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# An Introduction to FIBREGY project

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# FIBREGY

# SOME FACTS

**FIBREGY**
*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*

**CALL**: H2020-LC-NMBP-31-2020
**INTRUMENT**: Innovation Action

**STARTING DATE**: 01/01/2021
**PROJECT DURATION**: 36 mos.

**8.0 M€**
**TOTAL BUDGET**

**6.5 M€**
**MAX GRANT AMOUNT**

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

**> 40**
**RESEARCHERS**

**> 900 PM**
**TOTAL EFFORT**

**80%**
**OF TOTAL EFFORT DEVOTED TO ENGINEERING, DEVELOPMENT, BUILDING AND TESTING**

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# CONSORTIUM

The FIBREGY consortium includes relevant developers of OWTP concepts (ENEROCEN and TIDETEC), specialized FRP shipyards like (IXBLUE and TUCO), a reference classification society (BV), prestigious research organizations selected according to their expertise and experimental capabilities (ULIM, INEGI and CIMNE), two engineering offices with complementary expertise in offshore engineering, CAE software and monitoring solutions (TSI and COMPASSIS), a company specialized in the design and manufacturing of flexible paint films and coatings with integrated technological functions (CORSO) and a EU association representing the interests of more than 250 producers and processors of reinforced plastics/composites (AVK).

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# MOTIVATION

- The open sea is a very aggressive environment, which largely affect the maintenance costs of installations.
- A massive amount of steel goes into offshore assets, which explains why corrosion accounts for approximately 60% of offshore maintenance costs.
- Despite the convenient immunity to corrosion and superior fatigue performance of FRP, none of the structures of the Floating Offshore Wind Turbine concepts that have reached a high TRL are based on FRP.
- If we look at the field of tidal power generators, the use of FRP materials for rotor blades is common  but, with rare exceptions , the platform structure -the major cost item- is made of steel.
- Reasons: lack of design and assessment (certification) guidelines, different technology gaps that have to be filled to demonstrate the full feasibility of using FRP materials in the offshore industry, prove a significant lower life cycle reduction.

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# OBJECTIVES (1 / 2)

- The overall objective of the FIBREGY project is to enable the extensive use of FRP materials in the structure of the next generation of large Offshore Wind and Tidal Power platforms.
- **OBJ 1.** To develop multi-functional FRP material solutions for the structure and the main components of large offshore wind energy and tidal power platforms.
- **OBJ 2.** To research into advanced manufacturing technologies for large structures and functional components of OWTP platforms.
- **OBJ 3.** To re-engineer two existing OWTP concepts, which has been selected as the most promising solutions from the market uptake point of view.

