The importance of technology certification for growing investor confidence in floating wind power:

The W2Power approach

FIBREGY Open Industrial Day
Madrid, 18th June 2024

Pedro Mayorga
Co-founder & CEO - EnerOcean S.L.

Outline

1. About us
2. Challenges and our solutions
3. Systematic step by step approach
4. Third party verification
5. Next steps: PRIMAVERA project

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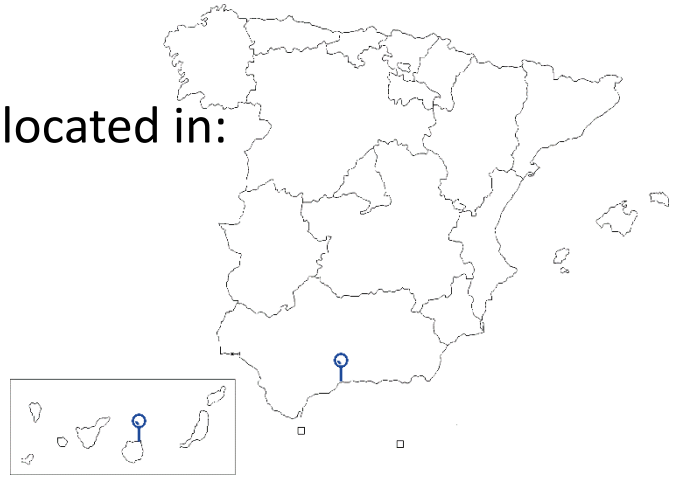
About us

2007 First Spanish Marine Energy Engineering company

R&D based company located in:

- Andalucía
- Canarias



Active member of National and Regional Marine and Energy Clusters

Business scope:

- Technology developer (W2Power)
- Floating Wind projects developer

eni.com

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RENEWABLE ENERGIES

PLENITUDE INVESTS IN ENEROCEAN'S FLOATING WIND TECHNOLOGY

22 APRIL 2022 - 11:00 AM CEST

Milan/Malaga, 22 April 2022 – Plenitude (Eni) announces today that it is to invest in EnerOcean S.L., the Spanish developer of the W2Power technology for floating wind power. The deal is structured as a long-term partnership focused on the deployment of the W2Power technology as a lead contender for floating wind power developments worldwide.

offshoreWIND.biz

Eni's Plenitude Investing in W2Power Floating Offshore Wind Technology

TECHNOLOGY

April 22, 2022, by Adnan Durakovic

Italian oil and gas major Eni will, through its energy transition unit Plenitude, invest in EnerOcean S.L., the Spanish developer of the W2Power technology for floating wind power.

OUR INDUSTRIAL SHAREHOLDERS

plenitude

One of the biggest energy companies in the World

69 +32000

Main shareholder of EnerOcean

RENEWABLES PORTFOLIO

- 1400 MW Installed in 2021
- 15 GW in 2030
- 60 GW in 2060

GHENOVA

Biggest naval engineering company in Spain +800

Main engineering supplier to NAVANTIA
Experienced in offshore wind

ISATI GLOBAL SOLUTIONS

Spanish wind turbines engineering company +100

Supporting Leading OEMs

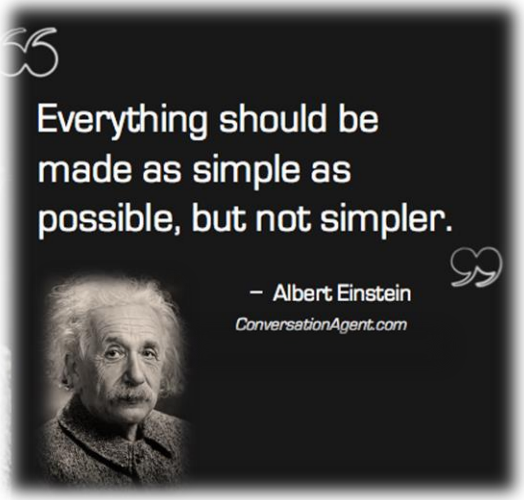
INRIGO

Norwegian O&G SME company

1Tech

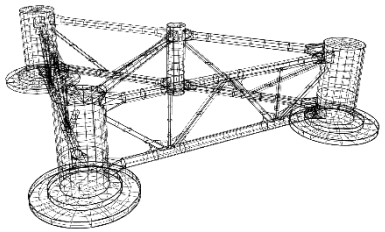
Belgian energy consulting company

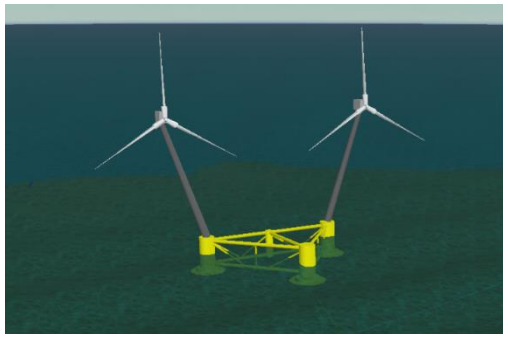
EnerOcean's engineering approach



- Phylosophy: **simple** and versatile design to overcome the complex technical challenges that could prevent FOW from being competitive
  - Steel, semisubmergible floater and catenary mooring **boost versatility**
  - Twin turbines, leaning towers and single point mooring **bring down costs**

- Design and development methodology to reach the **highest TRL**, increasing wind farms investors' confidence:
  - **Robust and sistematic development** combining theory, analysis and experimental campaigns, including ocean sea trials.
  - **Verification** of design under extreme conditions by reputed third party





W2Power prototype at sea. The Technology to use

[1) Video EnerOcean Web]

[2) Video Enred (Canal Sur)]

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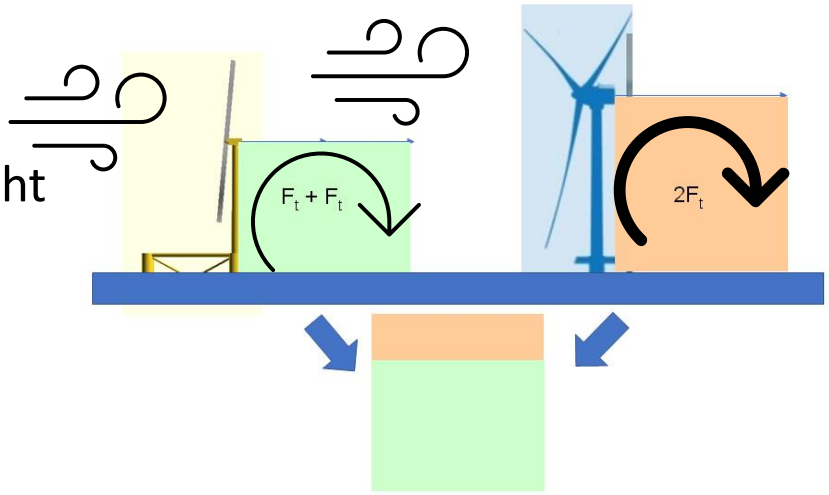
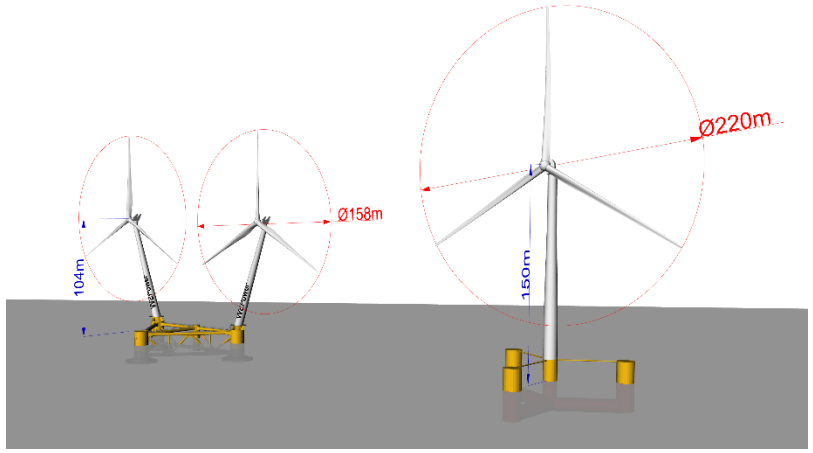
Floating wind: The key challenge

