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Wave Energy in Southern Europe (WESE)

European Maritime and Fisheries Fund (EMFF)

Final Report

Deliverable 1.9

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Beneficiary
(or coordinator organisation in case of multiple beneficiaries): Fundación AZTI – AZTI Fundazioa

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DECLARATION BY THE PROJECT COORDINATOR[1]

I, Juan Bald Garmendia, coordinator of the "Wave Energy in Southern Europe (WESE)", hereby confirm that:

– This final report represents an accurate description of the work carried out in this project;

– The project:

( ) has fully achieved its objectives and technical goals;

(X) has achieved most of its objectives and technical goals with relatively minor deviations;

( ) has failed to achieve critical objectives.

– To the best of my knowledge, the financial statements submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project and - if applicable - with the certificate on financial statement.

Date and Signature
08/02/2022

[1] By "project coordinator" shall be understood the person responsible for the work to be performed under this grant. If different from the person who signed the Grant Agreement representing "the beneficiary" (or "the coordinator" in case of multiple beneficiaries), a formal letter must accompany this report, in which the latter authorises the project coordinator to report on behalf of the beneficiary or beneficiaries.

1. FINAL PUBLISHABLE SUMMARY REPORT

This is a comprehensive summary overview of results, conclusions and impacts of the project. The publishable report shall be formatted to be printed as a stand-alone document. This report should address a wide audience, including the general public. Please ensure that it:

- Fits in the space provided in this page;
- Is of suitable quality to enable direct publication by the CINEA or the European Commission;
- Is comprehensive, and describes the work carried out to achieve the project's objectives, its main results and conclusions. Please mention the target groups (such as policy makers or sectors of the civil society) for whom the project results could be relevant.

Wave Energy in Southern Europe (WESE)

The emerging marine renewable energy (MRE) industry, also known as ocean energy (mostly wave and tidal energy), yields many unknowns about its potential environmental pressures and impacts. Wave energy converters (WECs) are still perceived by regulators and other stakeholders as risky, particularly for some groups of species and habitats. In many cases, this perception of risk is due to the high degree of uncertainty that results from a scarcity of data collected in the ocean as well as lack of differentiating between real and perceived risks. The main non-technical obstacles in the MRE consenting process seem to be the time-consuming procedures linked to uncertainty about environmental impacts, the need to consult with numerous stakeholders, and potential conflicts with other marine users. De-risking environmental consenting (permitting) of wave energy projects has therefore been identified as a key challenge in the development of the MRE industry (Strategic Roadmap "Building Ocean Energy for Europe”). MRE stands as one of the main pillars of the European Union (EU) Blue Growth strategy which notes the need for studies, research, and actions on environmental consenting. In order to move beyond current consenting barriers, the European Commission has provided support to increase such research and reduce uncertainty around the potential environmental impacts of MRE development.

Launched in November 2018 and funded by the EU’s European Maritime and Fisheries Fund (EMFF), the WESE project aims to improve the current knowledge on potential environmental effects and risks of wave energy, better inform decision-makers and managers on environmental risks, and reduce environmental consenting uncertainty. The WESE Consortium, led by the RD&I Basque center AZTI, has involved key MRE stakeholders from across Portugal and Spain to accomplish these goals. The multidisciplinary team includes test site owners (BiMEP) device developers (IDOM, AW-Energy), consultants, researchers (WavEC, CTN, AZTI), and data managers (Hidromod). The project finished in October 2021.

WESE Work Plan: the workplan of the project was divided in different work packages devoted to:

(i) Environmental monitoring (underwater acoustics, seabed integrity, and electromagnetic fields) around wave energy devices currently operating at sea:
- Onshore: the Mutriku Oscillating Water Column plant, Basque Country, Spain;
- Nearshore: the WaveRoller surge technology, under testing in Peniche, Portugal;
- Offshore: the MARKMOK-A-5of IDOM, OWC technology installed in BiMEP, Basque Country, Spain.

(ii) Modelling data for larger arrays (underwater sound propagation, electromagnetic fields, and coastal dynamics);

(iii) Review and implementation of a risk-based approach on the environmental consenting procedures;

(iv) Development of Maritime Spatial Planning tools for site selection under a risk-based approach; and

(v) Development of a data sharing platform of the results obtained in the project (MARENDATA).

WESE project major outcomes:

(i) A better knowledge of some of the pressures and impacts of wave energy converters through environmental monitoring and modelling;

(ii) Efficient guidance for environmental consenting procedures in Spain and Portugal;

(iii) Implementation of innovative Maritime Spatial Planning (MSP) Decision Support Tools (DST) for site selection and suitability maps for future wave energy developments in Portugal and Spain: (i) WEC-ERA tool (Wave Energy Converters Ecological Risk Assessment tool, https://aztidata.es/wec-era/) and VAPEM tool (Ecological Assessment and Marine Spatial Planning Tool, https://aztidata.es/vapem/)

(iv) A data sharing platform, MARENDATA (https://marendata.eu/) that will serve data providers, developers, and regulators.

Target groups: academy, developers (industry), policy and decision makers and society in general.

2. PROJECT OBJECTIVES

Please provide an overview of the project objectives, as included in Annex I of the Grant Agreement. If applicable, please refer to any recommendations or guidance received from the CINEA or the European Commission in previous reports or meetings and indicate how these have been taken into account. **Maximum 1 page.**

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 to be completely understood. Wave Energy Converters (WECs) operation in the marine environment are still perceived by regulators or stakeholders as a risky activity, particularly for some groups of species and habitats. Therefore, de-risking environmental consenting of WE projects has been identified as a key challenge to foster the sector development (Ocean Energy Forum, 2016)[1]. Based on current knowledge gaps according to the most recent state of the art review developed by the Annex IV Initiative, under the Ocean Energy Systems (OES) (Copping et al., 2016)[2], corresponding to environmental effects assigning highest risks for the marine environment, different priority areas of research have been identified to reduce pressures and impacts evaluation uncertainty. The main goal of the present project is to contribute to increase the current knowledge on these priority research areas to better inform decision-makers and managers on environmental real risks and reduce environmental consenting uncertainty of ocean WE projects across Europe. This main goal will be achieved through the following specific objectives:

