LifeDemo a~e

LIFE14 CCM/ES/001209

Demonstration of the efficiency & environmental impact of wave energy converters (WEC) in high energy coasts.

Layman report

With the contribution of the LIFE Programme of the European Union

Quantum INNOVATIVE

Universidade Vigo

CETMAR CENTRO TECNOLÓGICO DEL MAR

HCTech. R&D+Hydrography

ACSM

GRUPO JOSMAR

LifeDemo a~e

LIFE14 CCM/ES/001209

The energy problem and marine energies in Europe

With a view to mitigating the negative impacts of climate change, the European Commission established its Energy Roadmap 2050, calling for at least 30% of the EU's energy consumption in 2030 to come from renewable sources. It pinpointed that the solutions existing at that time would reach a point where growth decreases, which is why a search for new solutions has been established. On 20 January 2014, an action plan called "Blue Energy Action needed to deliver on the potential of ocean energy in European seas and oceans by 2020 and beyond" was put forward, emphasising the need to support the development of systems to harness wave and tidal energy.

Within this framework, wave energy has been identified as having the highest energy potential of those listed, and on a global level, Europe, due to its geography, is a particularly advantaged region. According to the Strategic Energy Technologies Information System of the European Commission, the energy potential of wave energy worldwide is estimated at 29,500 TWh/year.

In this respect, Galicia stands out with an average energy potential of between 30 and 35 kW per metre of wave front. These values place it as one of the areas with the best potential for wave power generation worldwide, with good accessibility and the proximity of the generation areas to points of consumption.

LifeDemoWave

LifeDemoWave is one of the projects funded by the Life programme of the European Union in its 2014 call for proposals, within the Climate Change Mitigation sub-programme. This project has been launched for demonstration purposes and is coordinated by the company Quantum Innovative and has been developed jointly with five other partners: Universidade de Vigo (Vigo University), Hercules Control, CETMAR Foundation, ACSM and Josmar Group. It has a total budget of €1,836,788, of which the EU has funded €1,034,119. The entities participating in the project and the region assigned for testing are all in the Autonomous Community of Galicia; consequently, the project development concentrates its efforts on raising public awareness and encouraging the cooperation of local industries in this region.

Quantum INNOVATIVE
Universidade Vigo
CETMAR CENTRO TECNOLÓGICO DEL MAR
HCTech. R&D+Hydrography
ACSM
GRUPO JOSMAR

LifeDemo wave

LIFE14 CCM/ES/001209

Project goals

The main goal of the LifeDemoWave project is to demonstrate the viability of two wave energy converter devices (WEC), which have already been researched and patented by the consortium, taking the following aspects into consideration:

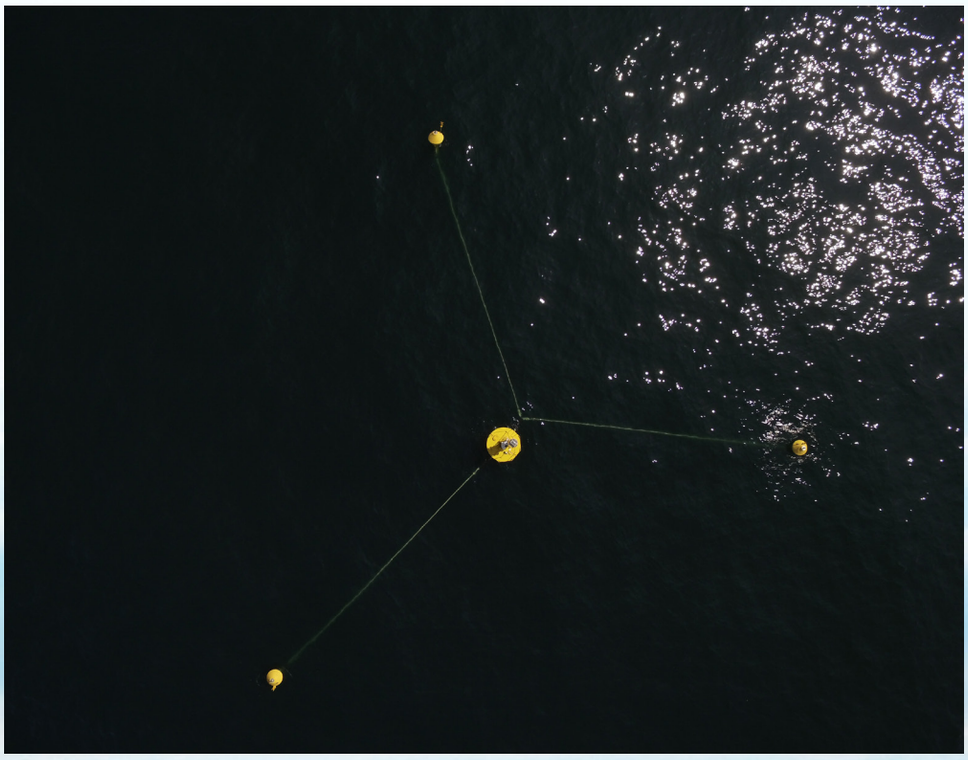
- Environmental impact and mitigation of climate change
- Socio-economic viability
- Sustainability of the marine ecosystem
- Monitoring, dissemination and raising public awareness
- Alignment with European guidelines