- On fixed foundations, turbines of >10MW reduce the number of connection points, reducing overall cost per MW of a wind farm.
- Bigger turbines introduce higher loads due to their greater hub height and nacelle weight (more serious problem on floaters vs fixed)
- Main design driver for floaters is the overturning moment, which is mostly caused by the thrust of the wind acting on the rotor, and by inertia and gravity forces induced by the nacelle (top head mass). Proportional to these forces and the lever (vertical hub height).
- Therefore the overturning moment of two 6 or 8 MW turbines is much less than that of one 12 or 16 MW turbine of the same area and total weight.
- W2Power is a solution to de-couple the MW power per connection point from the floater's size and weight: the lighter floater results in lower cost per MW.

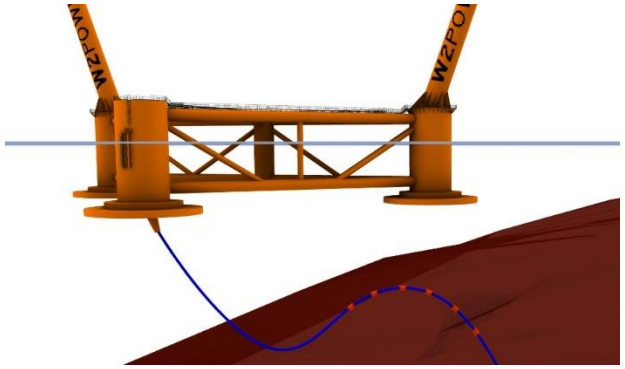




Key technology advantages ⇨ Lower energy cost

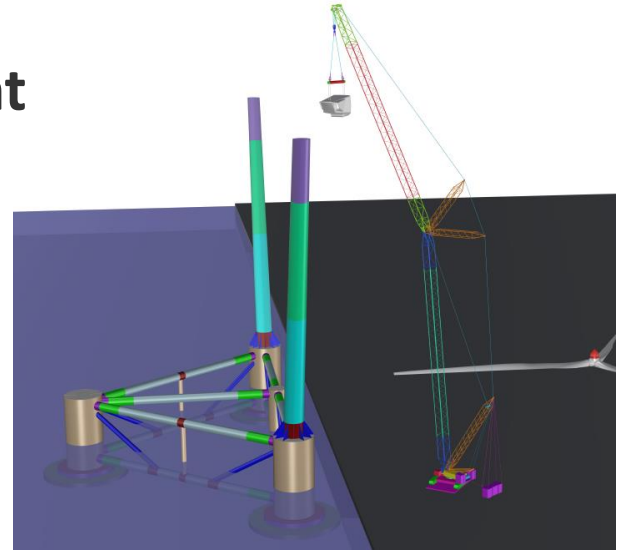
✓ Lightweight but large semi-sub

- Sea Proven hydrodynamic stability,
- Optimized steel weight per MW
- Smaller column volume, less draft



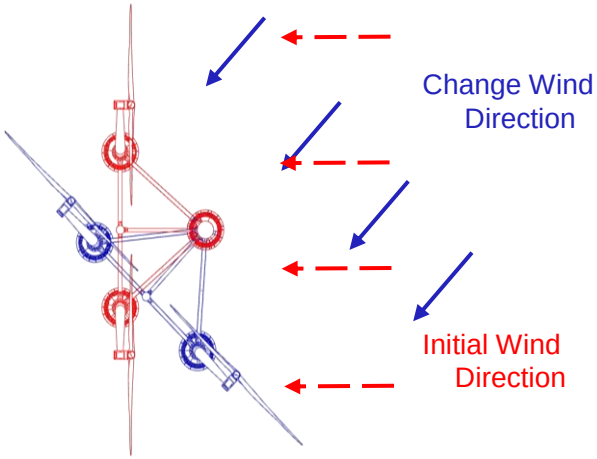
✓ Smaller lighter turbines at a lower height

- Multiple vendors. Proven models
- Cheaper assembly
- Lower OPEX. No advanced vessel needed
- Less steel, low CAPEX



✓ W2Power self-orientation

- As proven at sea :
- Allows closely spaced turbines
- Turbine yaw sub-systems not required
- Accurate even in low winds



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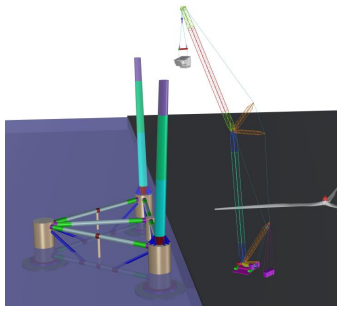

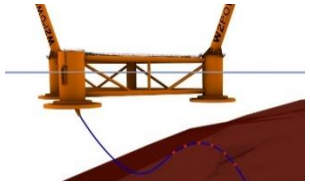

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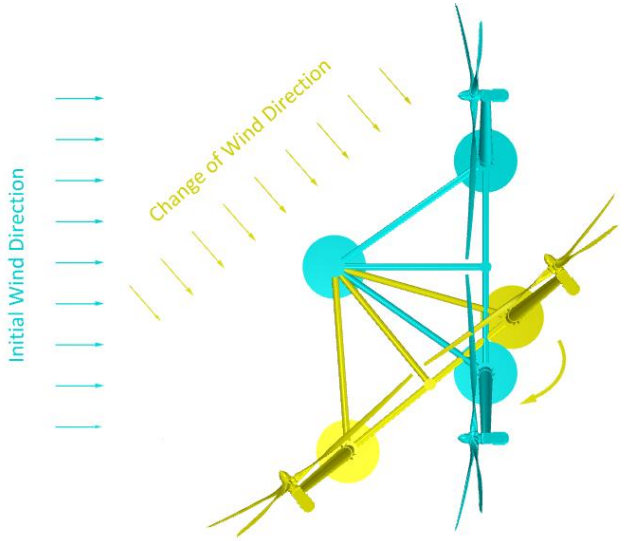