1) **Work Package 2: Collection, processing, analysis and sharing of environmental data** around wave energy harnessing devices currently operating at sea, to increase the knowledge on positive, negative and negligible environmental impacts of the next priority research areas: (i) risk to marine animals from sound generated by wave devices; (ii) changes in physical systems (energy removal); (iii) effects of Electromagnetic Fields (EMF). Among this activity we will develop strategic research to address knowledge gaps regarding the priority research areas above mentioned.
2) **Work Package 3:** Resulting data collection will be used to apply and improve existing **modelling tools** and contribute to the overall understanding of potential cumulative impacts of larger scale, and future, wave energy deployments and to development of mitigation measures;
3) **Work Package 4: Development country-specific licensing guidance on WE licensing processes**, including recommendations on good practices to streamline the procedures and identification of omissions and/or procedures that may require simplification to improve its management and integration. The application of an adaptive and risk-based approach to the consenting process of wave energy projects will be studied. Reports that could support authorities' decision making on impacts evaluation, monitoring requirements and planning and monitoring data analysis, will also be produced. This work will be carried out in close collaboration with regulators and key stakeholders in each country and with the developers that are part of the project Consortium.
4) **Work Package 5:** Development and implementation of **maritime spatial planning (MSP) Decision Support Tools (DSTs)** for Portugal and Spain for site selection of WE projects. The final objective of such tools will be the identification and selection of suitable areas for WE development for promoters and investors; as well as to support decision makers and decision makers during the licensing process. These DSTs will consider the previous findings of the project described above (environmental and legal) and integrate the risk-based approach developed. The main output of this task will be to contribute to integrated and evidence-based decision making as an essential process for sustainable, effective, and efficient maritime spatial planning (MSP).
5) **Work Package 6:** Development of a **Data Platform** that will serve data providers, developers and regulators. This includes the partners of the project. WESE Data Platform will be made of a number of Information and Communications Technology (ICT) services in order to have: (i) a single Web access point to relevant data (either produced within the project or by others); (ii) generation of Open Geospatial Consortium (OGC) compliant requests to access data via command line (advanced users); (iii) a dedicated cloud server to store

frequently used data or data that may not fit in existing Data Portals; and synchronized biological data and environmental parameters in order to feed models automatically.

[1]Ocean Energy Forum (2016). Ocean Energy Strategic Roadmap 2016, building ocean energy for Europe.
[2]Copping, A., N. Sather, L. Hanna, J. Whiting, G. Zydlewsk, G. Staines, A. Gill, I. Hutchison, A. M. O'hagan, T. Simas, J. Bald, S. C., J. Wood and E. Masden, 2016. Annex IV 2016 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. Pacific Northwest National Laboratory on behalf of the U.S. Department of Energy (the Annex IV Operating Agent). 224 pp.

3. WORK PROGRESS AND ACHIEVEMENTS

Please provide a concise overview of the progress of the work in line with the structure of Annex I of the Grant Agreement. Deliverables and dissemination activities can be mentioned, but should be described in detail in section 4. Similarly, details related to the management of the project shall be further reported in section 5. **Maximum 5 pages.**

- **A summary of progress explicitly compared to the objectives specified in section 2 above** providing, if applicable, details for each task as detailed in the agreed work plan of your proposal (Annex I of the Grant Agreement);
- Highlight clearly significant results and outputs;
- If applicable, explain the reasons for deviations from Annex I, and explain the impact on other objectives/tasks as well as on available resources and planning;
- If applicable, explain the remedial actions that have been applied.

WP2. Collection, processing, analysis and sharing of environmental data: In the WESE project scope, Work Package 2 aimed to collect, process, analyse and share environmental data collected in sites where WECs are operating in real sea conditions in Spanish and Portuguese coastal waters, representing different types of technology, sites and, therefore, types of marine environment (onshore, nearshore and offshore) that can potentially be affected by wave energy projects: (i) Idom-Oceantec MARMOK-A-5, installed in the Biscay Marine Energy Platform (BiMEP) in Spain; (ii) WaveRoller (AW-Energy), installed in Peniche (Portugal) and (iii) Mutriku Wave Power Plant, in operation in Spain. Data were collected for three of the priority areas of research: 1) risk to marine animals from sound generated by wave devices, 2) changes in physical systems (seafloor integrity) and 3) effects of Electromagnetic Fields (EMF) emitted by the energy transfer cables.

a) **EMF (more details can be seen in Deliverable 2.1 and 2.2)**: for the MARMOK-A-5 device installed at BiMEP, a campaign was performed by MAPPEM Geophysics during the 20th and 21st of May 2019 according to the monitoring plan described in Deliverable 2.1.

   In the case of WaveRoller device in Peniche, Portugal, the installation of the device has started by the end of October 2019 and the monitoring campaigns were planned to be performed in spring-summer 2020 to allow enough deployment time to produce measurable/observable impacts. Meanwhile, WavEC suffered technical problems (equipment needing calibration or repair) that prevented them from doing the campaigns. In addition, due to the COVID outbreak, the expected maintenance works of AW-Energy device were postponed from May to August-September 2020, and for security reasons electricity export from the device was stopped since then. Consequently, it was not possible the acquisition of data during the electricity export phase of the device. Adequate sea state and the needed logistics only allowed an at-sea maintenance action to take place in October 2020. After the maintenance action the device was placed again on the seafloor. During the last coordination meeting celebrated on the 26th of April 2021, AW-Energy informed the project partners that, although the WaveRoller device was not exporting electricity, the device is active and moving. Accordingly, it was decided not to perform the EMF monitoring, since the device will not produce EMF.

   Overall, no EMF signal could be identified as being originated from the cable. The sea conditions were very calm during the survey, and reports from the WEC operation show the power output from the device was small (our estimates account for less than 6kW), with the low emissions possibly being masked by ambient EMF noise (e.g. swell, vessel generator).

b) **Underwater Sound (more details can be seen in Deliverable 2.1 and 2.3):** for the MARMOK-A-5 device installed at BiMEP and Mutriku Wave Power plant, a vessel surveys was carried out on the 06-05-2019 and 07-05-2019 respectively according to the monitoring plan described in Deliverable 2.1. During this survey noise measurements were undertaken in different locations during a short period of time (5 minutes). At the same time a passive acoustic sensor was moored in a specific location for a long time, from the 7th of May of 2019 to the 18th of June of 2019 (that is, continuously for 42 days) in both sites. This way we achieve a high temporal resolution for it allows to register variations due to environmental changes in different cycles of operation of the WEC.

In the case of WaveRoller device, it was not possible the acquisition of data during the operation phase of the device.

In general, the contribution of the devices operation to the ambient soundscape is not very significative. Regarding the MARMOK-A-5 device, the most significative contribution to its surrounding soundscape appears between 40 and 120 Hz, with increments of 14 dB re µPa ($H\_w<1$ m), 13 dB re µPa (1 m$\leq H_w<2$ m) and 6 dB re µPa ($H\_w>2$ m), even though the variability is quite relevant. Another sources of noise, most relevant with high wave heights, are the mooring chains, which can be perceived at frequencies beyond 2500 Hz, with SPL values approximately ranging from 90 (for lower wave heights) to 105 (higher wave heights) dB re 1 µPa. It should be noted that this metrics have been calculated at a distance of 90 m away from the converter.

Regarding the Mutriku Power Plant, there is no clear indication of an increase in the sound pressure levels when the plant is operating, at least at a distance of 1000 m away from the central. As it corresponds to a shallow water environment, the lower frequencies are shown to be filtered out, therefore being the higher frequencies those with more acoustic energy. In any case, the higher difference (between background noise and the sound with the plant working) of sound pressure levels is just about 5 dB re 1 µPa, at 80 Hz, below typical deviations.

c) **Seafloor integrity (more details can be seen in Deliverable 2.1 and 2.4)**: non-destructive methods were used for seafloor monitoring both in BiMEP and in Peniche: (i) a ROV was used to record videos of the seafloor in the vicinities of the MARMOK-A-5 moorings and chains (and also of the electric cable and the connector) on May 15th and 22th 2019, and at the WaveRoller area on October 17th 2020, including the foundation, the electrical cable, and mooring cables; (ii) in the BiMEP area, a side-scan sonar survey was also undertaken on May 14th 2019 to look for changes in the reflectivity of the seafloor close to the moorings.

