FIBREGY

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952966.

# Development, engineering, production and life-cycle management of improved FIBRE-based material solutions for structure and functional components of large offshore wind enerGY and tidal power platform

# An introduction to FIBREGY

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# SUMMARY


- FIBREGY's main goal is to enable the extensive use of FRP materials in the structure of the next generation of large offshore platforms .
- The project will develop and qualify FRP materials for offshore applications, elaborate new design procedures and guidelines, generate efficient production, monitoring methodologies, and validate and demonstrate advanced software analysis tools.
- To ensure the industrial relevance of the project outcomes, the different activities will be focused on two promising offshore energy concepts, which will be re-engineered.
- The different technologies to be developed in FIBREGY will be demonstrated by using advanced simulation techniques and building a real-scale prototype.
- Different LCA studies will be carried out to evaluate the impact of the proposed options.


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**8.0 M€**

**TOTAL BUDGET**

**12** **PARTNERS FROM 7 COUNTRIES**

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# CONSORTIUM

- Concept developers:
  - ENEROCEN and TIDETEC
- FRP shipyards:
  - IXBLUE and TUCO
- Classification society:
  - BV
- Research centers:
  - ULIM, INEGI and CIMNE
- Engineering offices:
  - TSI, COMPASSIS
- Dry painting solutions:
  - CORSO
- Association of plastics industry:
  - AVK

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# W2POWER

- W2POWER is a twin semi-submergible platform concept developed by ENEROCEAN.
- It enables a rated of 12 MW on one simple floating platform.
- W2POWER is currently one of the most advanced multi wind turbine designs, and the only one with a 1/6 prototype already deployed at the Canary Islands.
- It is also one of the most promising, with an expected LCoE reduction versus conventional semisubmersible wind turbines of 20%, according to the conclusions of the DEMOWIND project.

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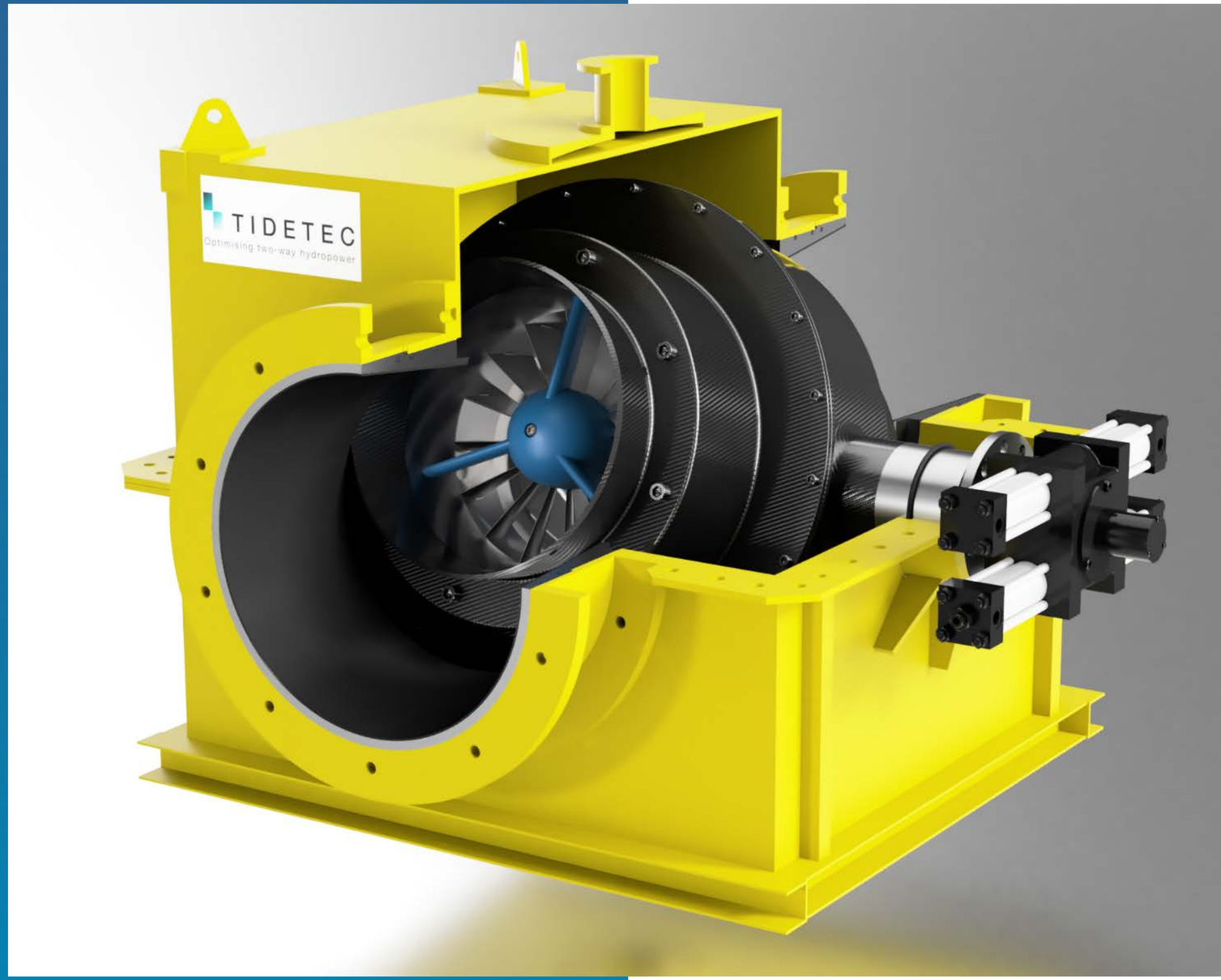
# TIDETEC’s tidal turbine