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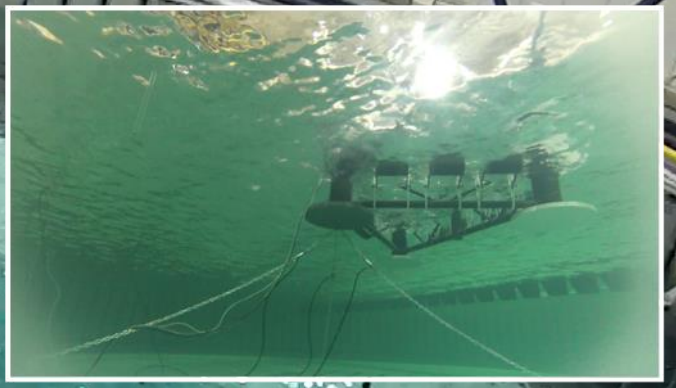
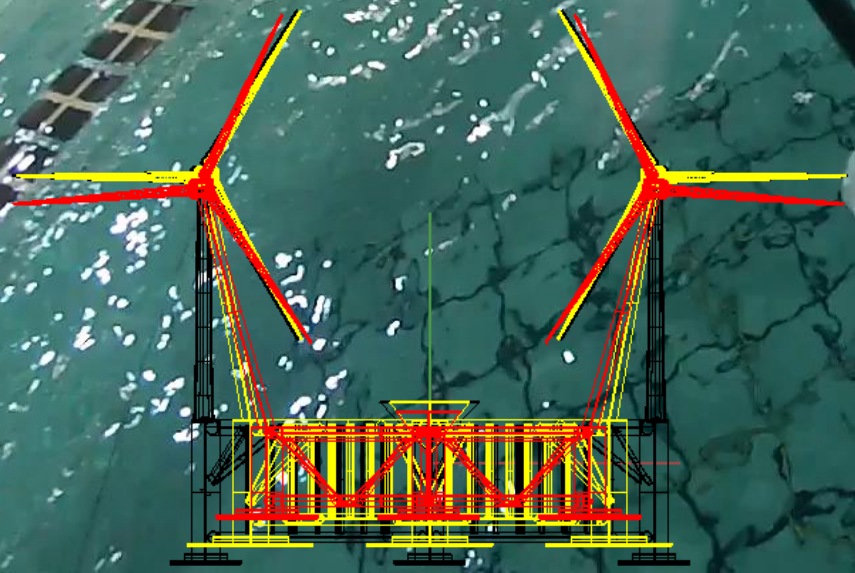
Systematic Step by Step Development: 2009-2015

- Concept validation.
- Consolidation of Technology
- Development model





Use of Europe's best laboratories and test tanks to verify models, components and key features:

- Marintek (Norway).
- University Edinburgh (United Kingdom).
- UCC (Ireland).
- FloWave (United Kingdom).

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Systematic step-by-step development

Sea testing preparation and campaigns 2016-

Survivability Performance Exceeded

Stability and Reliability Demonstrated:

- No need to switch to emergency mode.
- No need to Access the platform for maintenance..

DATA COLLECTION AND ANALYSIS

- Realtime environmental data
- Video Recording
- Platform motions and strains
- Wind turbines SCADA data

FACED 7 STORMS WITH +4M WAVES

(24m equivalent height at full scale)

Max waves of 5.4m equivalent to +30m

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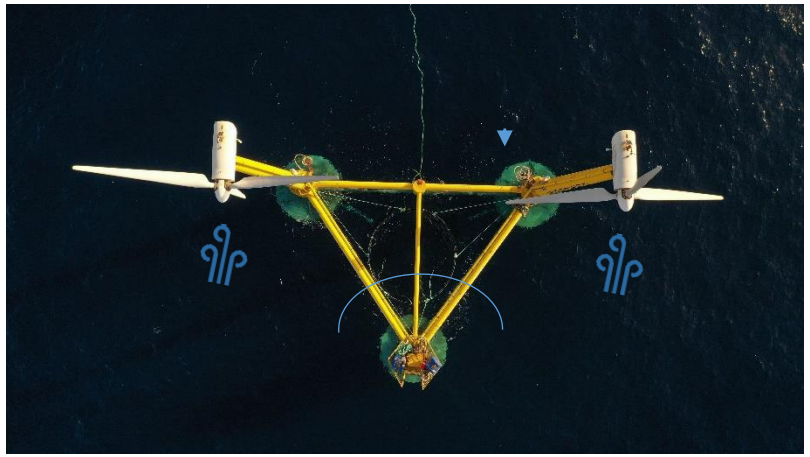
Excellent results of prototype sea testing



Wind alignment demonstration, functional mooring subsystem validated

New projects for continuous improvement being tested

Simple and cost-effective sea operations

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Classification societies

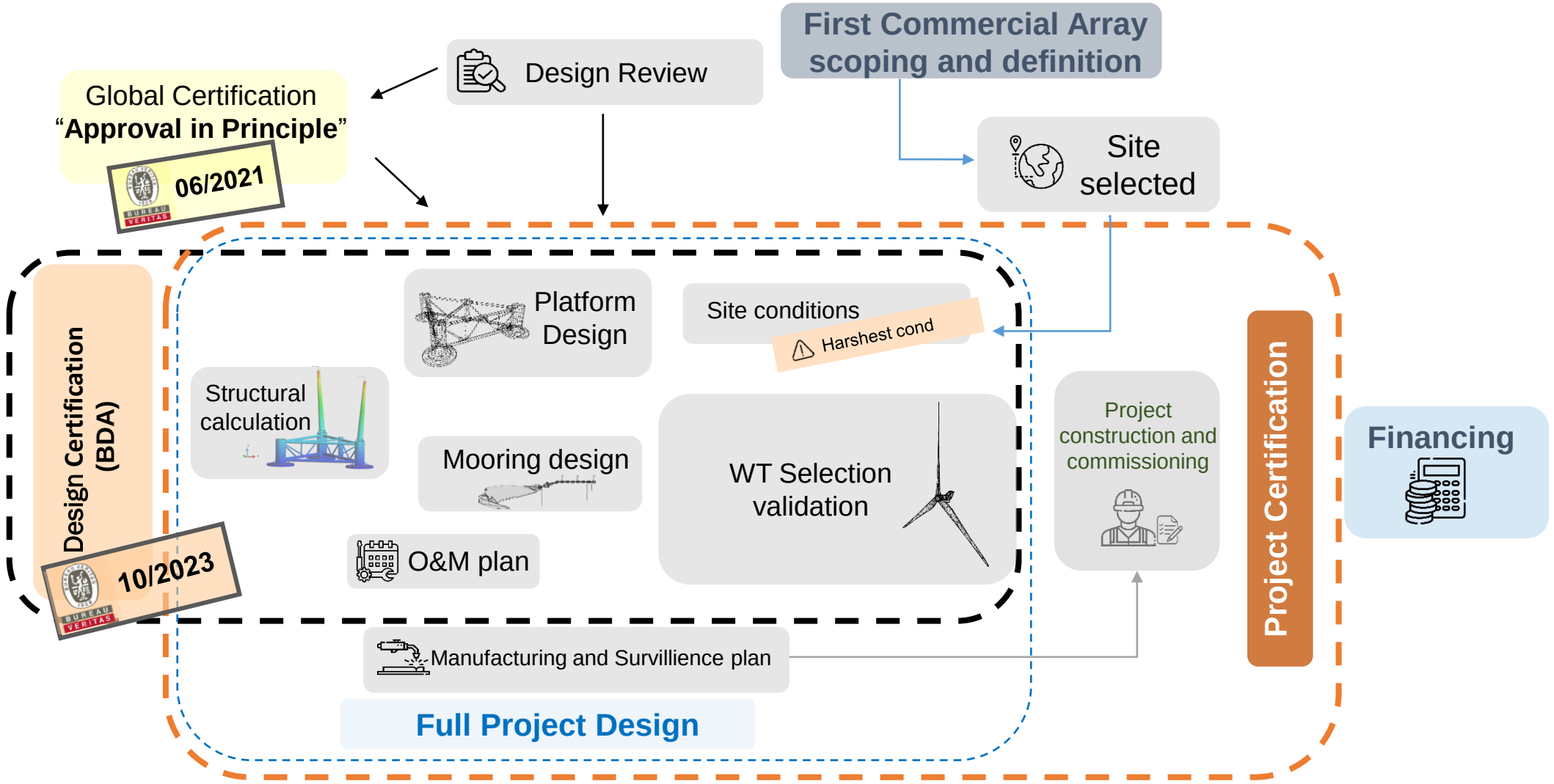
- They are playing an increasingly crucial role in developing and implementing floating offshore wind projects and technologies. They perform studies and services such as:
  - **Technical assessment** of floating wind turbine design. This includes structural integrity, fatigue and load analysis.
  - **Certification services** for floating wind structures and components. This includes certification of design, production, installation and O&M processes.
  - **Risk management** for offshore wind projects, helping investors and operators to asses and manage risks.
  - **Standard development** for the design, construction and O&M of floating wind turbines as well as for offshore grid infrastructure.