For the case of MARMOK-A-5, considering the chains of the four mooring lines and the cable from the convertor to the connector, it can be estimated that the area affected by the sections that are moving over the sediment could add up to roughly 250-300 m^2. Considering that the total area occupied by the device (polygon bounded by the four anchors and the connector) is approximately 290,000 m^2, the affection area estimated relative to the total occupied area is 0.1%. Regarding the side-scan sonar survey, due to de hard sea conditions, the acquired data did not give a clear image of the seafloor and consequently it was not possible to collect data useful for the analysis of the impact associated to the anchors, mooring lines and umbilical cable. Hence, the assessment based on video recordings using the Remotely Operated Vehicle (ROV) could not be compared with the assessment using acoustic methods.

For the case of WaveRoller device, according to the interpretation of the recorded videos, the WaveRoller unit seems not be impactful to the seafloor integrity. Three issues worthy to mention are: (i) the mooring and electrical cables were completely lying on the seafloor, the only exception being a small portion of a steel mooring that was found on a rocky substrate/outcrop near to the foundation. This could be owed to the great local hydrodynamics and to storms along the year; (ii) also close to the foundation (~1 m from it), a small sand "dune" was found. The "dune" could have been formed by sediments depositing behind the device as a consequence of its presence; (iii) a piece of a synthetic strap found on the seafloor, although possibly insignificant with regards to impacts, is evidence that wave energy projects as well as any anthropogenically driven activity at sea may represent some type of littering.

Once environmental data were acquired, analysed and processed, an understanding of how this data collection, processing, validation, and reporting to allow comparison among sites was undertaken was done in the Deliverable 2.6 setting the basis for the establishment of general guidelines for the development of future monitoring plans in Deliverable 2.7. In this sense one of the main conclusions is the need to promote monitoring techniques based on autonomous remote sensing devices that are not dependant of the sea conditions and able to cover properly the temporal and spatial resolution of the expected environmental impacts coming from wave energy harnessing devices. Consequently, we need to minimise or avoid any measurement undertaken from sea surface in a vessel, since the sea conditions that we need to detect signals coming from WECs will be most probably detected when sea conditions are bad and consequently with very limited capabilities to monitor. For underwater acoustic, the mooring of more than one hydrophone in different locations for at least one month is one of the most promising methodology for underwater acoustic monitoring which has worked very well in the project. For seafloor integrity, visual inspections with ROV is a useful, non-destructive sampling technique but need to be complemented with side-scan sonar images acquired through autonomous and remote sensing devices such as AUVs in order to avoid the limitations associated to sea conditions and be able to cover a larges spatial area. For EMF, similar to seafloor integrity, remote sensing needs to be promoted through autonomous devices equipped with appropriate sensors such as AUVs. That way we can solve the problem of maintaining and appropriate proximity to cables and avoid the limitations associated to sea conditions.

WP3. Modelling: it aimed to develop strategic research to address gaps in knowledge to improve modelling of potential cumulative pressures and environmental impacts of future wave energy deployments at larger scale coming from: (i) EMF emitted by subsea power cables; (ii) underwater acoustic fields radiated by the WECs and (iii) energy absorption and impact on marine dynamics.

a) **Electromagnetic fields (EMF) (more details provided in Deliverable 3.1)**: In general, both case studies, MARMOK-A- in BiMEP and WaveRoller in Peniche, showed small environmental impact derived from EMF. The BiMEP subsea cable serving IDOM device (operating at rated power) show amplitudes of |B|=0.40µT and |E|=13 µV.m^{-1} close to cable surface, with rapid decay to |B|=0.008µT and |E|=2 µV.m^{-1} when distanced 1 m away from the cable. The Peniche subsea cable serving the Waveroller device (also operating at rated power) showed amplitudes of |B|=7µT and |E|=215 µV.m^(-1) close to cable surface, with rapid decay to |B|=0.11µT and |E|=29 µV.m^{-1}. The rather small EMF can be attributed to the small cable currents, or in other words, to the cables being oversized for the power capacity of the devices. Thus, to access the pressure of increasing the number of devices, the EMFs were also estimated for the maximum current capacity of both power cables. The BiMEP subsea cable operating at its maximum current of 422A (corresponding to 9.6MVA), would produce an estimated EMF levels raise up to |B|= 127µT and 4.2mV·m^{-1} near the cable surface, and |B|=2.74µT and 675µV·m^{-1} when distanced 1 m away from the cable. For the Peniche subsea cable operating at its maximum current of 125A (corresponding to 2.2MVA), the EMF levels would raise to |B|=37.5µT and |E|= 1.1mV·m^{-1}, respectively; and |B|= 0.63µT and |E|= 150µV·m^{-1} when distanced 1 m away from the cable. The EMF shows an exponential decay with distance, with the computed amplitudes being reduced by at least one order of magnitude with a distanced 1 m from the cable source. Minding the EMF amplitude being linearly proportional to the electric current, the results can be extrapolated for any cable current.

b) **Underwater Sound (more details can be seen in Deliverable 3.2)**: the aim of this task was to model the underwater acoustic fields radiated by the WECs with the support of the results of the deliverable D2.3. To achieve this goal, a parabolic equation acoustic propagation model with full range dependence in environment variables (bathymetry, temperature, salinity, and seabed substrate elastic parameters) was implemented for three different frequencies (62.5, 125, and 1000 Hz), several depth levels, ranging from 5 m to 100 m, and different sea states (based on significant wave height).

   In the case of the MARMOK-A-5, this device sound emission is most energetic in the 62.5 Hz band, although worse acoustic propagation conditions existed for this case in BiMEP, as the shallow water environment inhibits efficient sound transmission. When considering the depth in which greater overall values of SPL were found, the area of disturbance (for which $SPL_{on} > SPL_{off}$) obtained is 0.9 km^2 for such frequency and wave heights between 0 and 1 m, which is equivalent to a 0.28 km radius circle around the device. This can be viewed as an upper bound to the distance of disturbance around the device. When considering a swarm of 80 identic devices, differences up to a maximum of 50 dB re 1 µPa were found between this and the single device scenario (placed in the centre of the swarm), for the incoherent case. The radial distances (from the centre of the swarm) at which the sound pressure level fields are indistinguishable from the background noise levels are now much greater though, with maximum values for low wave heights (where there is less background noise) and frequencies around 3.4 km.

   For Mutriku wave power plant, the highest acoustic disturbances were found in the 1 kHz band, with maximum values SPL around 110 dB re µPa. When considering the depth in which greater values of SPL are found, the area of disturbance obtained is 15 km^2, for such frequency and wave heights greater than 2 m. In addition, for the depth-averaged SPL field, the maximum distance at which $SPL_{on} > SPL_{off}$ is satisfied is 2593.7 m from the plant. It must be noted (from D2.3) that the uncertainty in the Source Level values is around the calculated difference in SPL, but the analysis did not explicitly consider it; therefore, results for Mutriku are not conclusive.

c) **Marine Dynamics modelling (more details given in Deliverable 3.3)**: In the present study the impact of WEC farms in nearshore morphodynamics is evaluated in two distinct case studies, BiMEP and Peniche. In the first case the hydrodynamics and beach shoreline evolution is studied by means of a probabilistic approach; and in the second case wave and morphodynamic evolution is analysed using a dynamic downscaling methodology. In the first case, the WEC farm studied is composed by 80 WECs deployed at 80m water depth at 4km from the coast in the BiMEP area. The P and Hs reduction produced by the WEC farm is limited and with little effect at the coastline. This is attributed to the long distance at which the WEC farm is located from the coastal zone, which is far enough to significantly reduce the wave shadowing effect that occurs in the vicinity of the WEC farm. The morphodynamic impact is quantified in the only beach of the study site (Bakio beach) where the hydrodynamic impact is limited. Both accretion and erosion magnitudes are considerably low, consequently it could be considered that the WEC farm does not provide any protective effect for the beach.

