SSO) across various platforms and devices, making it convenient for users to access multiple services with their Microsoft accounts. With features like conditional access and identity protection, Azure AD offers advanced security capabilities to protect against threats such as phishing and account compromise. Organizations may benefit from Microsoft's extensive compliance certifications and integrations with other Microsoft services like Office 365. However, reliance on a single provider like Microsoft may raise concerns about vendor lock-in and dependency.
Google	Google's identity service, often referred to as Google Sign-In, offers seamless integration with Google accounts, enabling users to sign in to third-party services using their Gmail or Google Workspace credentials. Google's robust security measures, including multi-factor authentication and continuous monitoring, enhance the overall security of user accounts.
Facebook	Facebook Login is a popular identity solution that allows users to log in to third-party websites and apps using their Facebook credentials. It offers a convenient sign-up and sign-in process, particularly for social-oriented services where users prefer to use their existing Facebook accounts.

[4] General Data Protection Regulation is a European Union regulation on information privacy in the European Union and the European Economic Area.

When leveraging third-party identity providers such as Google, Microsoft, and Facebook, the benefits and considerations largely align with those outlined previously for generic third-party IDPs. However, each provider brings its own set of features and considerations.

6. Integration of Marendata into the PRIMRE Portal

6.1 Introduction

MARENDATA, has been seamlessly integrated into the Portal and Repository for Information on Marine Renewable Energy (PRIMRE) available at https://primre.org/. This integration was facilitated through the development of an Application Programming Interface (API) that enables the exchange of data and metadata between Marendata and the PRIMRE portal. A deep link was made available from the primary endpoint, directing users straight to the test site on the Marendata website.

6.2 Integration Process

The integration of Marendata into the PRIMRE portal involved the development and implementation of an API. This API serves as a conduit for the exchange of data and metadata between the two platforms, allowing for seamless interoperability. Through this API, Marendata's vast repository of marine renewable energy information is now accessible within the PRIMRE portal, enhancing the portal's scope and utility.

6.3 Metadata Schema

The integration of Marendata into the PRIMRE portal necessitated the establishment of a standardized metadata schema to ensure consistency and interoperability across knowledge hubs. The PRIMRE metadata schema, which serves as the foundation for organizing and categorizing data within the portal, is designed to be comprehensive yet flexible. It incorporates elements from established schemas such as DCAT (Data Catalog Vocabulary) and Project Open Data, while also accommodating unique properties specific to the marine renewable energy domain.

6.4 Key Components of the PRIMRE Metadata Schema

- Standard Data and Information Package Terms

- These terms serve as the highest level of categorization within the metadata schema, providing a framework for organizing diverse datasets and information packages related to marine renewable energy.

- Basic MRE Technology Terms
  - The schema includes terminology specific to marine renewable energy technologies, enabling precise classification and retrieval of relevant data and resources.

- Consistency and Compatibility
  - By adopting the PRIMRE metadata schema, knowledge hubs including Marendata can ensure compatibility with the PRIMRE portal and other sites within the PRIMRE community. Consistency in metadata fields facilitates seamless integration and enhances the discoverability of content.

6.5 Benefits of Integration

- Enhanced Discoverability
  - By incorporating Marendata into the PRIMRE portal, data owners from SafeWAVE gain access to a broader range of marine renewable energy comunity within a centralized platform, thereby enhancing discoverability and accessibility.

- Community Engagement
  - The PRIMRE metadata schema serves as a common framework for knowledge hubs within the marine energy field, fostering collaboration and community engagement while ensuring consistency in data organization and classification.

6.6 The Endpoint

The end user accessing the OpenEI PRIMRE search engine will receive information about Marendata and gain access to the endpoint: https://marendata.eu/service/primre.

The Marendata API is tasked with mapping the metadata stored in the Marendata database to conform with the PRIMRE schema, as outlined in the following link on the OpenEI website: https://openei.org/wiki/PRIMRE/Guidelines#schema.

This metadata, aligned with the PRIMRE schema, is then delivered to the end user in JSON format. The endpoint supports filtering data based on the modified date. Marendata maintains a record of when metadata is altered, enabling users to filter search responses using a query such as: https://marendata.eu/service/primre?modifiedDate=2023-01-01. The date format adheres to "yyyy-MM-dd".