Approval in Principle vs Basic Design Approval

- Approval in Principle (AiP):
  - An AiP is a **preliminary assessment** of a design, indicating that it meets relevant rules and regulations set by the Classification Societies.
  - It is a **non-binding evaluation** and does not guarantee future approval for construction.
  - It can be obtained based on **limited design calculations** and drawings.
  - Obtained by EnerOcean in **June 2021**.

- Basic Design Approval (BDA):
  - A BDA represents the **final verification** of a design.
  - A BDA implies an **authorisation** to proceed to large-scale construction.
  - It results from an **extensive and exhaustive** engineering work, drawing on comprehensive and sophisticated simulations, model tank testing and often strong involvement of key suppliers.
  - Obtained by EnerOcean in **October 2023** for our up to **15 MW** design.
  - For EnerOcean, this certification represents the completion of a comprehensive assessment of critical elements of the W2Power design, which is currently moving to full-size commercial installations.

W2Power farm certification and development strategy



ACHIEVEMENTS

First multi-turbine offshore wind platform with “Single Point Mooring” worldwide tested successfully in the open sea

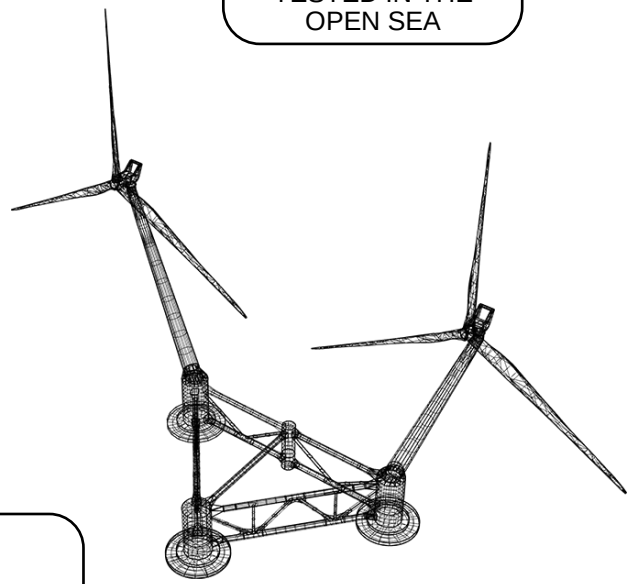
2019

PIONEERING PROTOTYPE SUCCESSFULLY TESTED IN THE OPEN SEA

2020

ATLANTIC PROJECT AWARDS

Best Marine Energy Renewable project



The W2Power offshore wind platform is the first in the world to integrate an aquaculture cage

2022

FIRST OFFSHORE WIND DESIGN TO INCORPORATE AQUACULTURE

2023

FIRST OFFSHORE WIND PROTOTYPE IN THE WORLD WITH CARBON FIBER TOWERS

Sea trials in April 2024

2023

PROJECT WITH TOP EVALUATION IN THE CALL

The “PRIMAVERA DEMOS” project obtained the highest score in the Renmarinas Demos call funded by NextGenerationEU

2023

CERTIFICACIÓN DE BUREAU VERITAS “BASIC DESIGN APROVAL (BDA)”

Design Approval

W2Power floater for wind turbine

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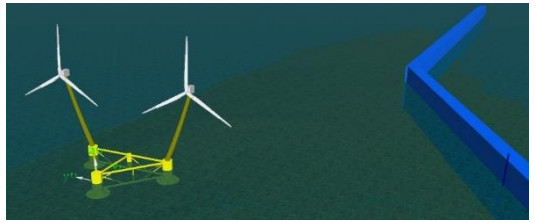
PRIMAVERA Project

First full scale floating platfom in Granadilla Port,



Autoridad Portuaria de Santa Cruz de Tenerife

Power Generation Capacity: 11,0 MW

Annual Energy Generation Capacity: 53,9 GWh

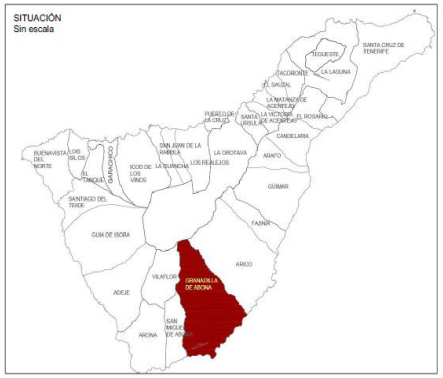
Location: Port of Granadilla, Tenerife, Spain

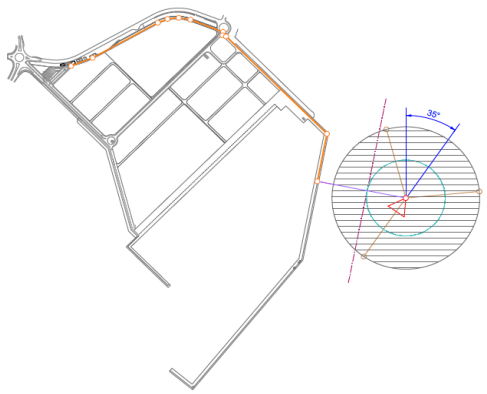
Floater Technology: W2Power Twin Turbine semi-submersible