As the project is for demonstration purposes, two prototypes with rated power of 25 kW have been manufactured, installed and tested in real conditions on the Galician coast to demonstrate their technical and socio-economic viability, their scalability to commercially exploitable devices, and their replicability and transferability to alternative environments with different energy potentials.

The project also aims to highlight the environmental benefits of the system compared to other technologies, by measuring carbon footprint reduction and other pollutants throughout the cycle.

Specific goals

- Demonstrate the technical capacity and survival ability of these devices in extreme sea conditions within the DOUGLAS and BEAUFORT scales.
- Demonstrate energy efficiency, electrical quality and high use ratio.
- Measure carbon footprint reduction and emission reduction in the whole cycle compared to other technologies.
- Demonstrate the generation capacity of these systems compared to other solutions from a socio-economic point of view.
- Scope of the main stakeholders.
- Measure and reduce the environmental impact on ecosystems in the demonstration areas.
- Scalability and replicability, adapted to commercial scales and different geographical conditions.
- Full adaptation to the requirements of European regulations and policies on renewable energies and air and water quality.



Demonstration of the efficiency & environmental impact of wave energy converters (WEC) in high energy coasts.

Partners

Quantum Innovative is a spin-off of the Universidade de Vigo that was created by the CIMA research group. The company has positioned itself in the market offering advanced solutions in mechanical engineering.

The **Universidade de Vigo** is one of the main Spanish public universities. In its three campuses, R&D projects are carried out in the fields of science, humanities, social-legal sciences and technology. The following research groups are participating in LifeDemoWave:

- Grupo CIMA: mechanical engineering.
- Grupo en.e: electrical engineering.
- GPI-RV: image processing and virtual reality.

CETMAR, Centro Tecnológico del Mar, is an initiative of the Consellería do Mar (Regional Ministry of the Sea), the General Management of R&D&i of the Xunta de Galicia and the Ministry of Science and Innovation. Its goals are to encourage cooperation between institutions, research centres and the maritime-fishing sector and promote joint R&D&i activities and effective technology transfer.

Hércules Control is a spin-off of the Universidade de Vigo, originating from the GPI-RV research group, with extensive experience in environmental consulting and R&D sea-related projects.

ACSM (Advanced Crew and Ship Management) is a company specialising in global maritime services, including comprehensive submersible ROV services for offshore projects, with clients all over the world.

Grupo Josmar develops innovative projects in broad areas of the marine and fishing industry. It offers all the necessary know-how for the construction and maintenance of sea-related systems.

LifeDemo wave

LIFE14 CCM/ES/001209

The LifeDemoWave demonstration project

LifeDemoWave is a demonstration project, whose main goal is to demonstrate the feasibility of the use of wave energy for power generation. For this purpose, two prototypes based on the consortium's patents were developed, and they were installed in an experimental area on the Galician coast, with the additional objective of highlighting the energy potential of the area.

In order to do so, activities were developed focusing on design, construction and demonstration, covering the full technical development of the project.

Demonstration of the efficiency & environmental impact of wave energy converters (WEC) in high energy coasts.

Power Take Off systems for harnessing wave energy

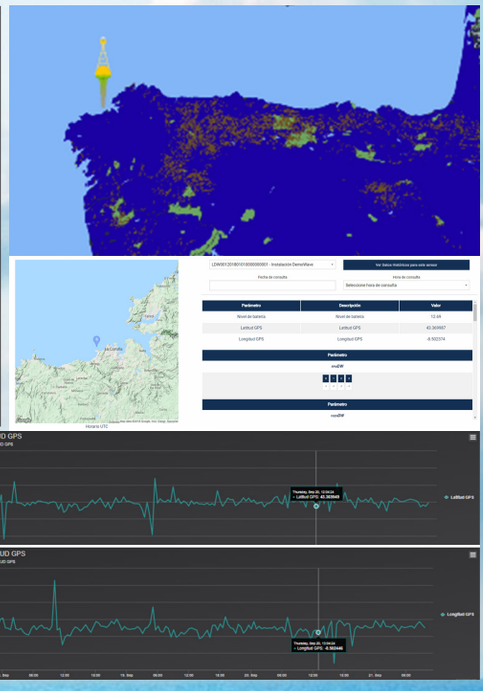
Full design and development, up to construction, of the components used to harness the mechanical action of waves. The LifeDemoWave system is a wave energy generator (WEC) of the point absorber, floating structure type. It consists of two parts, floating and stationary, and this differential movement is what harnesses the power of the waves. This movement is converted into electrical energy by means of two different Power Take Off (PTO) systems, which make use of mechanical and hydraulic action for accumulation and conversion.