In the second case study, the impact of an array of 17 bottom-mount Waveroller devices were analysed in terms of energy removed from the system by the devices and its impact on the nearshore morphological evolution. Results show that the WEC array not only removes energy from the system but can also change the shape of the transmitted wave spectrum. Results also indicate that the WEC array offers little protection to extreme wave conditions due to the frequency operation limits of the Waveroller. No significant sediment exchange between long shore areas have been observed.

In the Deliverable 3.4 a synthesis of the most significant acquired knowledge in all modelling activities (EMF, underwater acoustics, and marine dynamics) was presented.

WP4. Risk and adaptive based consenting for wave energy deployments: the WP4 of the WESE project aimed to develop guidance manuals for environmental consenting procedures in Spain and Portugal for ocean energy projects based on an environmental risk-based approach and adaptive management processes.

For this purpose the first task consisted on the development of a database of key stakeholders (more details can be seen in Deliverable 4.1) such as project developers and promoters (license applicants and specialist consultants), policy makers and regulators, consenting and surveying service providers (including technology providers, Environment Impact assessment practitioners, consenting and surveying consultants), energy companies, academic experts (both in science and policy) and representatives of appropriate lobby and pressure groups. A total number of 310 stakeholders were identified belonging to 7 groups, 6 roles and 16 sectors.

The second task of WP4 was the review of the legal and institutional review of national consenting processes in Spain and Portugal and undertake an introduction to the general considerations of a risk-based approach and AM (more details can be seen in Deliverable 4.2).

Once this review was done, the following task has been the study of the legal feasibility for the implementation of a risk-based approach and adaptive management (more details can be seen in Deliverable 4.3). For this purpose two dedicated workshops were undertaken with the Portuguese and Spanish stakeholders identified in the first task on the 23 and 24 of June 2020 respectively. Together with a review of the concepts of Adaptative Management, Risk Based approach and Legal and Institutional procedures in Spain and Portugal made on Deliverable 4.2 some conclusions and findings were made: (i) A risk-based approach to survey and consenting is an element of Adaptive Management (AM), which in turn is a structured process that enables learning by doing and adapting based on what is learned. This is an important process to implement when environmental impacts uncertainty exists, to better guide monitoring activities towards risks (and impacts) quantification; (ii) The results of two workshops held with key stakeholders involved in the consenting process in both countries are presented to support this analysis. Outcomes show the implementation of a risk-based approach could be implemented on two levels: in the legal framework and in the licensing and post-installation operational procedures; (iii) Advancing the use of risk-based approaches for MRE will require the development of mechanisms that minimize financial risks for developers, while assuring adequate protection of the marine environment and receptors, which may require investments by governments to gather data that will assist with large-scale planning and management of marine resources. Additionally, the adoption of such approach requires long term commitment and relies on strong relationships and clear communication from all parties.

Finally, based on the results of the previous tasks a guidance was developed for Spain and Portugal (more details can be seen in Deliverable 4.4) aimed at describing the various steps of the licensing process of MRE projects to be located in the continental coast.

WP5. Risk and adaptive based consenting for wave energy deployments. The main objective of this WP was the identification of the most suitable areas for the development and deploying of MRE in the Portuguese and Spanish

Atlantic area. For that purpose, dedicated DSTs have been developed and implemented to assist in the process of data integration and modelling.

To achieve this goal, the first task has been to search of information that have a spatial character and coverage at European level regarding different topics (maritime activities, technical aspects, environmental aspects and legal constrains) through public available data sources (EMODnet, Copernicus, DG-MARE's Atlas of the Sea and European Joint Research Centre). It should be noted that the process of generation of relevant information for site suitability has been a continuous process throughout the WESE project. More details can be seen in Deliverable 5.1.

In a second step, a Decision Support Tool (DST) for the identification of the most feasible areas for wave energy projects in the context of maritime spatial planning (MSP), has been developed and implemented (more details can be seen in Deliverable 5.2). The DST is based on a conceptual model which considers the main environmental, technical, and socio-economic factors that could influence the suitability for the establishment of wave energy projects. The conceptual model has been developed considering the Marine Strategy Framework Directive (MSFD) for the integrated consideration of the 16 types of pressures and 27 ecosystem elements that could be affected by such technologies and has been operationalised using the Bayesian Belief Network (BBN) approach.

Two different but complementary tools have been developed. The first one, WEC-ERA tool (Wave Energy Converters Ecological Risk Assessment tool), is an open access web-app that permits the user to assess the ecological risk of WECs: https://aztidata.es/wec-era/. The user can analyse the risks associated to three different wave energy technologies (i.e. OWC, OSWC and Wave Turbine) at their three life-cycle phases (i.e. construction, operational and decommissioning). The assessment is based on the integration of 16 pressure types and 27 ecosystem elements according to the MSFD. The second tool is the VAPEM tool (Ecological Assessment and Marine Spatial Planning Tool). This is a DST which integrates the WEC-ERA information together with the technical and socio-ecological risks linked to wave energy projects, into a Bayesian model. VAPEM tool is also an open access web-app: https://aztidata.es/vapem/. This tool permits the user the exploration of predefined scenarios or the generation of scenarios by the user. It provides information on the feasibility of wave energy projects development under different technical, environmental, and socio-economic conditions. The outcome of the assessment is also provided as a spatially explicit feasibility map. This tool is described in detail in a dedicated paper that has been produced: *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.*

Finally, with the developed tools a set of 24 maps were created which are showing the spatial distribution of technical suitability, environmental risks and potential conflicts with other uses and activities in relation to offshore wave energy sector in the Portuguese and Spanish Exclusive Economic Zones (more details can be seen in Deliverable 5.3). In the Portuguese and Spanish, 17% of the total area has been identified as suitable for the development of wave energy projects, while the highly suitable areas, go down up to just 0.2% of the area. Still almost half of the region is not suitable due to technical restrictions (45.9%). The areas limited by environmental risks are representing 5.3% of the study area, while the areas that would be excluded for the development of wave energy projects due to the presence of excluding human activities or underwater infrastructures are just 0.9% of the study area. The approach implemented also allows the identification of areas that are presenting combined restrictions for the development of wave energy projects. In that sense, the combination of environmental and technical restrictions are present in 18.1% of the area, uses and technical restrictions in 7.5%, and uses and environmental restrictions in 0.3% of the area. All type of restrictions are identified for 4.7% of the study area.

WP6. Data sharing platform. Closely related with the tasks undertaken in WP2, a Data Platform for sharing all the environmental data acquired during the life of the project was developed. This data platform will serve data providers, developers and regulators. The Data Platform name is MARENDATA (https://marendata.eu/) and is made of a number of ICT services: (i) a single Web access point to relevant data based on Hidromod's AQUASAFE software; (ii) generation of requests to access data via command line (advanced users); (iii) a dedicated cloud server to store frequently used data or data that may not fit in existing Data Portals and (iv) synchronized collected data and modelled environmental parameters in order to feed EIA methodologies.

For this purpose, one of the first tasks that has been undertaken is to understand the concept of a data platform and data management (more details can be seen in Deliverable 6.1). The second task has been to understand and define: (i) the concept of metadata that has been adopted by WESE data platform, following the INSPIRE data specification template in its relevant parts, i.e., dataset-level, services metadata and data quality (Deliverable 6.2) and (ii) the types of secondary data (results, reports and post-processed primary data) and how they are to be generated and delivered to the user by the platform (Deliverable 6.3). Then the design of the platform, how the user will interact with the platform and the services of the platform were developed in Deliverable 6.4. and 6.5 respectively.

Finally, the developed MARENDATA data platform was updated and improved through the life of the project in successive moments (months 15, 24 and 36) incorporating new capabilities and services to the data platform (more details can be seen in Deliverable 6.6).

4. DELIVERABLES AND DISSEMINATION ACTIVITIES

Use this section to summarise all deliverables produced over the whole project duration (e.g. reports -other than the interim and final reports contractually required to be submitted to the CINEA-, websites, software etc.), as well as all dissemination activities executed (publications, workshops, conferences, etc.). For each of them, please signal if they were a contractual obligation[2], and provide the title, description and date of production, organisation or publication. If relevant, please provide proof on how the provisions of Article II.7 of the Grant Agreement (Visibility of Union Funding) were implemented. **Maximum 2 pages.**

All the Deliverables were a contractual obligation provided for in Annex I. In all of them, the visibility of Union funding has been referenced in the citation of each deliverable and included in the cover page of each deliverable with the flag of the Union and the text "This project has been funded by the European Commission".

DELIVERABLES

WP2:

- Vinagre P.A., Cruz E., Chainho P., Ruiz P., Felis I., Muxika I., Bald J., 2019**. Deliverable 2.1 Monitoring plans for Noise, Electromagnetic Fields and Seabed Integrity**. 60 pp. Submission date: 28 February 2019.
- Chainho P., Bald J., 2020. **Deliverable 2.2 (Monitoring of Electromagnetic fields)**. 55 pp. Submission date: 30 November 2020.
- Felis, I., Madrid, E., Cruz, E., and Álvarez-Castellanos, R., 2021. **Deliverable 2.3 Acoustic Monitoring**. 85 pp. Submission date: 30 November 2020 (Version 1); 30 April 2021 (Version 2); 08 October 2021 (Version 3).
- Muxika I., Vinagre P., and Bald, J., 2020. **Deliverable 2.4 Monitoring of seafloor integrity.** 59 pp. Submission date: 30 November 2020.
- Leitão, J.C., Basos, N., Rodrigues, J., Santos, H., 2019. **Deliverable 2.5 Data validation and reporting first upload to the data platform**. 19 pp. Submission date: 29 June 2020.
- Vinagre P.A., Chainho P., Madrid E., Muxica I., Bald J., 2021. **Deliverable 2.6 Data results and analysis towards impacts evaluation and understanding**. 27 pp. Submission date: 23 December 2021.
- Bald., J., Vinagre P.A., Chainho P., Madrid E., Muxika I., 2021. **Deliverable 2.7 Guidelines on EMF, noise, and seabed integrity monitoring planning for wave energy devices**. 16 pp. Submission date: 23 December 2021.

WP3:

- Chainho P. and Bald J., 2021. **Deliverable 3.1 EMF Modelling.** 30 pp. Submission date: 04 June 2021.
- Felis, I., Madrid, E., Bald, J.,2021. **Deliverable 3.2 Acoustic Modelling**. 57 pp. Submission date: 28 October 2021.
- de Santiago, I., Moura, T., Chambel, J., Liria, P., and Bald, J., 2020. **Deliverable 3.3 Marine dynamics modelling**. 37 pp. Submission date: 14 May 2021.
- Madrid. E, de Santiago, I., Moura, T., Chainho, P. 2021. **Deliverable 3.4 Synthesis of knowledge acquired and gap analysis**. 28 pp. Submission date: 03 September 2021.

WP4:

- Galparsoro, I., I. Menchaca, M. Apolonia, D. Marina, P. Etxaniz, B. de Miguel and J. Bald, 2019. **Deliverable 4.1 Stakeholder database**. 48 pp. Submission date: 28 February 2019.
- Bald, J., and Apolonia, M., 2020. **Deliverable 4.2 Review of consenting processes for wave energy in Spain and Portugal focusing on risk-based approach and Adaptive Management**. 52 pp. Submission date: 03 June 2020.
- Apolonia, M., Cruz, E., Simas, T., Menchaca, I., Uyarra, M.C. and Bald, J., 2021. **Deliverable 4.3 Feasibility for the implementation of wave energy licensing based on a risk-based approach and adaptive management in Spain and Portugal**. 67 pp. Submission date: 15 May 2021.

[2] Contractual obligation: this refers either to an activity/deliverable required in the Call for Proposals or provided for in Annex I.

- Menchaca, I., Machado, I., Apolonia, M., Bald, J. 2021. **Deliverable 4.4. Guidance for a risk based and adaptive management consenting of wave energy projects in Spain and Portugal**. 54 pp. Submission date: 23 December 2021.

WP5:

- Galparsoro, I., M. Apolonia, I. Mentxaka, O. Solaun, A. Uriarte and J. Bald, 2019. **Deliverable 5.1. Report on available and gathered information**.18 pp. Submission date: 13 November 2019.
- Galparsoro, I., A. D. Maldonado, Á. Borja and J. Bald, 2020. **Deliverable 5.2 Development and implementation of a decision support tool for wave energy development in the context of maritime spatial planning**. 43 pp. Submission date: 30 November 2020.
- Galparsoro, I., G. Mandiola, A. D. Maldonado, S. Pouso, I. de Santiago, R. Garnier, I. Menchaca and J. Bald, 2021. **Deliverable 5.3. Creation of suitability maps for wave energy projects in the context of Maritime Spatial Planning.** 35 pp. Submission date: 23 December 2021.