- TIDETEC’s tidal power generator is likely to be the most cost effective technology to harness tidal power.
- The rotating turret is the core of the TIDETEC’s concept, enabling optimal bi-directional functionality (compared to standard technology that only utilizes 60% of streams flowing back)
- Furthermore, the cost of the complete 20 MW turbine will not be larger than the systems planned today. The increase in the turret cost (10%) is balanced out due to the simpler turbine design.
- TIDETEC’s LCoE estimate for its current technology are within the range of 45-75 €/MWh.



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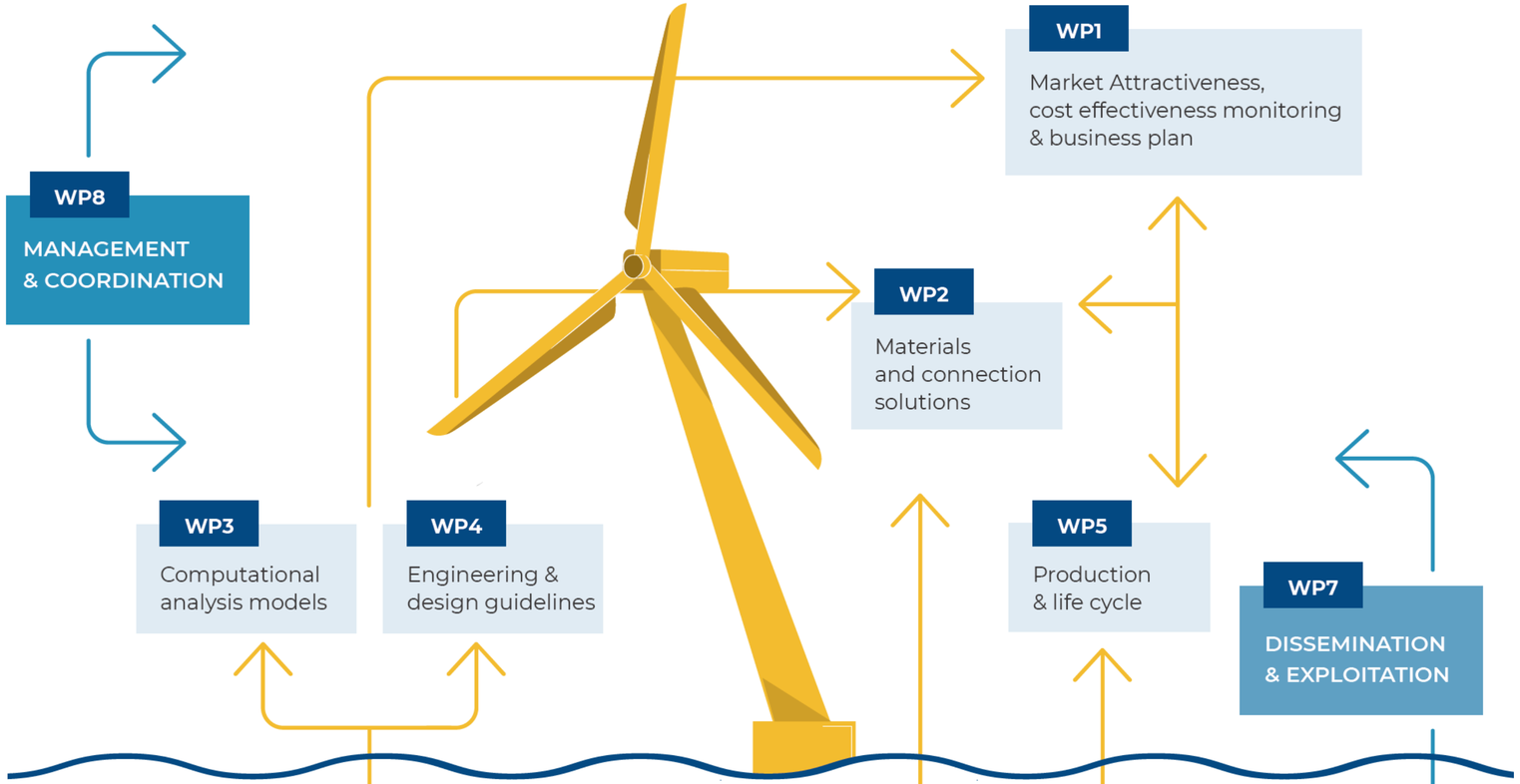
# Workplan



**WP1**
Market Attractiveness, cost effectiveness monitoring & business plan

**WP2**
Materials and connection solutions

**WP3**
Computational analysis models

**WP4**
Engineering & design guidelines

**WP5**
Production & life cycle

**WP7**
DISSEMINATION & EXPLOITATION

**WP8**
MANAGEMENT & COORDINATION

**WP6**
Three-tier validation & demonstration

Mid-large scale experimental campaign

Strength and fatigue experimental campaign

Real scale demonstrator

Start date: 1/1/2021
Duration: 36 months

2021 2022 2023 2024

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# Main achievements so far …

**WP1**
- Market analysis and qualitative benefits / Cost-benefit analysis

**WP2**
- Catalogue of FRP materials (selection and experimental data)
- Fatigue performance of composites (experimental data) **PUBLIC**
- Environmental protection of composites (experimental data of dry coatings) **PUBLIC**
- Connections (analysis and multi-criteria matrix tool) **PUBLIC**

**WP3**
- Fatigue assessment criteria for FRP structures and computational model
- Aero-hydro-servo-elastic solver for multi-wind turbines
- Structural digital twin model

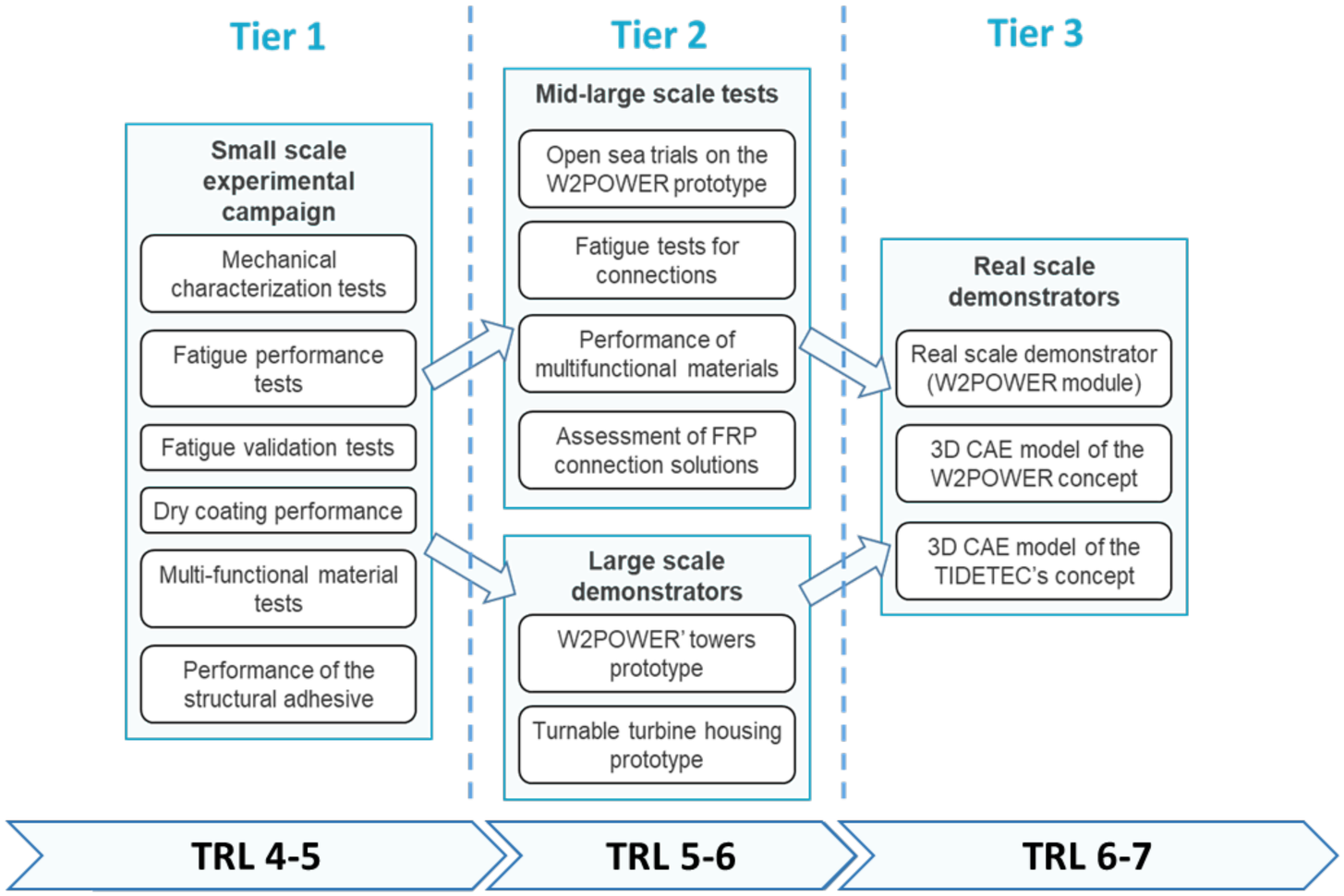
**WP4**
- Critical review of applicable standards and gaps identification **PUBLIC**
- W2Power redesign in FRP
- Turnable Tidal Turbine design in FRP

**WP5**
- Design and workplan for manufacturing the different demonstrators

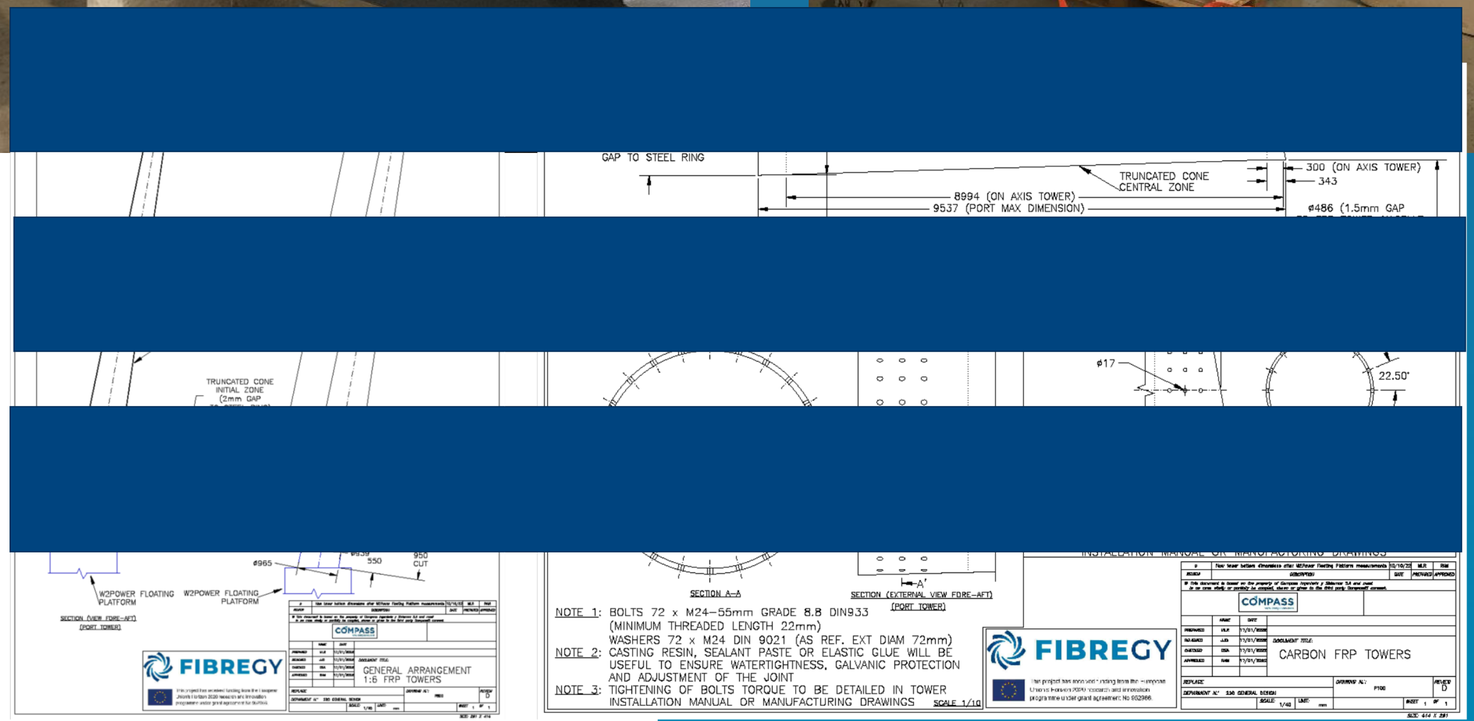
**WP6**
- Middle scale test on dry coatings and connections (experimental data) **PUBLIC**
- Construction of the W2Power tower demonstrator

# Validation and Demonstration plan

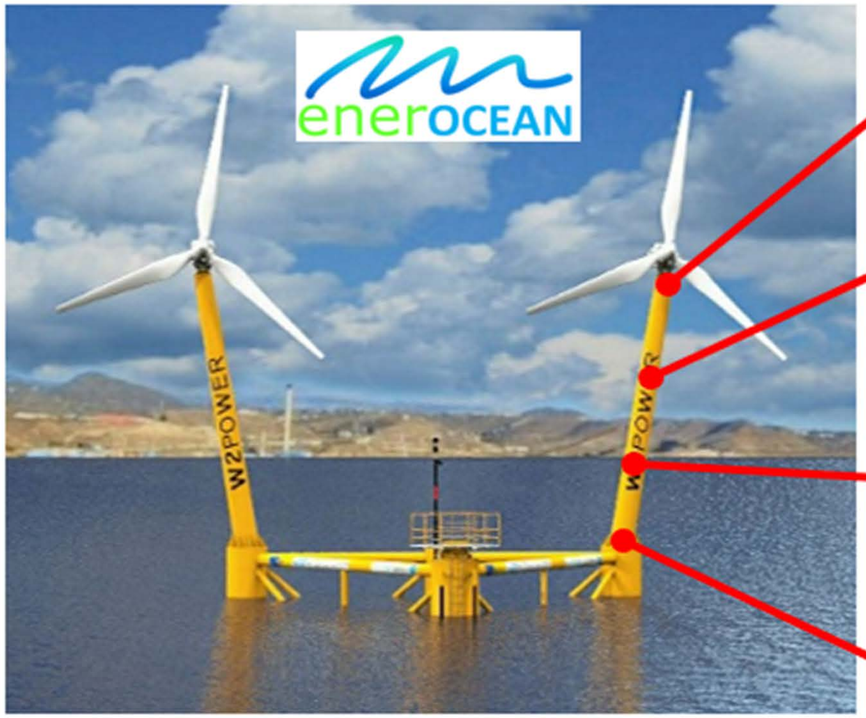
- FIBREGY has conceived an extensive three-tier testing, validation and demonstration plan, which includes a comprehensive ‘coupon level’ and mid-scale experimental campaign, the testing of different large-scale prototypes and the building of a real-scale demonstrator.
- The validation and demonstration plan of FIBREGY will ensure that a TRL 6-7 is achieved by the end of the project

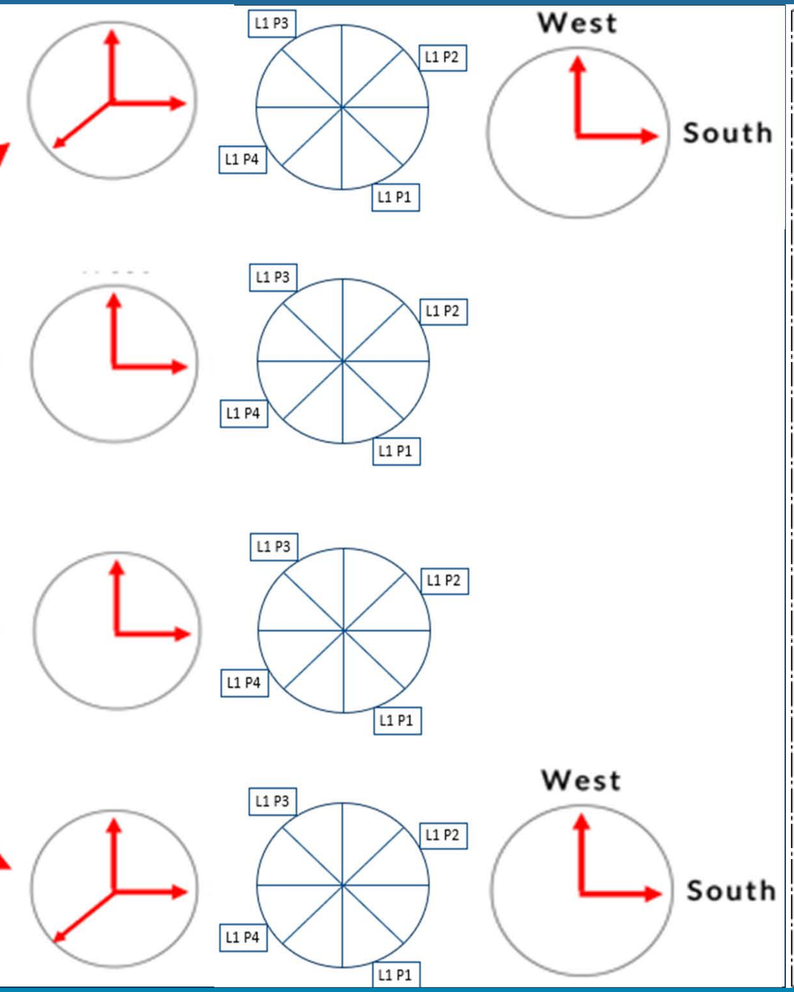


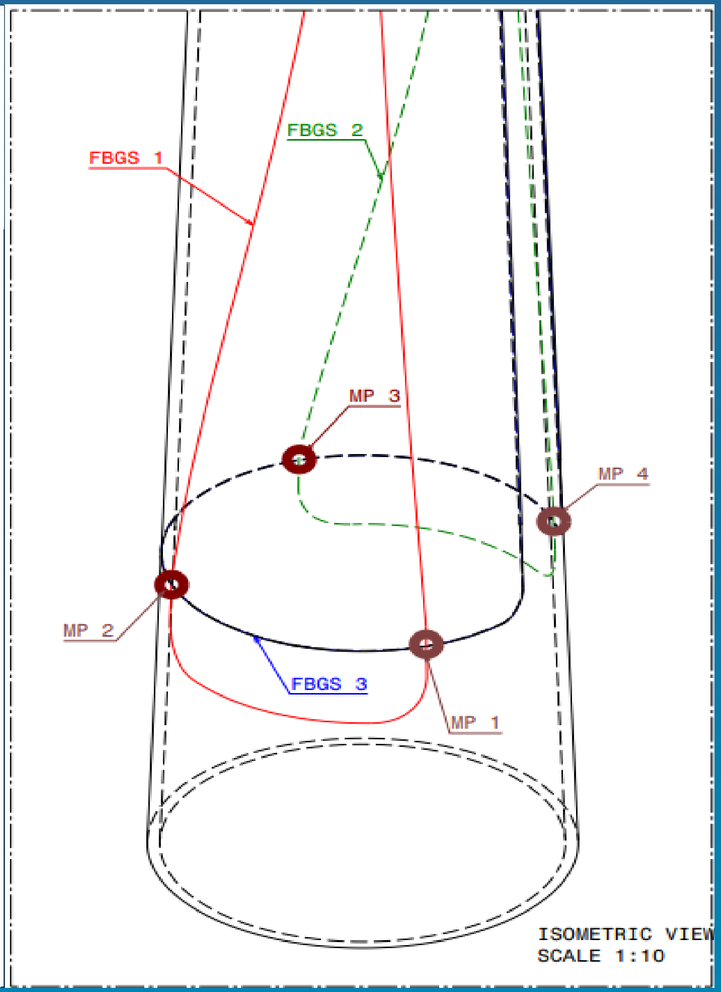
# FIBREGY's Demonstrators: W2POWER's carbon towers