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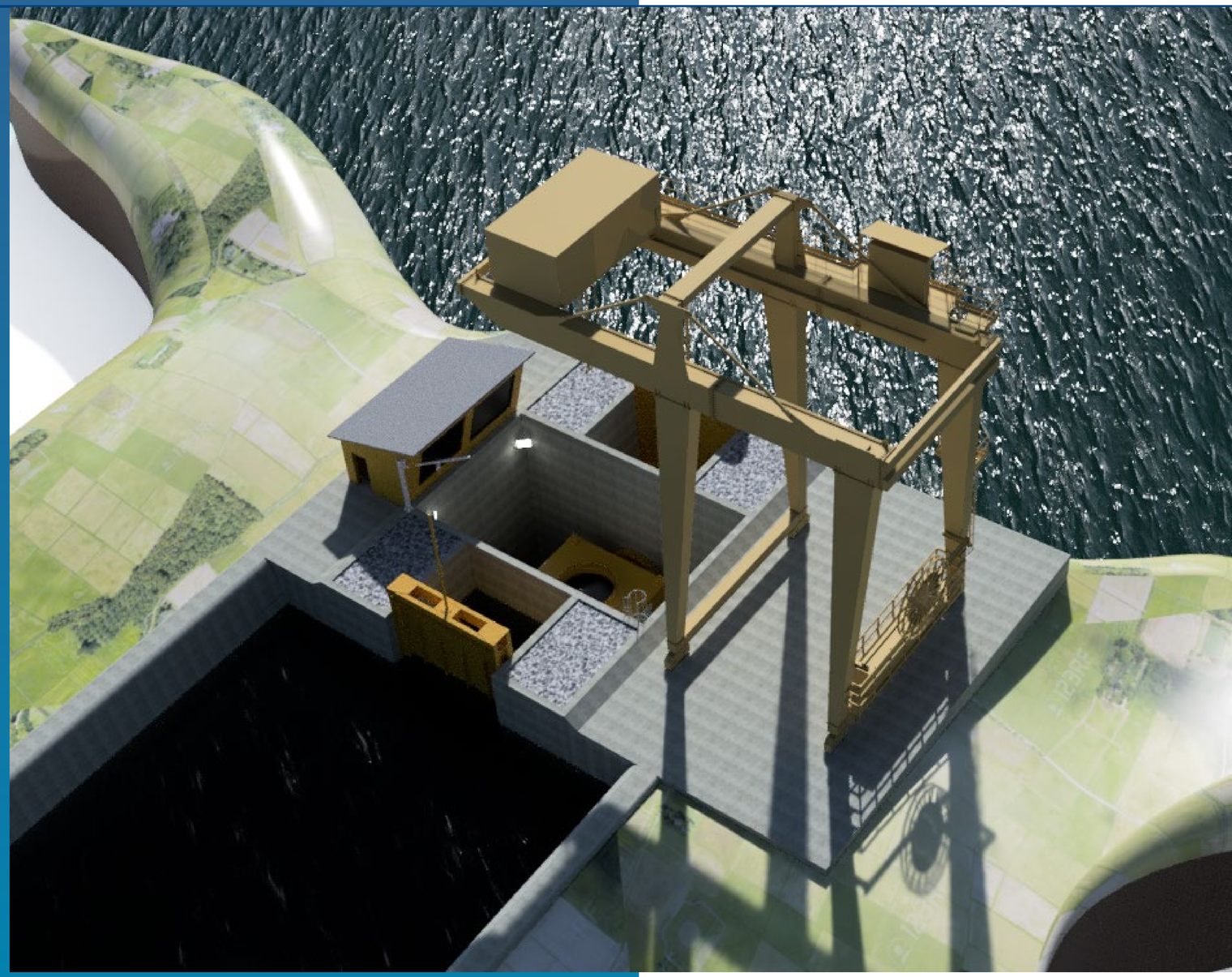
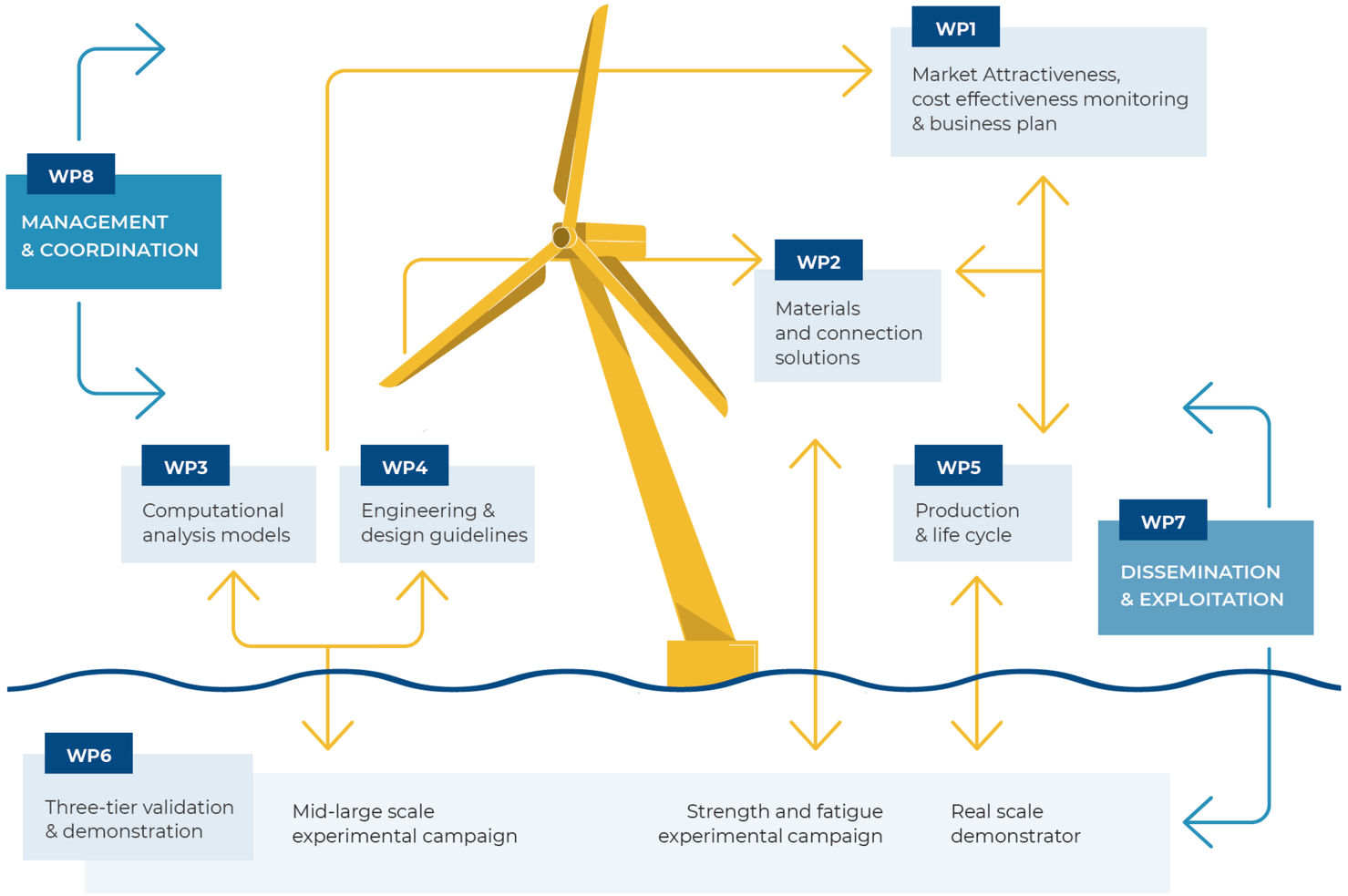
# OBJECTIVES (2 / 2)