The diagram of Figure 8 visually illustrates the process, offering clarity on the underlying operations. In line with the diagram's logic, the end user will receive a JSON response from the Marendata API. An example of such a response is provided in Figure 9.

6.7 Deep Link to Marendata Website

A deep link has been established from the primary endpoint, directing users straight to the test site on the Marendata website. This bypasses a previous metadata page, available in the first version of the service, offering a more seamless and user-friendly experience for individuals accessing Marendata through the endpoint.

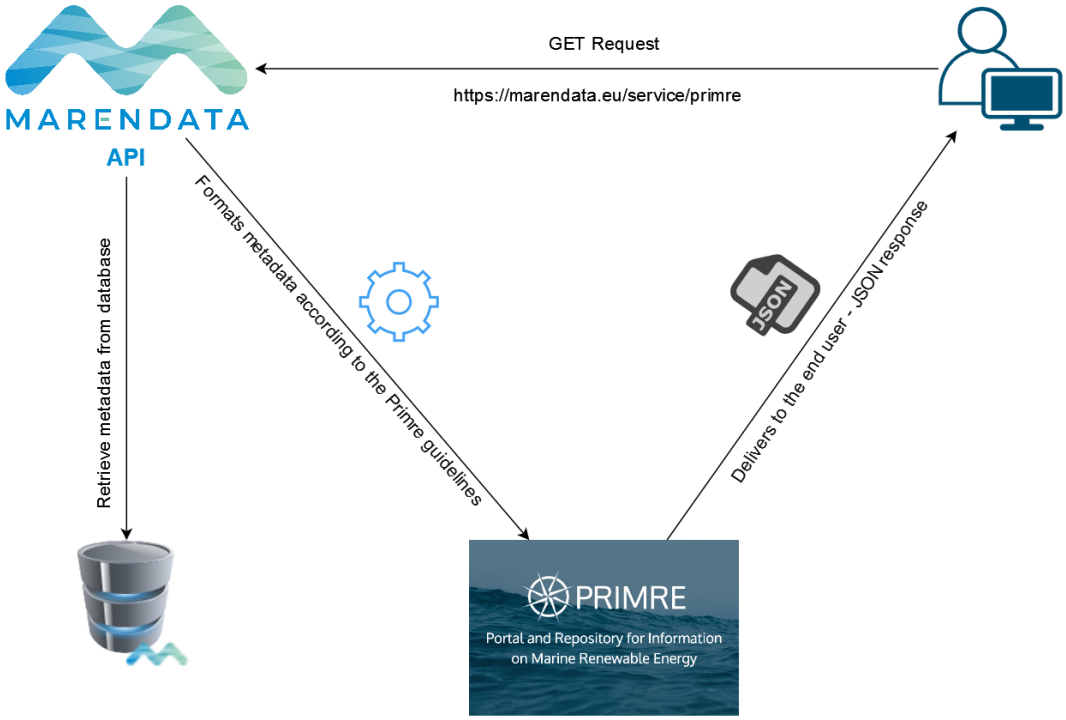

Figure 8. Diagram of Marendata integration in PRIMRE


```
▼ 0:
    URI:              "https://marendata.eu/service/Metadata/1"
  ▼ type:
      0:              "Document"
    landingPage:      "https://marendata.eu/service"
    sourceURL:        "https://marendata.eu/service"
    title:            "MONICAN - Ocean Buoy - Waves Position 1"
  ▶ description:      "The MONICAN project impl…azaré Submarine Canyon."
  ▼ author:
      0:              "Instituto Hidrográfico"
  ▼ organization:
      0:              "Instituto Hidrográfico"
    originationDate:  "2013-04-10T11:20:30+01:00"
  ▼ spatial:
      extent:         "point"
    ▼ coordinates:
        0:            39.5105
        1:            -9.63433
    technologyType:   []
  ▼ tags:
      0:              "Wave Direction"
      1:              "Oceanographic geographical features"
    modifiedDate:     "2013-04-10T10:20:30Z"
```


Figure 9. Example of a JSON response

7. Messages and notifications

Messages and notifications have been created for actions being executed to enhance the user experience. Some actions take longer than a few seconds; therefore, the user is informed that the process has been activated and is in progress.