WP6:

- Leitão, J.C., Santos, H., Galvão, P. and J. Bald, 2019. **Deliverable 6.1 Conceptual Data Platform**. 24 pp. Submission date: 02 July 2019.
- Leitão, J.C., Santos, H., Galvão, P., and Bald, J., 2019. **Deliverable 6.2. Primary data structure**. 17 pp. Submission date: 04 July 2019.
- Leitão, J.C., Moura, T., Leitão, P.C., Bald, J., Liria, P., Cruz, E., Vinagre, P., Felis, I., 2019. **Deliverable 6.3. Secondary data structure.** 35 pp. Submission date: 31 October 2019.
- Leitão, J.C., Moitinho, L., Basos, N., Santos, H., 2019. **Deliverable 6.4 Design of the Data Platform**. 15 pp. Submission date: 31 October 2019.
- Leitão, J.C., Moitinho, L., Basos, N., Santos, H., 2020. **Deliverable 6.5 Data Services**. 17 pp. Submission date: 08 February 2020.
- Leitão, J.C., Moitinho, L., Basos, N., Santos, H., 2019. **Deliverable 6.6 Data Platform**. 15 pp. Submission date: 08 February 2020.
- Leitão, J.C., Moitinho, L., Cardoso, S., Santos, H., 2020. **Deliverable 6.6 Data Platform**. 22 pp. Submission date: 30 November 2020 and 23 December 2021.
- Leitão, J.C., Moitinho, L., Cardoso, S., Santos, H., 2020. **Deliverable 6.6 Data Platform**. 33 pp. Submission date: 23 December 2021

DISSEMINATION ACTIVITIES

- **Project Website:** as stated in the **Deliverable 7.2 Communication and dissemination plan**, the website has been launched in December 2018 at http://wese-project.eu/**.**
- **Social media:** as stated in the **Deliverable 7.2 Communication and dissemination plan**, accounts in **Twitter** and **Linkedin** have been launched to disseminate project milestones, announcements of project publications, participation in external events, dates of workshops and all other relevant news related with the project development.
- **Press releases:** four press releases have been made during the life of the project: (i) **Press release 1**: Distributed on 20th February 2019 to announce the project launch and website and present the objectives of the project throughout its duration (from November 2018 until October 2021); (ii) **Press release 2**: Distributed on 5th June 2019 to communicate another milestone of the project: the launching of environmental monitoring activities around wave energy converters in BiMEP and Mutriku; (iii) **Press release 3**: Distributed on the 9th March 2020 to communicate the launch of the WESE & SEA Wave MARENDATA platform for ocean energy data sharing; (iv) **Press release 4**: Distributed on the 22nd December 2020 to announce the monitoring campaigns in Peniche, Portugal.
- **Other Media:** during the life of the project different publications of the project findings have been done in different media such as the (i) European Commission Website; (ii) MarineEnergy.biz website; (iii) SETIS Magazine of the European Commission; (iv) Renewable Energy Magazine; (v) Maritime Journal; (vi) Tethys Stories supported by the Annex IV of the International Energy Agency (IEA) Ocean Energy Systems (OES)
- **Poster presentations**: two poster presentations were done in: (i) the V Marine Energy Conference on the 13th November 2018 in Bilbao (Spain) and (ii) IV Marine Energy Week Congress on the 13th February 2019 in Bilbao (Spain).
- **Oral presentations**: an oral presentation about the WESE project and results of different WPs was done in: (i) OES-Environmental & ORJIP International Forum #3: Updates on Monitoring and Research Around Wave Devices celebrated on the 23rd April 2020; (ii) Sectoral Forum on Wave Energy of the Basque Energy Cluster on

the 5th November 2020; (iii) Understanding the Environment" organized by the Faculties of Science, and Economics and Business Administration of the University of Navarra in Pamplona (Spain); (iv) Sea Journeys II", a marine biology congress organized by the AEICBAS (Student Association of Abel Salazar Biomedical Science Institute, University of Porto); (v) webinar of ETIP Ocean 2 project about environmental monitoring solutions for ocean energy, on the 19th of May of 2020; (vi) webinar of ETIP Ocean 2 project about Best consenting practices for ocean energy, on the15th December 2020; (vii) webinar of ETIP Ocean 2 project about Environmental Toolkits for Consenting Ocean Energy, on the 13th December 2021; (viii) Ocean Energy Europe on the 7th December 2021.

- **Final Event**: The final event of the project aimed at sharing and discussing the results of the projects with key relevant stakeholders in the field of wave energies, specifically scientists, developers, and policy and decision makers. To this end, two events were organized; the first event was organized in the context of the EWTEC conference (European Wave and Tidal Energy Conference), in Plymouth (UK) between the 6 and 10 of September 2021. The participation was mainly from researchers/academia and developers, who attended both physically and online. The second event, was celebrated on the on the 28th of October 2021 an online event, was organized independently, and attendees were again mainly developers, researchers/academia, but also policy/decision makers, NGOs and consultants attended.

It is considered that the two complementary Final events allowed for a good participation of relevant stakeholders and, therefore, dissemination of the results of WESE project and gathering important feedback that will be considered in the ongoing EU funded project SafeWAVE or other projects.

5. PROJECT MANAGEMENT

Please use this section to summarise project management activities. **Maximum 2 pages.**

- Describe briefly the main tools put in place to ensure sound project management (internal controls, monitoring tools, performance indicators, etc.). If applicable, describe performance of the tasks in terms of selected indicators;
- If applicable, please describe any problem encountered among the different beneficiaries or affiliated entities (distribution of tasks, coordination, communication, etc.);
- Report any other problems related to project management which have occurred and explain the remedial actions that have been applied as well as its results;
- Indicate changes which have occurred to the legal status of any of the beneficiaries or their affiliated entities, if any.

The *general management* of the project was led by the project coordinator Juan Bald, AZTI; and the *financial-administrative management* by Oihane Erkoreka, AZTI.

The main tools put in place to ensure sound project management have been established at the beginning of the project through the development of a Project Management Plan (Deliverable 1.1) and a Risk Management Plan (Deliverable 1.2). The Project Management Plan gathers all the tasks to be undertaken in the project to ensure that the aims of the project, key events, milestones and deliverables are clear to all partners (and their roles and responsibilities in meeting them) well in advance, the project is managed according to budget planning, the internal coordination and communication among partners and with the European Commission is properly done, and that all partners make a full contribution to the success of the project. The Risk Management Plan describes the main constraints and risks associated with the WESE project implementation and propose the corresponding mitigation measures for each risk. Very briefly, the main tools that both plans have put in place to ensure sound project management are the following:

a) A **Work Plan** in Excel format has been developed and uploaded to the Documents folder of the project SharePoint. The contents of this Work Plan are the following:
    a. List of all WPs, Tasks and Deliverables.
    b. Time schedule of all WPs, Tasks and Deliverables.
    c. Responsibilities of partners for each WPs, Task and Deliverables.
    d. Time schedule for progress and interim reports.
    e. Time schedule for face to face and on-line meetings.

b) A **project management structure** and procedures for decisions and conflict resolution with roles and responsibilities has been developed and agreed in a Consortium Agreement that has been signed by all partners.

c) The **administrative and financial management** of the project is led by AZTI. For this purpose, templates for technical and economic progress reports are available in the Sharepoint and guidelines in the Project Management Plan (Section 5).

   A **programme for regular communication** (through e-mail, face-to-face and skype meetings) has been stablished in the Work Plan. Specific Outlook e-mail lists have been developed for each WP according to the distribution of WP and Task leadership. The project coordinator organised periodic project meetings (once every 6 months) to monitor the progress of the project and share/exchange views on the results between the partners. Kick-off meeting took place at AZTI's headquarters of Pasaia, Spain (26 and 27th November 2018) and following to this first meeting different on-line and face to face meeting were held: 25 March 2019 (on-line); 17-18 June 2019 face to face in Lisbon; 22 July 2019 (on-line); 9-10 October 2019 face to face in CTN headquarters in Cartagena (Spain); 21 February 2020 (on-line); 7-8 May 2020 (on-line); 29 July 2020 (on line); 27-28 October 2020 (on-line); 17 December 2020 (on-line); 25-26 March 2021 (on-line); 26 April 2021 (on-line); 29 September 2021 (on-line). As it can be seen, since March 2020 until the end of the project all the meetings have been held on-line trough Teams platform due to the sanitary situation associated to COVID outbreak. The aim of these meetings was the updating of the project progress (technical and economic) in light of the Work Plan established. The minutes of each meeting where uploaded to the One Note of Office 365 application. This way, all partners can access to the presentations made, agreements and recordings of the meetings.