- **OBJ 4.** To develop, validate, and demonstrate advanced engineering models for the prediction of material degradation, assessing the lifespan strength performance and for real time assessment of the structural health of large FRP-based OWTP platforms.
- **OBJ 5.** To generate new design, performance criteria and production guidelines..
- **OBJ 6.** To validate, assess, and demonstrate the different developments of the project. .
- **OBJ 7.** To develop a realistic exploitation strategy grounded on the reliability and market value of the solutions to be developed, and their clear positive impact on the LCoE.



# WORKPLAN

- The different objectives of the FIBRESHIP project will be achieved through 6 technical work-packages; market attractiveness, cost-benefit analysis and business plan; fibre-based materials and assembling solutions; Development and validation of computational models; design, engineering and development of guidelines; optimized production procedures; and, technology validation and demonstration.
- To ensure the industrial relevance of the project outcomes, the different activities will be focused on two specific offshore energy concepts, targeted as the most promising for the market uptake: Enerocean's W2Power twin wind turbine platform and Tidetec's turnable tidal turbine.
- Anyhow, the experience acquired throughout the project will be generalized to other concepts.



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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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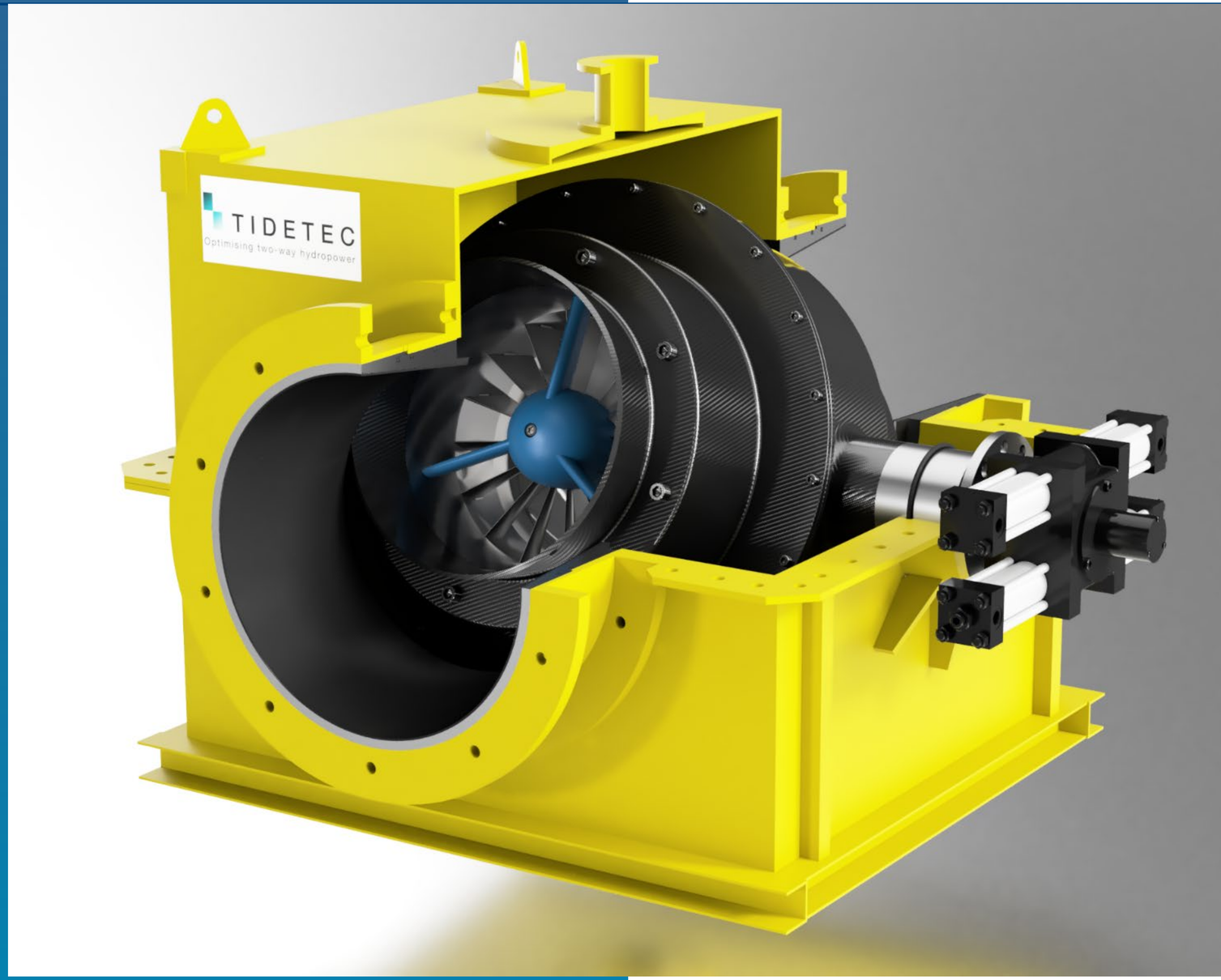
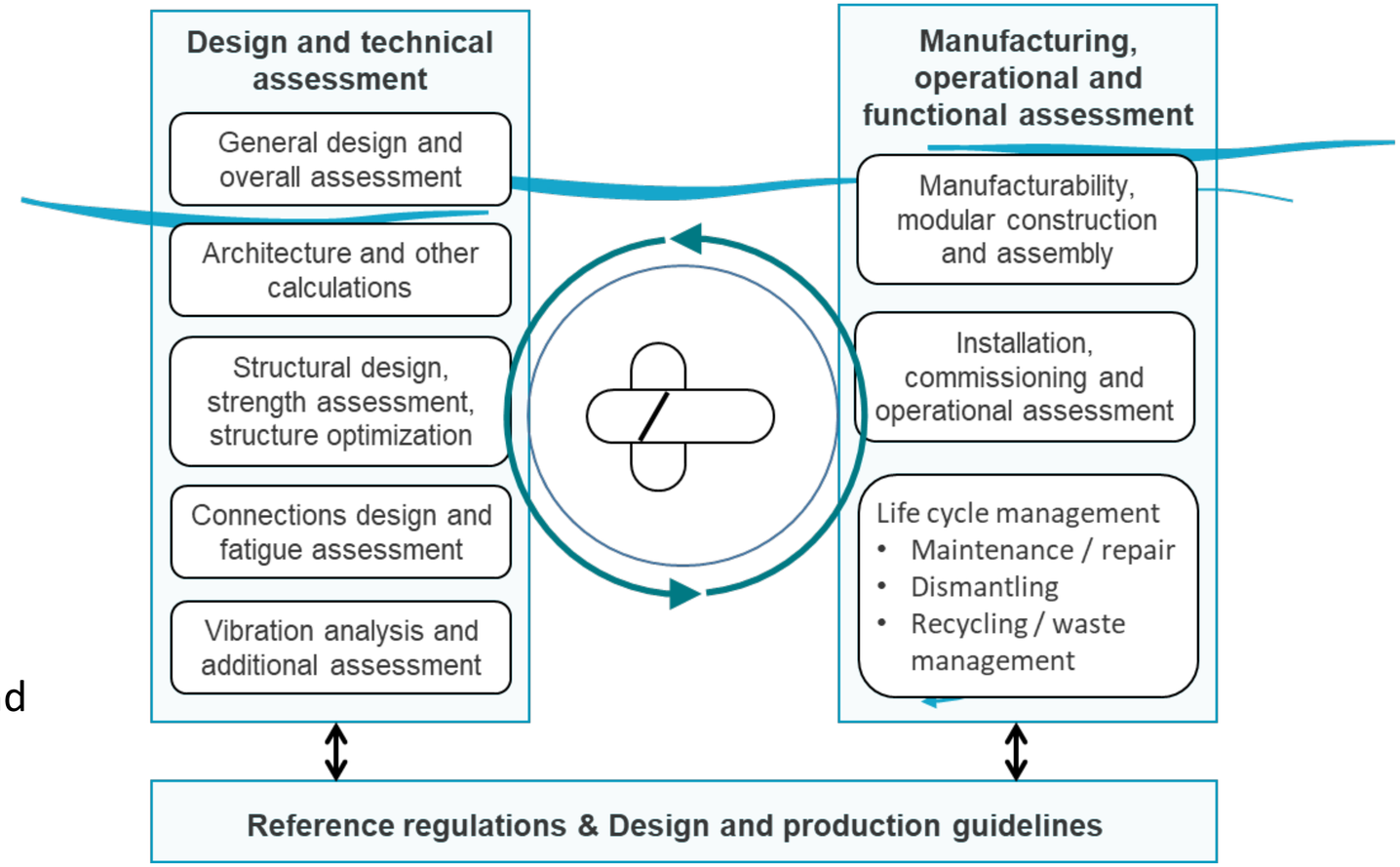
# TIDETEC’s tidal turbine