# FIBREGY's Demonstrators: W2POWER's towers SHM



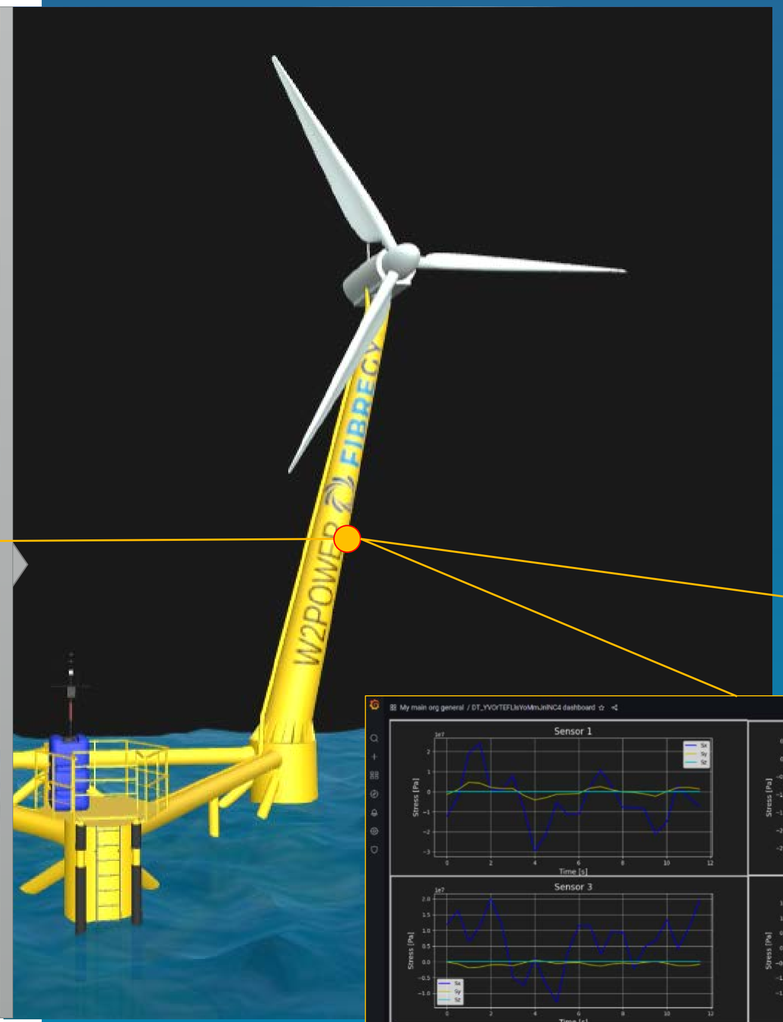

Triaxial / monoaxial accelerómeters

Strain gauges

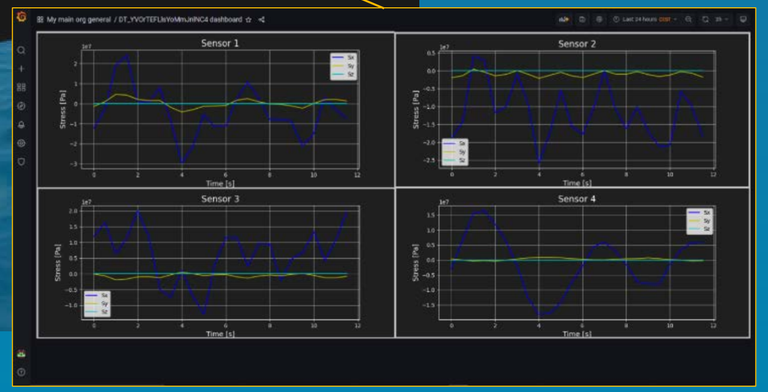
Inclinómeters

Embedded Fibre Optic Sensors (strain)

# FIBREGY's Demonstrators: W2POWER's digital twin and sea trials

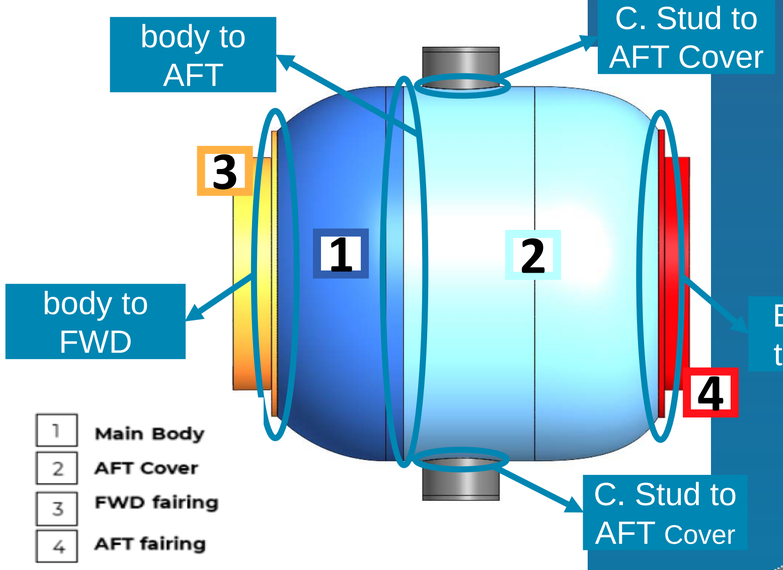

- Digital twin based on aero-servo-hydro-elastic model
  - Rotor (aero-elastic) + rotor & drivetrain dynamics + control + power generation (OpenFAST)
  - Mooring (linear)
  - Tower (elastic + fatigue)
  - Substructure (hydro-elastic + fatigue)
  - Seakeeping (radiation-diffraction) + dynamics (SeaFEM)
- IoT platform (OSI4IOT) integrating digital twin + monitoring data + weather forecast
- Sea-trials (3 months) planned for the coming months