For a transparent and fluent sharing of all the information and in the context of the COVID outbreak, since October 2020 the project activity has been managed trough **Microsoft Teams platform**. This platform offers new possibilities other than the classic documents management platform (SharePoint). The SharePoint of the project has been maintained and accessed through Teams, but new capabilities have been incorporated for a better management of the project. For example, all the project tasks have been organized trough Planner in Teams. This tool allows a better monitoring of the progress of tasks and a better sharing of all the information. Teams also allows the integration of the OneNote notebook of the project and other capabilities such as the integration of the Web page of the project, etc. This way, we have all the information and tracking of the project in a single platform acting as a one stop shop for all the partners. This Teams platform gather: the SharePoint or document repository, a Planner application for tasks and responsibilities management linked with the Work Plan, a direct access to the One Note for the minutes of the meetings, a direct access to the Work Plan, a direct access to project website and social media and MARENDATA.

In general there have been no problems among the different beneficiaries or affiliated entities. There has been no legal status change regarding any of the partners.

The main **deviations, important problems and difficulties met** during this period are the following:

The installation of the WaveRoller device in Peniche, Portugal, has started by the end of October 2019 and the monitoring campaigns were planned to be performed in spring-summer 2020 to allow enough deployment time to produce measurable/observable impacts. Meanwhile, WavEC suffered technical problems (equipment needing calibration or repair) that prevented them from doing the campaigns. In addition, due to the COVID outbreak, the expected maintenance works of AW-Energy device were postponed from May to August-September 2020, and for security reasons electricity export from the device was stopped since then. Consequently, it was not possible the acquisition of data during the electricity export phase of the device.

Adequate sea state and the needed logistics only allowed an at-sea maintenance action to take place in October 2020. After the maintenance action the device was placed again on the seafloor. A monitoring campaign of underwater sound was undertaken during the maintenance action on the 16th of October 2020, and a monitoring campaign of seafloor integrity was undertaken after the action on and 17th of October 2020.

During the coordination meeting held on the 26th of April 2021, AW-Energy informed the project partners that, although the WaveRoller device was not exporting electricity, the flap and connected equipment of the device is active and operating. Accordingly, it was decided to: i) not perform the EMF monitoring, since the device will not produce EMF, ii) not perform a second seafloor monitoring, because any effects of the installation are readily dissipated at the site (as highlighted in Deliverable 2.4), and iii) to undertake a second underwater acoustic monitoring campaign during the device operation (it will not produce EMF but will generate noise) in June-July 2021. Finally, expected underwater monitoring campaigns in Peniche have not been undertaken and consequently the results of the project are based only on BiMEP and Mutriku wave power plant test sites.

Regarding modelling of EMF, data coming from monitoring campaigns in BiMEP were not successful (this is one of the lessons learnt in the project) and the problems with the data acquisition in Peniche forced us to base the modelling on the characteristics of the cables and current transmission reported by developers. For this task, an open-source software was used by WavEC to model the EMF in Peniche and BiMEP.

In the particular case of BiMEP, EMF data coming from monitoring campaigns in BiMEP were not successful for two reasons:

(i) the sea conditions were very calm during the survey, and reports from the WEC operation show the power output from the device was small (our estimates account for less than 6kW), and consequently the phase currents responsible potential electromagnetic signals outside of the cable were very small (here our estimates account for less than 0.26A). However, the analysis of the electromagnetic signals, shows the classical 50Hz and harmonics signals from power lines, together with a strong 53.1Hz (an harmonics) unusual signal.

(ii) This 53.1Hz signal might have masked the signals from the cables themselves. This 53.1 Hz has been identified to be the vessel's electric generator with quite high probability. The generator is probably faulty and inducing strong signals in the water, then detected by the instrument (the PASSEM itself is powered through an UPS set to 50Hz output). Strong noise variations are due to this spurious signal.

6. SUBCONTRACTING

Describe whether any of the tasks has been subcontracted, provide justification, percentage of the volume subcontracted as compared to the total budget and explain how the subcontractor was selected. **Maximum 2 pages.**

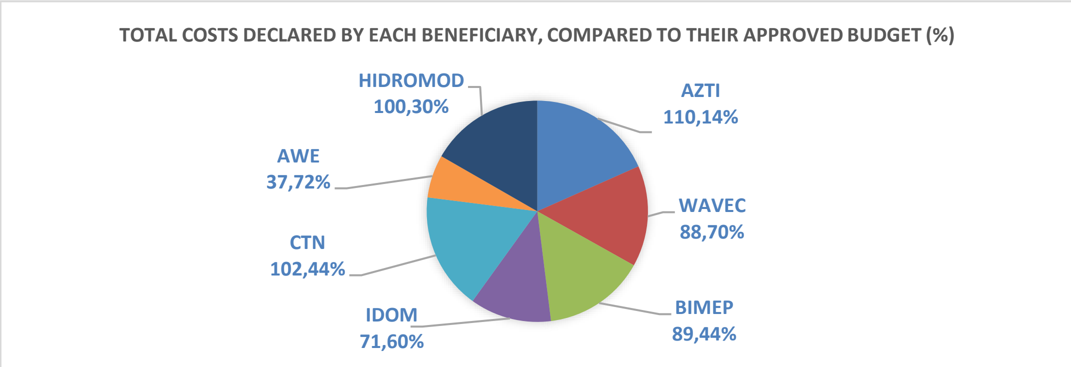
As stated in the Grant Agreement, none of the tasks have been subcontracted.

7. BUDGET

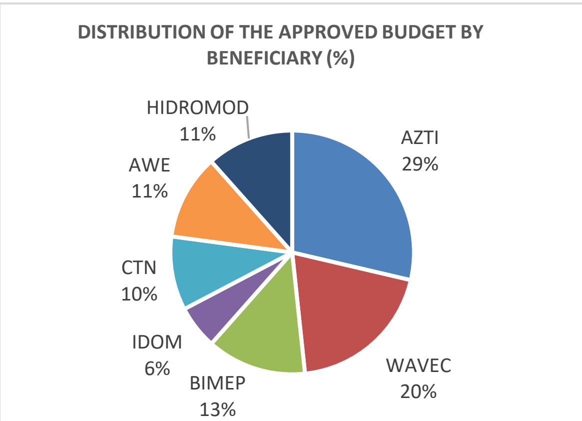
- Please fill in the separate template for the Financial Report;
- In the section below, please provide your assessment of the budget implementation, as compared to the information included in Annex III of the Grant Agreement. **Maximum 2 pages.**

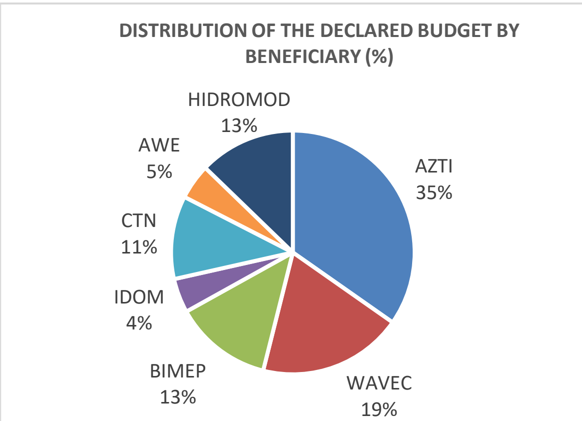
– Please explain any deviations from the planning, as well as their impact on the implementation of the project;
– Signal any relevant problem concerning eligible costs, distribution of budget, financial constraints or others.