The two PTO systems were installed successively on the buoy consisting of floating and stationary bodies, in order to test the systems under similar conditions and reach conclusions on the relative performance of both patents.

Electrical adjustment, control and telemetry systems

It has been taken into account at all times during the development of the electrical systems that the electrical signal generated can be channelled to the grid and used for domestic consumption, and the prototypes have the equipment needed for this process. However, the infrastructure present in the experimentation area does not enable connection to the electricity grid, hence the prototypes are also suitably equipped for energy dissipation.

Furthermore, the equipment developed has devices to control and monitor all the systems on board, both those related to electric power generation and those involved in navigation safety. The latter are powered by the wave energy equipment, but also have additional redundant power, which enables control over the equipment to be maintained in the event of failure or emergency, in accordance with current regulations.



Quantum INNOVATIVE · Universidade Vigo · CETMAR CENTRO TECNOLÓGICO DEL MAR · HCTech. R&D+Hydrography · ACSM · GRUPO JOSMAR

LifeDemo a~e

LIFE14 CCM/ES/001209

Prototype installation and demonstration stage

During project development, all the systems developed in the experimentation area were set up. This involved launching the whole unit and the towing it to the point of installation, where it stayed so the performances of the different subsystems could be studied between August 2018 and April 2019.

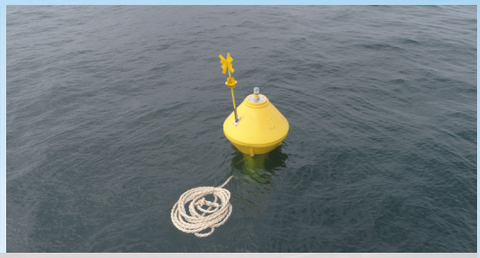
During this period, demonstration sessions were held in which the functioning of the prototypes in the installation area could be verified, in addition to holding further events aimed at disseminating the project and raising awareness of the need to investigate new renewable sources of energy.

Demonstration of the efficiency & environmental impact of wave energy converters (WEC) in high energy coasts.

Prototype mooring and stabilisation systems

Design and sizing of all the necessary equipment for the anchoring of prototypes in the experimentation area. The developed system enables a high survival rate of the prototypes installed in areas of high energy potential, where the working conditions are extremely hard.

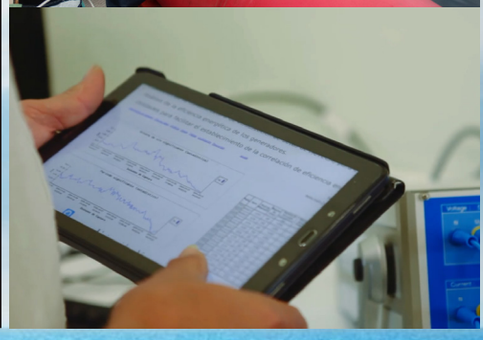
The system developed not only ensures the equipment stays anchored in the established location, but also keeps the prototypes stabilised and isolated from the seabed, optimising the energy yield of the waves. The very design of the mooring systems of LifeDemoWave enables the size of the anchoring system to be reduced, minimising the area affected, as well as manufacturing and installation costs compared to other solutions



Monitoring energy efficiency and environmental impact

During the period in which the prototypes were installed in the demonstration area, data was collected and the different parameters related to energy yield efficiency was monitored. These values enable the benefits of the system to be assessed and a study to be drafted on the savings in emissions and carbon footprint reduction entailed.

Moreover, before the systems were installed, during the development of the tests and after the removal of the prototypes, samples were taken in the experimentation area, which afterwards enabled a study to be drawn up on the impact the installation of these types of devices has on the flora, the fauna and the seabed, besides the noise pollution they generate.