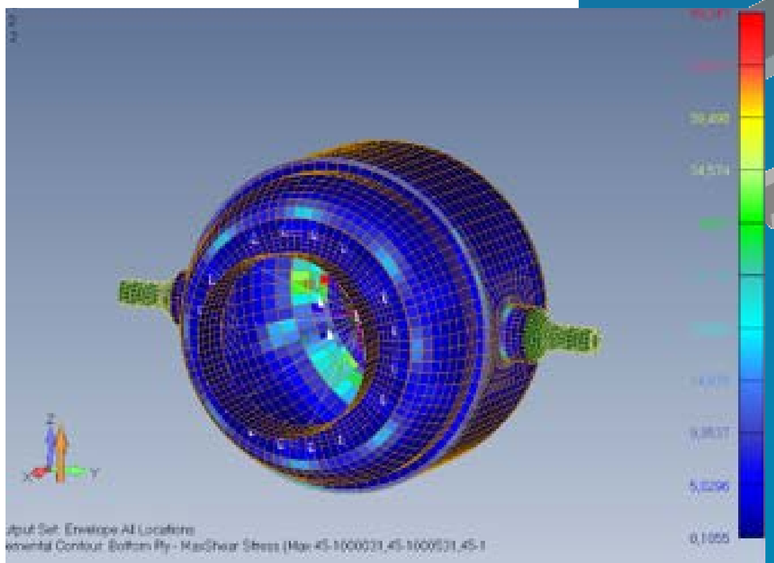


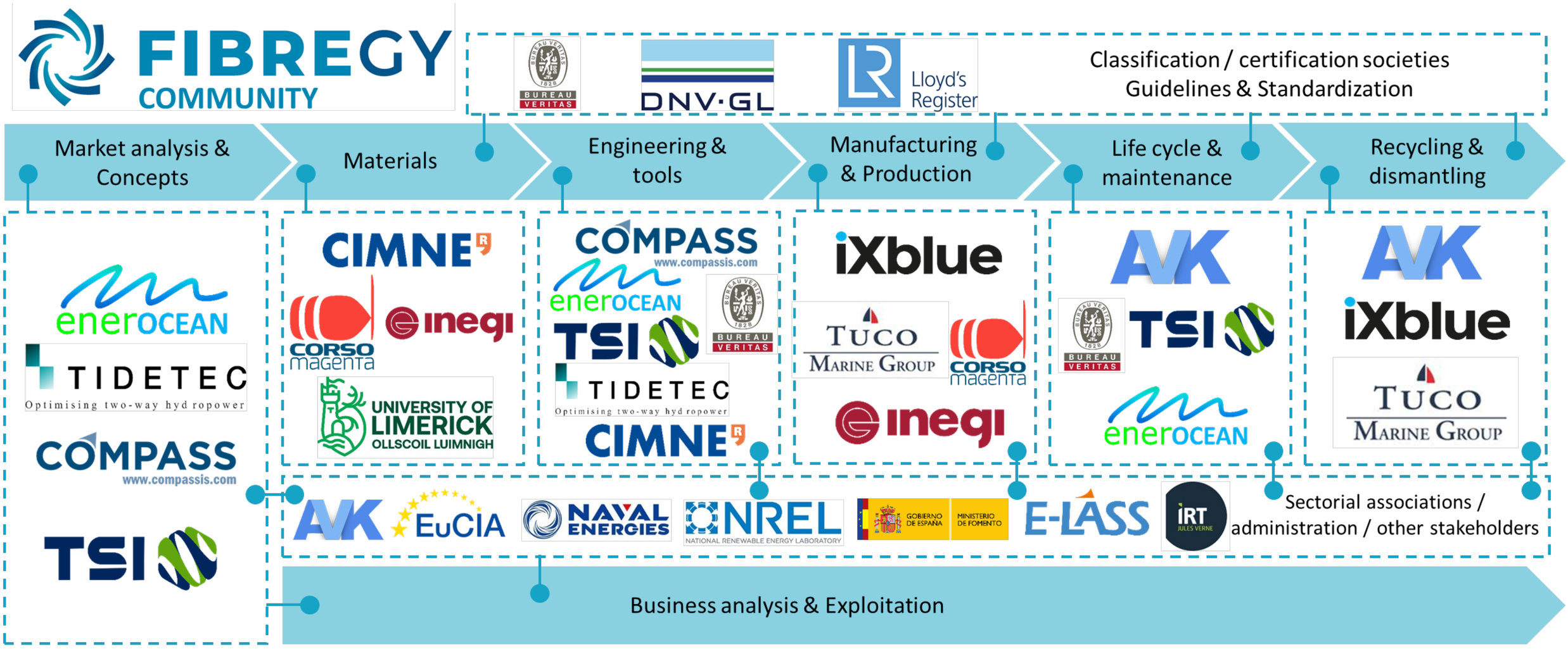

# FIBREGY's Demonstrators: W2POWER's column (real scale)


**It will be presented at an event in La Ciotat (France) in September 2023**

# FIBREGY's Demonstrators: TIDETEC's turbine FRP housing

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COMMUNITY
Classification / certification societies
Guidelines & Standardization
Market analysis & Concepts
Materials
Engineering & tools
Manufacturing & Production
Life cycle & maintenance
Recycling & dismantling
Business analysis & Exploitation
Sectorial associations / administration / other stakeholders

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# EXPECTED IMPACT

**Current technology: baseline**

**Two of the most promising concepts**

**Research on high performance/cost ratio FRP materials**

**Re-engineering and optimization of the two targeted platforms**

**Development of advanced pred. maintenance solutions**

**Innovative production and building technologies**

| | |
|---|---|
| OPEX REDUCTION<br><br>**GOAL ~30%** | → Increase of reliability.<br>→ Increase of fatigue life.<br>→ Immunity to corrosion.<br>→ Improved fouling release.<br>→ Advanced predictive maintenance. |
| INCREASE OF OPERATING LIFE<br><br>**GOAL >0,5%** | → Increase of fatigue life.<br>→ Immunity to corrosion.<br>→ Advanced predictive maintenance.<br>→ Improved seakeeping.<br>→ Reduced overhauling time. |
| REDUCTION OF ENVIRONMENTAL IMPACT<br><br>**GOAL >35%** | → Higher efficiency.<br>→ Lower equivalent GHG emissions.<br>→ Increase of platform lifespan.<br>→ Use of advanced dry coatings.<br>→ Higher recyclability rate. |

# LCoE REDUCTION

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# THANKS FOR YOU ATTENTION