Wind Turbines: Two HAWT

COD: Q4 2025-Q1 2026

Key Project Advantages





Full scale demonstrator, helping decarbonisation of port activities

Potentially First full scale multi MW floating demonstrator in Spain

Unique high quality wind resource in port Waters – Mean Wind Speed over 10.5 m/s

Long time experimental and training site

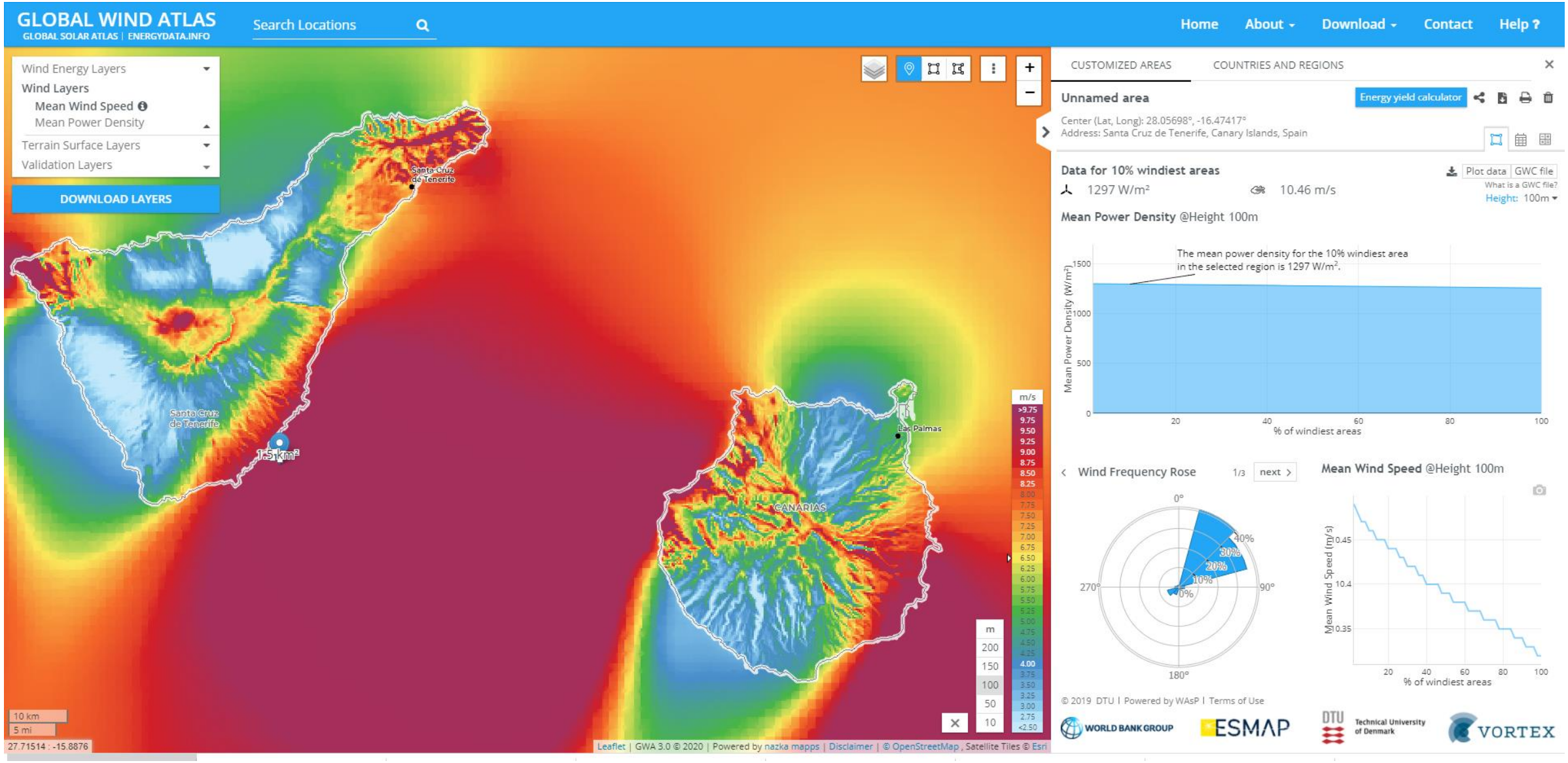
Support from Port Authority and Port Community