Messages are displayed for user actions: when an action starts (e.g., downloads); when an action completes; in case of any errors; and occasionally, informational messages for very long actions (Figure 10).

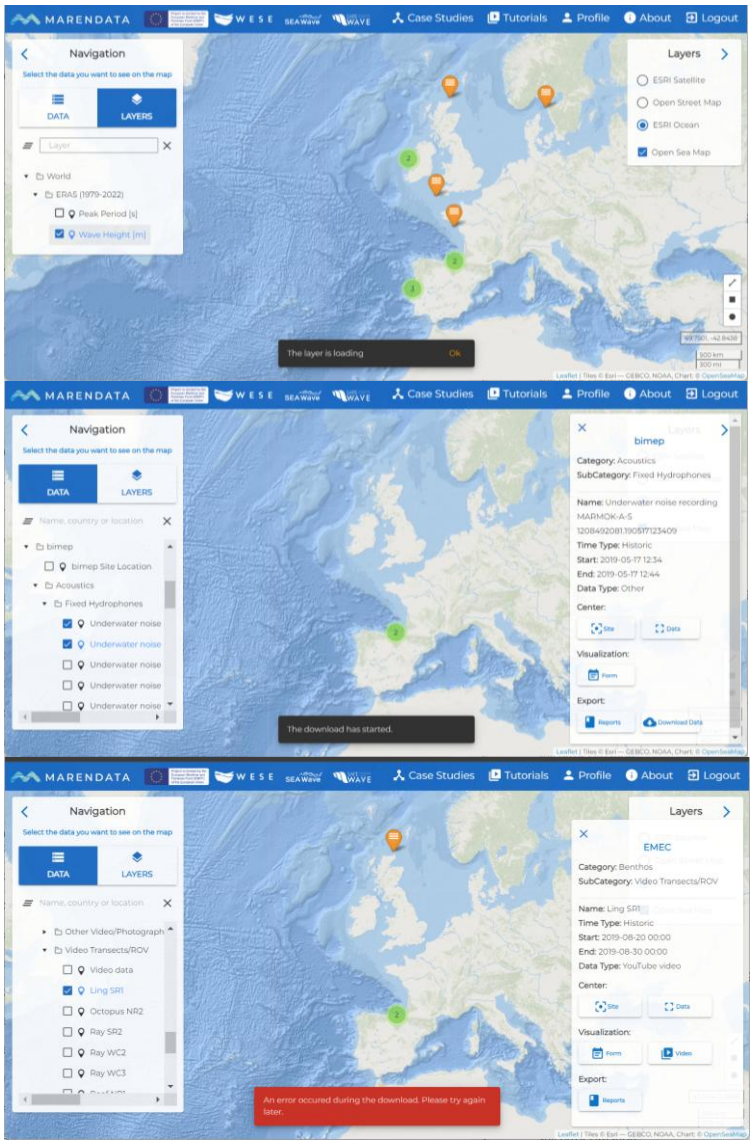

Figure 10. Messages for user actions.

8. Conclusions

Improved User Accessibility and Security

MARENDATA's integration of third-party identity providers like Microsoft, Google, and Facebook simplifies the user login process, enhancing both security and convenience. This change streamlines user access, increases platform adoption, and aligns with robust data protection measures.

Enhanced Data Sharing and Collaboration

The seamless integration of MARENDATA with the PRIMRE portal supports wider accessibility and discoverability of marine renewable energy data. By adopting a shared metadata schema and API, the platform enables effective data exchange and promotes knowledge sharing across the marine energy sector, benefiting a diverse community of stakeholders.

User-Centric Platform Enhancements

New features, such as case studies, long-term wave and wind data analysis, and improved notifications, focus on enhancing user experience and engagement with MARENDATA. These additions provide more comprehensive support for both new and existing users, facilitating data access, analysis, and platform navigation.

These developments collectively advance MARENDATA's mission of supporting the marine renewable energy industry by making high-quality, accessible environmental data available on a robust and collaborative platform

9. Acknowledgment:

We extend our gratitude to the PRIMRE community for their collaboration and support throughout the integration process.