The project has been successfully implemented with an expenditure of 91% of the total budget granted to the project. On a beneficiary level, and referring to the whole duration of the project, there have been 3 partners who have slightly overspent their total budget, 3 partners that have consumed between 10 and 30% less than their budget, and one partner with a lower budget expenditure (less than 40%). However, it can be confirmed that the project has been implemented as described in the Grant Agreement.



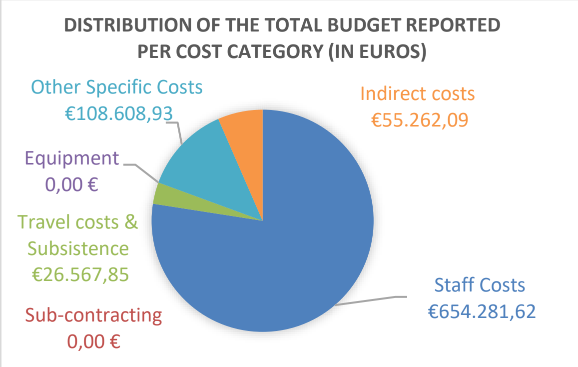
As for the **distribution of the total budget per beneficiary**, the percentage of the budget declared by each partner is aligned with the budget allocated to each beneficiary, being AWE the beneficiary with the highest deviation.

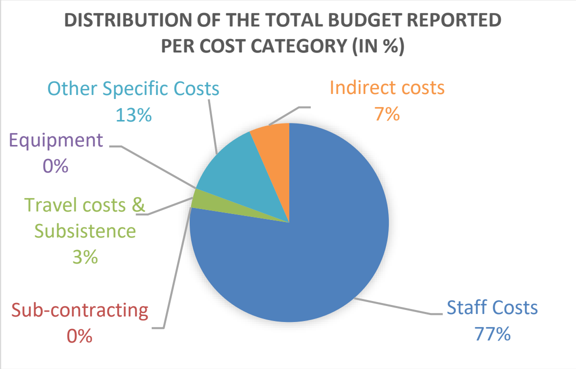




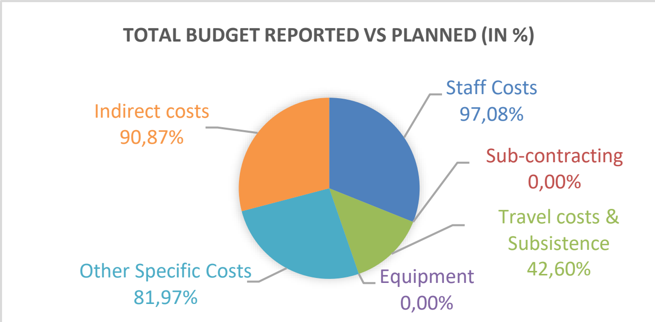
In relation to the two **reporting periods** in which the project is divided, the amount spent during the second reporting period has been higher than in the first reporting period (55% of the budget spent in the second period compared to 45% spent in the first period). This is consistent with the work done during the project, taking into account that major tasks of the project have been carried out during the last 18 months of the project.

Focusing now on the **different cost categories**, the following two graphs show how this distribution has resulted in:





At an **overall project level**, none of the **cost categories** has exceeded the approved amounts for each of them. The following graph shows the percentage of the total budget reported at cost category level, compared to the estimated budget of the Grant Agreement.



Considering the flexibility and possibility to transfer amounts between different cost categories, there are no significant issues to remark. The project has been adequately adapted to situations that have required it, such as the COVID-19 outbreak. A more detailed analysis of each type of cost category leads to the following conclusions:

- **Personnel costs**: As expected, staff costs represent the largest share of the budget (77% of the total budget). At the project level, up to 97% of the total personnel costs expected have been spent. According to Article II.22 of the Grant Agreement, beneficiaries are allowed to adjust the estimated budget set out in Annex III by transfers between themselves and between different budget categories, if the action is implemented as described in Annex I. Four partners have slightly exceeded their personnel costs indicated in the GA (AZTI, BiMEP, CTN and HIDROMOD). Concerning the hours committed to the project, they are in line with the hours estimated in the GA, only with a 4% increase (21,858 hours declared, compared to the planned 20,959 hours).
- **Travel & subsistence:** As might be expected, because of the COVID situation and the associated travel restrictions, there have been fewer travel activities than originally planned, which explains the low travel costs. As required by the situation, some trips were cancelled and several meetings moved from face-to-face to virtual ones, with a consequent reduction in expenditure. Less than half of the planned travel costs have been carried out, representing these travel costs only 3% of the total costs reported. Fortunately, it was possible to hold the last project meeting in hybrid format.
- **Other specific costs:** There is nothing relevant to point out. Up to 82% of the budget initially expected has been spent.

Finally, it is important to mention that there have been a few expenditures that would correspond to RP1 timing but have been included in the final report:

- WAVEC: As already communicated and approved by the Project Officer, WAVEC does not claim the VAT back, so they report the costs with the VAT included. Nevertheless, they did not include the VAT of an invoice in the previous interim report. Consequently, they are claiming it in the Financial Statement of this final report. In accordance with the Project Officer's instructions, it has been included in a separate line explaining the cost. This is “Other specific costs”, line 7.
- AWE: As already explained in the previous interim report, partner number 6. AWE, did not report any costs in the interim report due to their minimum cost spending (around 1,300€ staff costs). The report was submitted without their financial statement, and they are now declaring all their costs within this final report. The expenditure made in the first reporting period consists of a commitment of 17 hours.

8. ADDITIONAL INFORMATION

Please include any comment that you find relevant to convey to the CINEA or to the European Commission. You may refer to issues such as policy implementation, contract management or budget execution. **Maximum 1 page.**

9. ATTACHMENTS

Please list all the attachments accompanying this report including the project deliverables, if any. Please number the annexes and use the same reference number in the below list of attachments.

Annex 1 – Financial Statements

Annex 2 – Supporting documents

Annex 3 – Deliverables:

- Deliverable 2.6 Data results and analysis towards impacts' evaluation and understanding
- Deliverable 2.7 Guidelines on EMF, Noise and seabed integrity monitoring planning for wave energy devices
- Deliverable 3.4 Synthesis of knowledge acquired and gap analysis
- Deliverable 4.4 Guidance for a risk based and adaptive management consenting of wave energy projects in Spain and Portugal
- Deliverable 5.3 Suitability maps
- Deliverable 6.6 Data Platform (Month 36).
- Deliverable D7.5 - Project final event.