High Local content

Low environmental impact in industrial area

Mobilising the national and local value chain

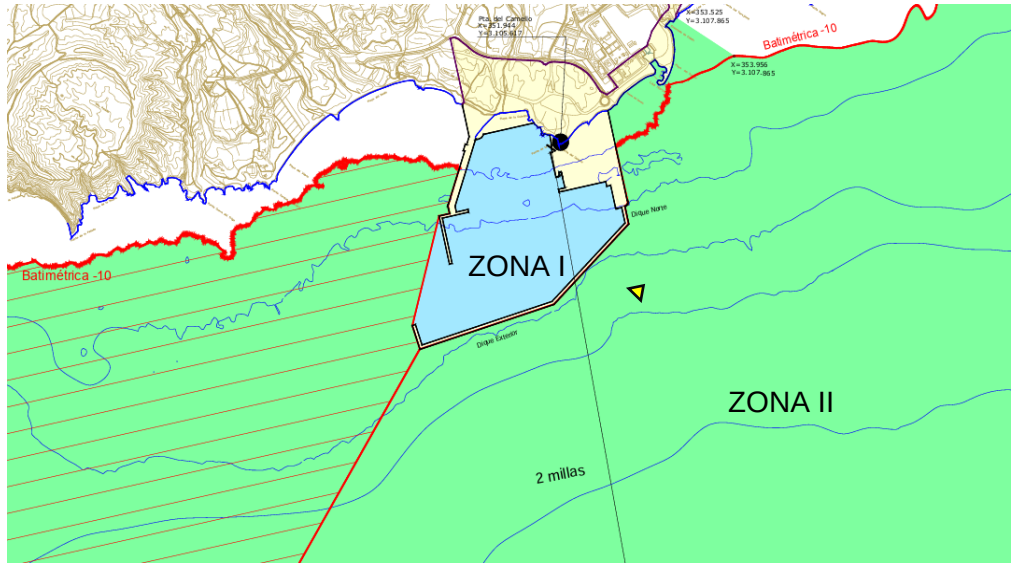
PRIMAVERA Project: World Class Resource



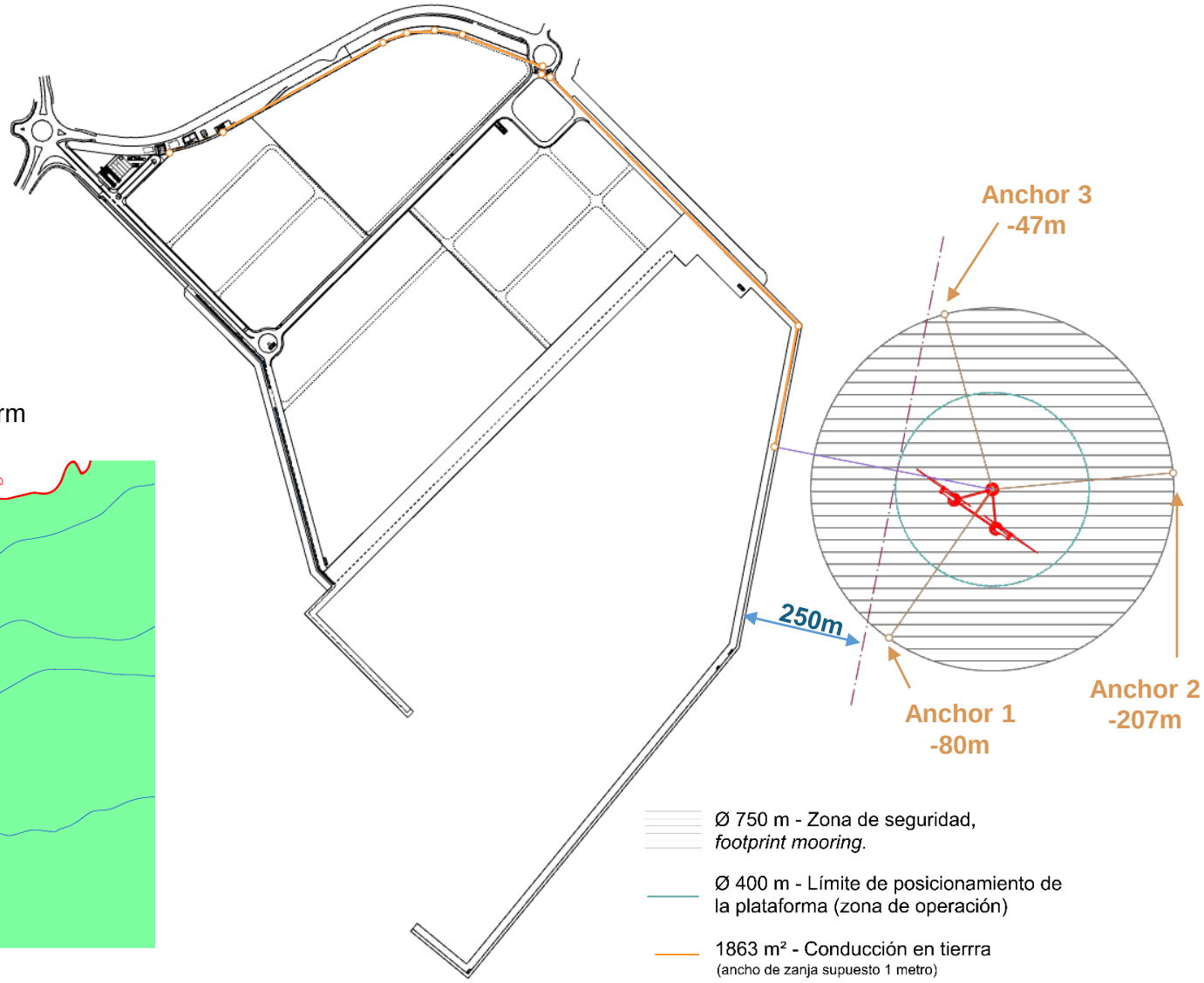
Granadilla Port

Autoridad Portuaria
Santa Cruz de Tenerife

- Located in the municipality of Granadilla de Abona
- Industrial and container transshipment port
- Direct links with the TF-1 highway
- Preferred location for the installation of the W2Power platform



RESTRICTED AREA
ZONA I. Area 100.2 Ha
ZONA II. Area 3498.5 Ha



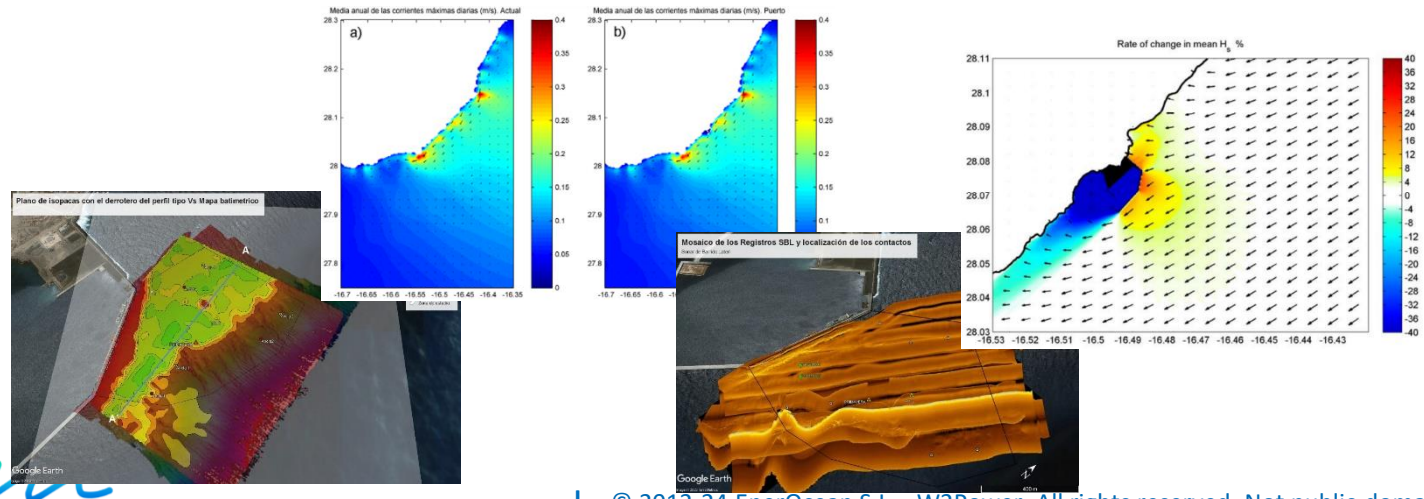
Environmental Campaign

Proyecto PRIMAVERA

Main campaign started on April 2023, availability of vessels and weather windows.

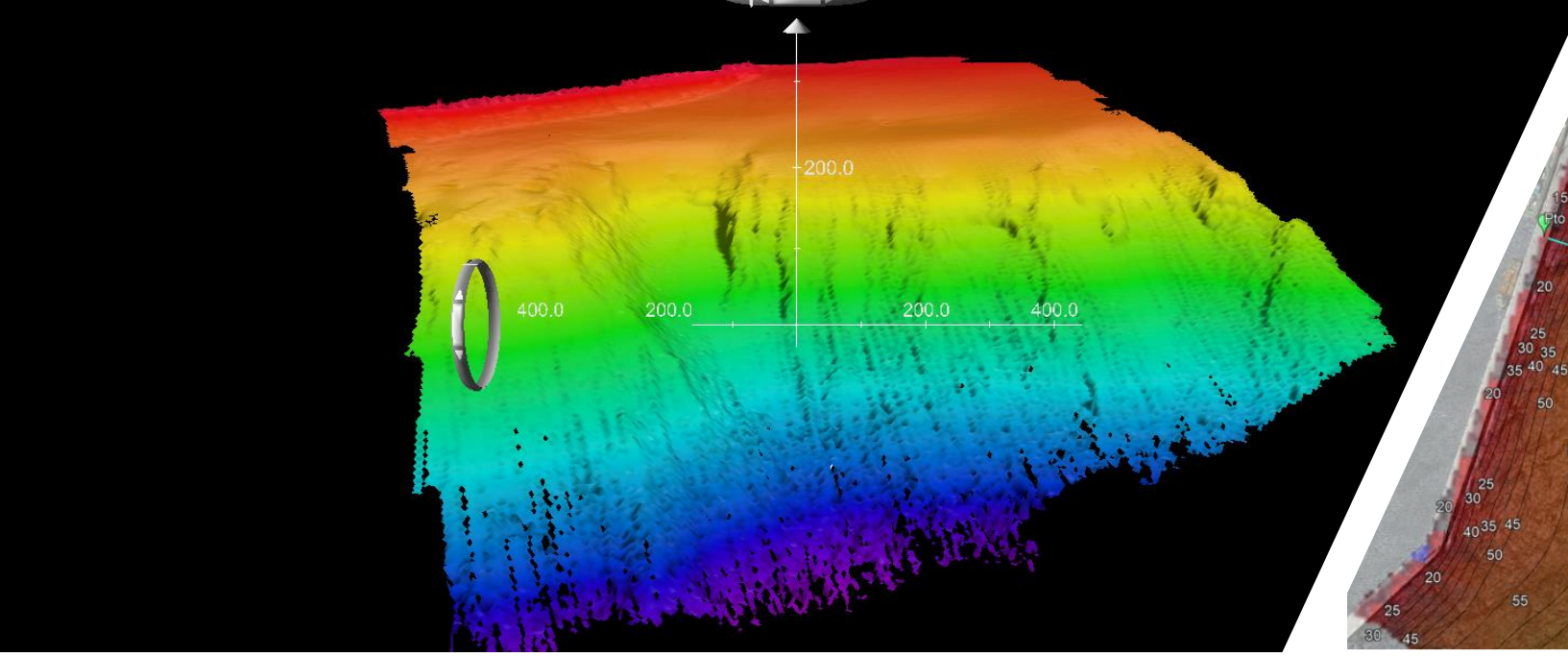
The activities that comprise the environmental campaign are:

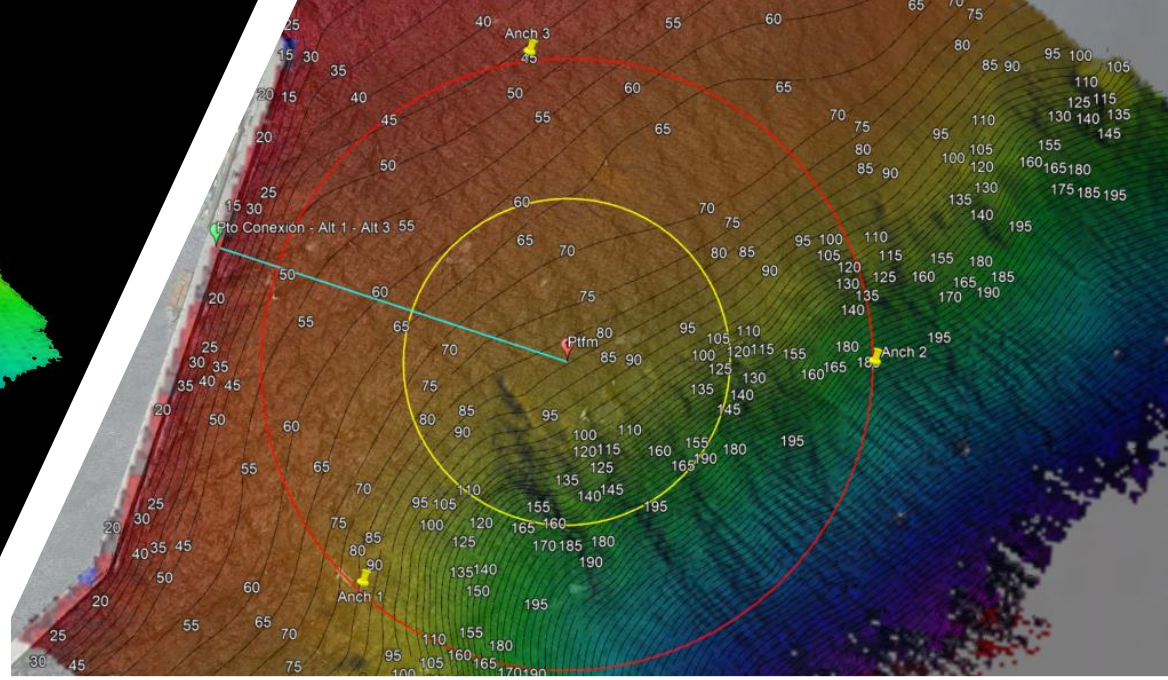
- Bathymetry.
- ROV tracks.
- Sediments.
- Bird/Bat studies (one year campaign, already completed).
- Archaeology campaign.
- Underwater noise study (hydrophone)
- Aerial noise.
- Carbon footprint report on PRIMAVERA project .

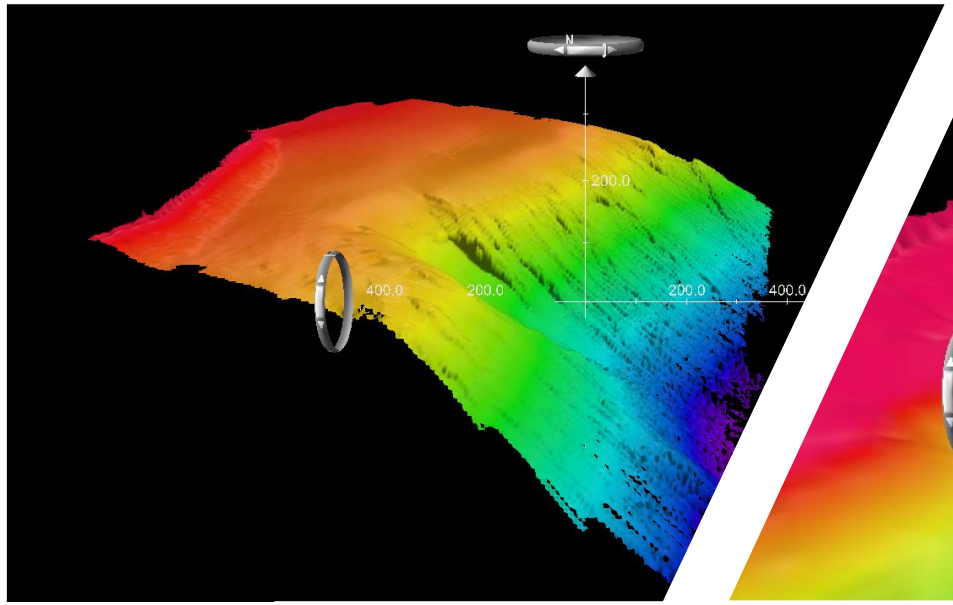


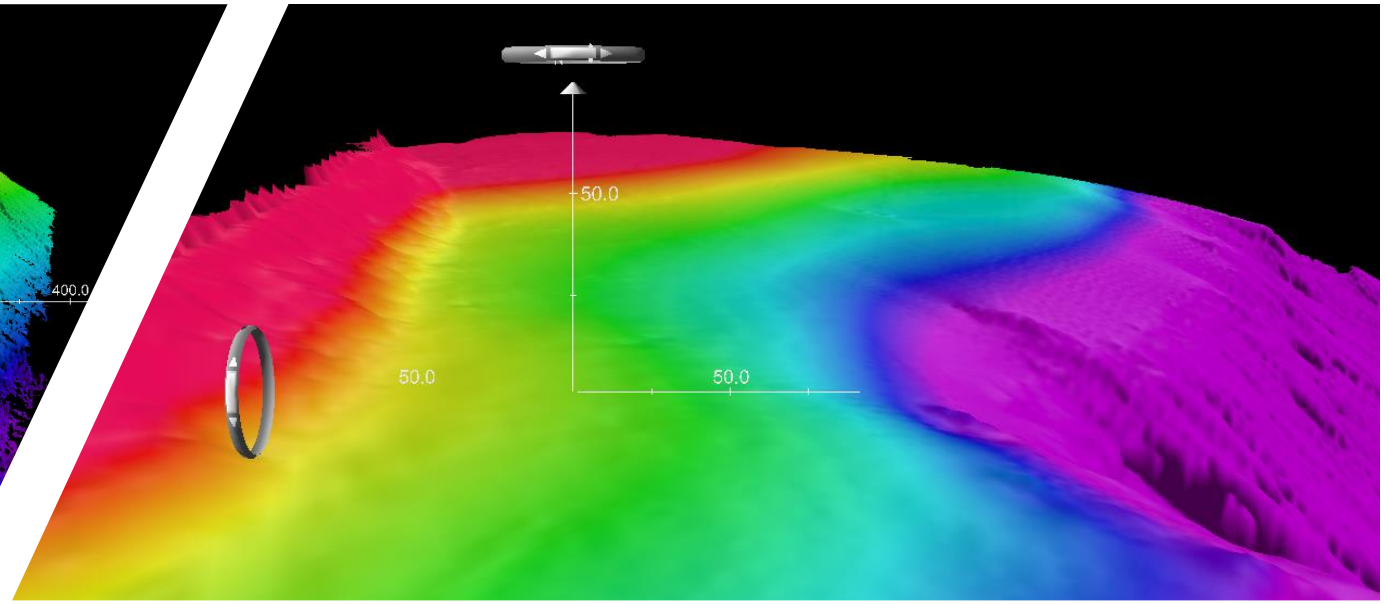
All Reports completed as of 1 Feb 2024

Annex 1. Legislation
Annex 2. Hydrography
Annex 3. Geophysics
Annex 4: Water and sediment quality
Annex 5: Benthic communities
Annex 6: Cetaceans and marine acoustics
Annex 7: Marine dynamics and dispersion
Annex 8: Annual birdlife study
Annex 9: Fisheries study
Annex 10: Wind farm and substation noise study
Annex 11: EMF (electromagnetic fields) study
Annex 12: Landscape study
Annex 13: Carbon Footprint Study
Annex 14:Cultural Heritage
Annex 15: Report according to RN2000
Annex 16: Marine Strategy Compatibility Report
Annex 17: Accident and catastrophe risk study
Annex 18: Report on the state of the body of water
Annex 19: MSP Compatibility



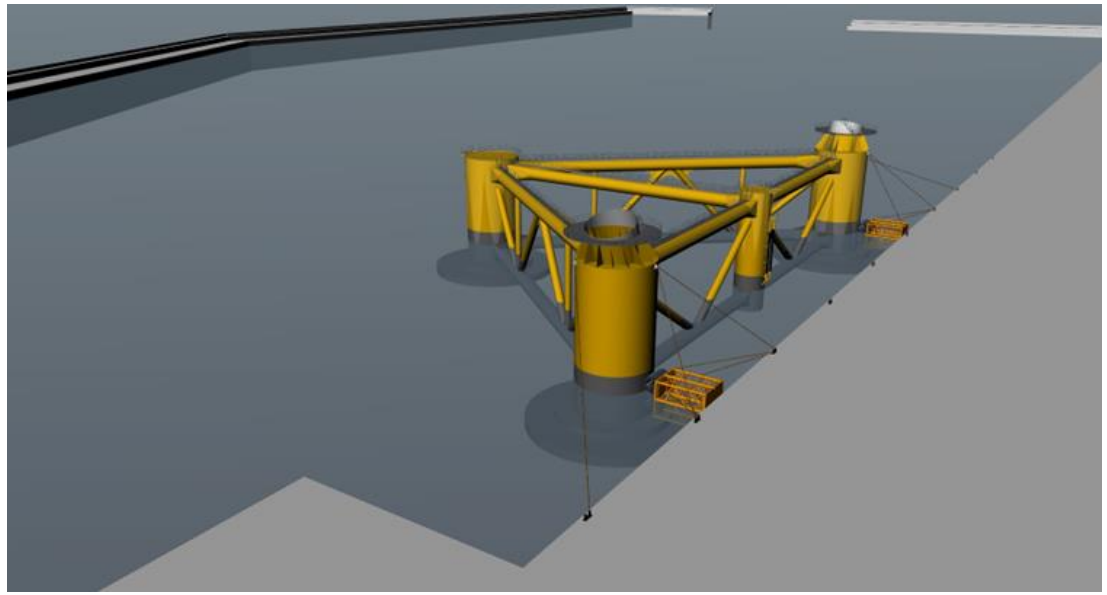


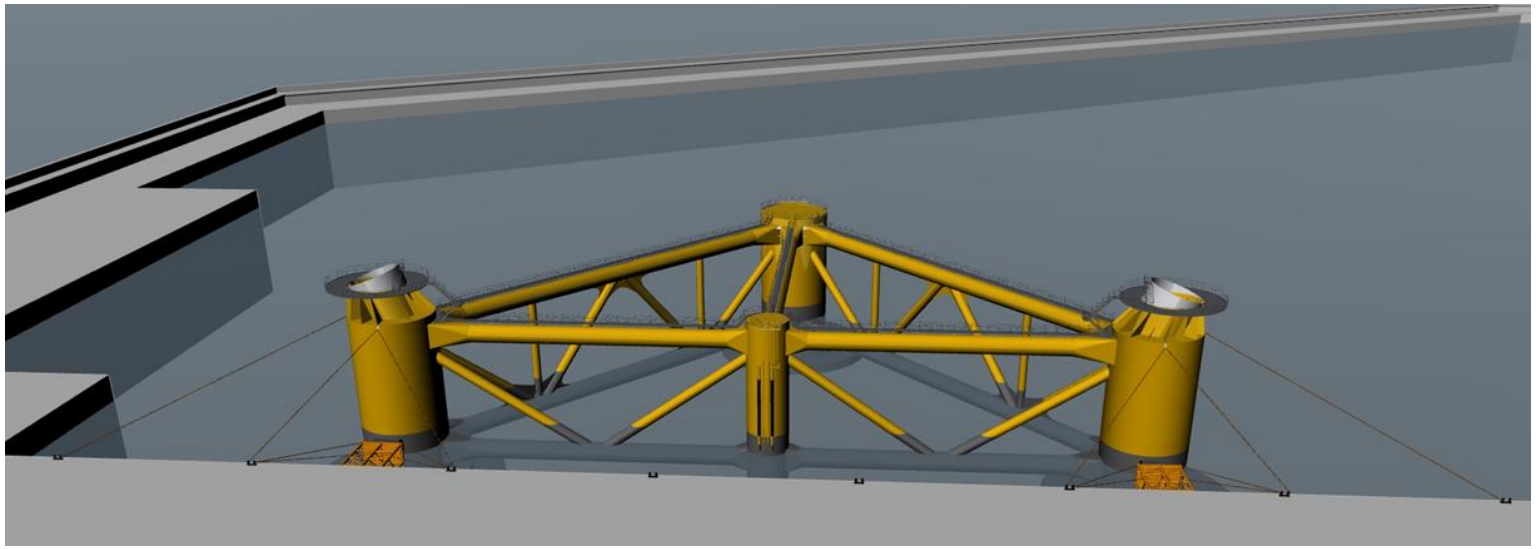




Preliminary Assembly Plan

Assembly at Puerto de Granadilla





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