Quantum INNOVATIVE · Universidade Vigo · CETMAR CENTRO TECNOLÓGICO DEL MAR · HCTech. R&D+Hydrography · ACSM · GRUPO JOSMAR

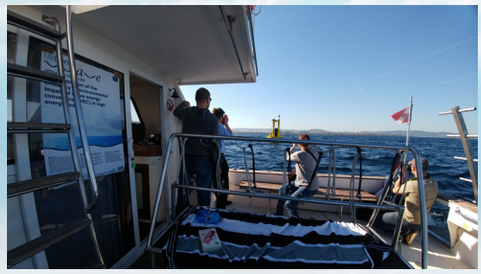
LifeDemo wave

LIFE14 CCM/ES/001209

Social and environmental impacts

For the duration of LifeDemoWave, analyses were carried out within the environmental and socio-economic frameworks associated with the construction and installation of a wave energy capture device during all its stages.
LifeDemoWave has demonstrated a curbed level of impact on the physical and biotic environments. For the duration of the project, it has cohabited with benthic communities, marine birds, fish life, etc., without altering their habitats in any way.

Regarding the socio-economic aspect, members of the energy, naval, fishing and administration sectors have been involved in the project with a high degree of participation and interest, and ongoing contact has been maintained with them to address problems and create a bridge between them and the project. LifeDemoWave has not stopped here, but rather it has gone on to raise public awareness through events for university students, researchers and school and college students, so that in the future they will be the ones who give the final impetus to technology of this type.



Economic and energy impact

LifeDemoWave has shown promising results, with high survival behaviour in extreme wave conditions, a compact and non-aggressive anchoring system; low costs in both CAPEX and OPEX (thanks to its ease of access for maintenance and minimal submerged mass); and competitive returns at generation level compared to similar technologies for a TRL 5.

This project has been another step towards obtaining alternative clean energy, future versions that can be optimised thanks to hydrodynamic behaviour correlated with sea simulations and trials.

The goal is to increase the scale of production and create wave energy parks to obtain in future iterations the desired TRL 9 with a competitive LCOE compared to other energy sources.

Disclosure and networking

The activities developed within the framework of the LifeDemoWave project have had a great impact, especially those related to the manufacture, assembly and installation of prototypes. Regional, Spanish and European entities have participated in these events, while maintaining contact with the project and its partners to keep abreast of its evolution.

The Instituto Enerxético de Galicia (INEGA), an agency that depends on the Department of Industry of the Xunta de Galicia, as the entity managing the experimentation area in which the demonstrations have been carried out, has kept abreast of the development of the project from its application phase onwards, and LifeDemoWave has received institutional support from the beginning.

Demonstration of the efficiency & environmental impact of wave energy converters (WEC) in high energy coasts.

BIMEP (Biscay Marine Energy Platform), the marine energy research platform of Euskadi (Spain), has also maintained regular contact with the LifeDemoWave consortium. BIMEP is characterised by having facilities in the open sea that allow developers of marine-energy-based generation systems to test and verify their prototypes under real conditions. During the development of LifeDemoWave, the possibility of installing prototypes in the BIMEP test park was considered, and steps were taken to go ahead with relevant procedures to request the installation permits for the prototypes.

Throughout the development of the LifeDemoWave project, the consortium has maintained a constant flow of information with EMEC, European Marine Energy Centre Ltd, in order to assess future collaborations and new tests in its facilities. EMEC is the first centre of its kind in the world to offer open-sea test facilities, accredited and designed for this purpose, to developers of marine energy systems.

Located in Orkney (Orkney Islands, Scotland), it is an area with excellent sea wave conditions, connected to the electricity grid, with protected port facilities and experience in the local community's maritime sector. With 13 test locations connected to the electricity grid, more marine energy converters have been implemented in EMEC than anywhere else in the world.

For its part, the private non-profit association WavEC Offshore Renewables has also participated in the dissemination of the LifeDemoWave project. Created to develop its activity in applied research, consultancy and other pro-bono activities, this activity includes the dissemination and promotion of opportunities associated with the early development of renewable and marine energy among companies, public administrations and the public in general, and also the training of young people in the field of renewable energy.

WavEC staff had the opportunity to visit the LifeDemoWave project at one of its initial stages, and to make a presentation in which they addressed the need to raise public awareness about the advantages of exploiting renewable energies.

Quantum INNOVATIVE · Universidade Vigo · CETMAR CENTRO TECNOLÓGICO DEL MAR · HCTech. R&D+Hydrography · ACSM · GRUPO JOSMAR

Life Programme
www.life-demowave.eu

Project number
LIFE14 CCM/ES/001209

Coordinator
Quantum Innovative

Partners
Universidade de Vigo, CETMAR, Hércules Control, ACSM, Josmar

Contact
Tel. +34 986 11 88 88
Fax +34 886 12 26 55
contacto@life-demowave.eu

Duration of project
01/10/2015 - 30/06/2019

Total budget
1.836.788 €

EU financial contribution
1.034.119 €

Follow us on our
social networks: