WHO WE ARE

Located in Portugal, operating worldwide

**Founded** in 2003

**Consulting organization** with a strong R&D background

**Ownership structure:**
8 associates from industry and academia

**Multidisciplinary team** of highly qualified personnel, with background in engineering, economics and biology

24 permanent **staff**; 7 **PhDs**

Working in close **collaboration** with universities, authorities and industry

**Extensive international partnerships**

**FACTS**

LISBON

WavEC
BACKGROUND IN OFFSHORE INDUSTRY

RESEARCH & DEVELOPMENT

- CFD & HYDRODYNAMIC MODELS
- ENVIRONMENTAL MONITORING SOLUTIONS
- SUBSEA ROBOTICS AND SENSORING
- LOGISTICS AND MARINE OPERATIONS
- INDUSTRY RELATED DATABASES
- TECHNO-ECONOMIC MODELS

WAVEC’S MULTIDISCIPLINARY TEAM

- NUMERICAL MODELLING
- MARINE ENVIRONMENT & PUBLIC POLICIES
- TECHNOLOGIES & MONITORING
- ECONOMY & INDUSTRY

ENGINEERING & CONSULTANCY

- CABLE AND MOORING DESIGN
- ENVIRONMENTAL IMPACT ASSESSMENT MONITORING PLANS
- BIOFOULING STUDIES
- LICENSING SUPPORT
- LIFECYCLE COST ASSESSMENTS
- OPTIMIZATION OF MARINE OPERATIONS
- SITE SELECTION AND RESOURCE ASSESSMENT
TIMELINE OF OFFSHORE WIND PROJECTS AND SERVICES

2011
Demonstration project of the Windfloat Technology

2016
Demonstration of an innovative gravity foundation for offshore wind

2019
Development of a single point mooring and electrical connector for Floating Wind
Create a network of excellence to support an emerging offshore wind industry in Portugal

Infrastructure and logistical challenges of Floating Offshore Wind Farms with +10MW Turbines

Support to Tender the Windfloat Atlantic project export cable

Analysis of alternatives for offshore wind substructures and Environmental Impact Assessment

Pre-FEED studies for a 1.2GW fixed offshore wind farm in the Baltic Sea

Heavy maintenance of floating offshore wind farms: Tow-to-Port VS Maintenance at site

Floating Component Exchange on fixed offshore wind farms

Technical and site support to the construction and installation of Windfloat Atlantic Export Cable

FEED study for a floating offshore wind turbine in Asia: Dynamic power cable layout design

Environmental Impact Assessment Study and monitoring plan for the Windfloat Atlantic Project

Analysis of alternatives for offshore wind substructures and Environmental Impact Assessment

Market study of ocean energy and offshore wind

2017
2018
2019
FLOATING WIND JIP:
HEAVY MAINTENANCE OF FLOATING OFFSHORE WIND FARMS

CLIENT CHALLENGES
✓ Investigate the main drivers behind using Tow-to-Port (TTP) VS float-to-float Heavy Lift Maintenance (HLM) strategies
✓ Evaluate key challenges and identify solutions to mitigate risks
✓ Undertake logistic assessments for both maintenance strategies and produce robust cost estimates

WAVEC IMPLEMENTATION (TTP)  
In partnership with
✓ Conduct a state-of-the-art review of the Tow to Port procedures and challenges
✓ Use our in-house Logistic and Marine Operations tool to investigate the impact of different criteria: type of repair, proximity to port, substructure type, metocean conditions...
✓ Derive cost estimates for the maintenance campaigns

PROJECT OUTCOMES
✓ Comparative analysis of the HLM and TTP maintenance strategies regarding -> Feasibility, Risk, Safety and Cost
DYNAMIC POWER CABLE LAYOUT DESIGN

CLIENT CHALLENGES
The client requested the design of dynamic power cable for a commercial FOWT to be installed in the South China Sea:
✓ Dynamic power cable and ancillary elements specifications;
✓ Dynamic cable layout respecting the applicable standards for the local site conditions

WAVEC IMPLEMENTATION
✓ Definition of cable characteristics, based on an internal database of commercially available subsea components
✓ Compute the optimal layout using an in-house numerical tool developed to maximize the cable lifetime

PROJECT OUTCOMES
✓ Optimal dynamic cable layout respecting the standard limit states (ULS, FLS), cable/mooring clash and marine growth
✓ The 1st commercial application of our in-house cable layout optimization tool

In-house cable design tool application on a representative FOWT (not the one delivered in this study)
WINDFLOAT ATLANTIC VIANA DO CASTELO, PORTUGAL

CLIENT CHALLENGES
- First array and pre-commercial project of the technology
- The Environmental Impact Assessment (EIA) and monitoring of the first park

WAVEC IMPLEMENTATION
- Input to the EIA regarding the effects on marine biodiversity
- Environmental monitoring planning (water quality, seabirds, marine mammals and structures colonization)
- Baseline environmental monitoring (reference conditions)
- Public outreach
- Consenting Due Diligences

PROJECT OUTCOMES
- Environmental license approval of the first Floating offshore wind farm project in continental Europe.
CLIENT CHALLENGES

✓ An analysis of alternatives for offshore wind support structures
✓ The Environmental Impact Assessment of the pilot project

WAVEC IMPLEMENTATION

✓ Comparison of offshore wind support structures from an environmental and technical point of view.
✓ Environmental impacts identification and evaluation, mitigation measures and monitoring activities planning

PROJECT OUTCOMES

✓ Input for informed decision on the best support structures;
✓ Environmental license approval of the first Offshore Wind Pilot project in Brazil (ongoing)
TECHNICAL SUPPORT TO TENDER AND CONSTRUCTION OF THE WINDFLOAT ATLANTIC EXPORT CABLE

CLIENT CHALLENGES
✓ 1st subsea asset owned by REN (subsea cable and connector).
✓ Need for expertise on the specific requirements for construction and installation of a submarine power cable.
✓ Challenging interfaces within the project (e.g. dynamic/export cable).

WAVEC IMPLEMENTATION
✓ Specify Tender main requirements, referring to standards and best practices.
✓ Tender evaluation and risk analysis.
✓ Technical design reviews of specific components (e.g. first 66kV dry-mate connector) and main installation procedures.
✓ Provide site support during several project phases.

PROJECT OUTCOMES
✓ Guarantee that the client requirements were met, throughout the engineering, procurement and construction stages.
PRE-FEED STUDIES FOR A 1.2GW FIXED OFFSHORE WIND FARM IN THE BALTIC SEA

CLIENT CHALLENGES

✓ Request to analyse the different farm layouts and impact of different design choices.
✓ Access to updated economic data.

WAVEC IMPLEMENTATION

✓ Impact of turbine size on construction logistics
✓ O&M Ports and logistics analysis for different maintenance strategies
✓ Metocean conditions and Site accessibility
✓ O&M strategy development
✓ Cost model inputs for Construction and O&M

PROJECT OUTCOMES

✓ Feasibility assessment of several project variants.
WAY FORWARD

FUTURE PATHWAYS:

- SUPPORT LCOE REDUCTION ON OFFSHORE WIND
- BE PART OF THE OFFSHORE WIND COMMERCIAL IMPLEMENTATION
- PUSHING THE STATE OF THE ART WITH R&D
- AS A PREFERRED PARTNER & SERVICE PROVIDER

- OPTIMIZATION OF LOGISTICS & MARINE OPERATIONS
- COMBINATION WITH OTHER ENERGY VECTORS SUCH AS HYDROGEN AND O&G
- RISK REDUCTION STRATEGIES & ASSET MANAGEMENT
- LEVERAGING ON R&D OUTCOMES
- ANTICIPATING INDUSTRY OPPORTUNITIES & CHALLENGES
- CUSTOMER ORIENTED R&D
- SUPPORTING VARIOUS OFFSHORE WIND TECHNOLOGIES
Paulo Chainho
*Project Engineer*
WavEC Offshore Renewables
E-mail: paulo@wavec.org
[www.wavec.org](http://www.wavec.org)