- 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.



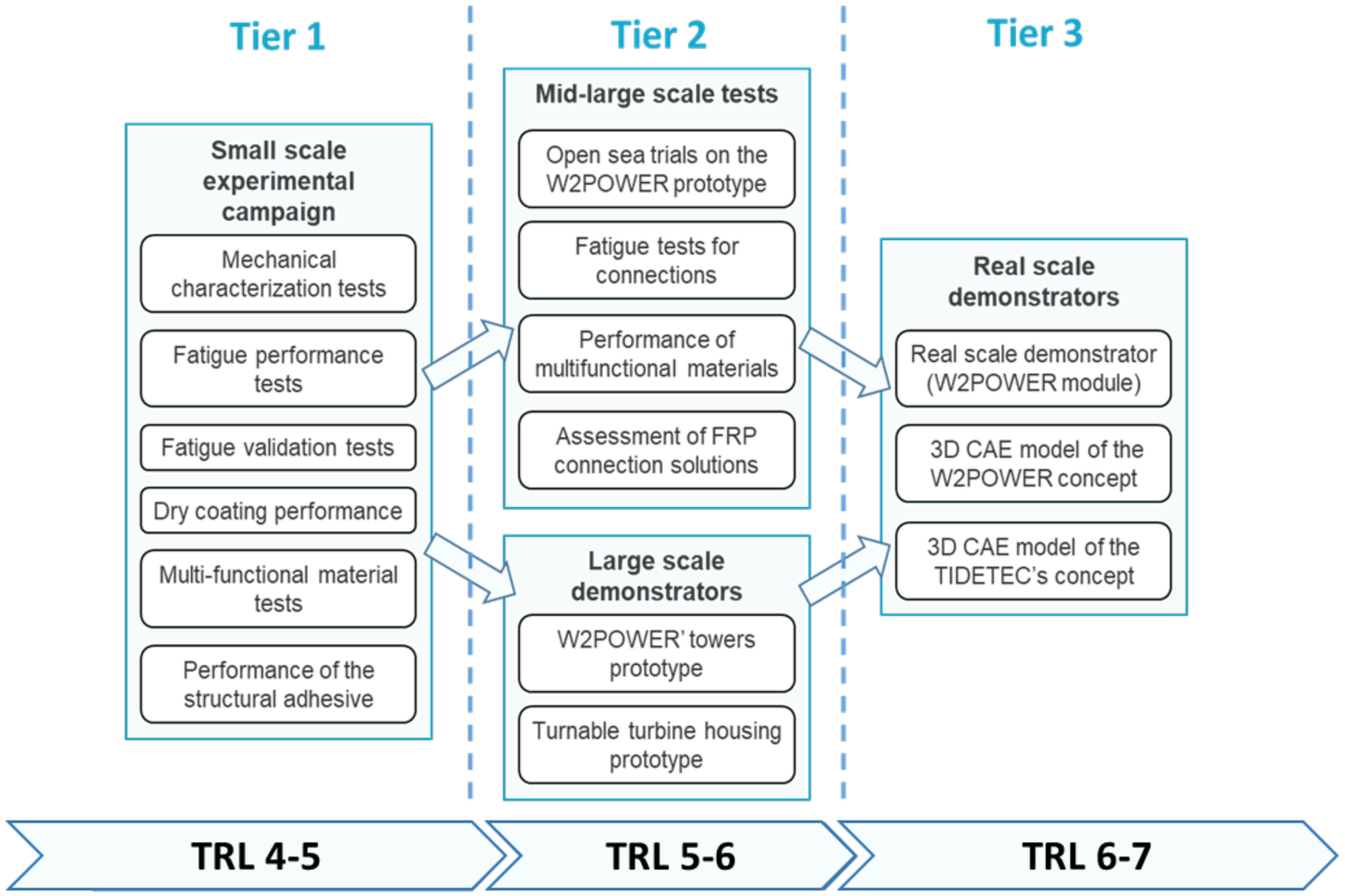
# ENGINEERING METHODOLOGY

- The design / engineering methodology will follow an iterative engineering methodology based on the experience of the engineering companies and the technology developers involved in these activities.
- In every case, the starting point will be a preliminary design, obtained from a direct translation of the steel structure into basic components using strength equivalence criteria, based on the partners' experience.
- The preliminary design will be used to assess some critical design aspects.
- The following iterations of the project development will strive to obtain a rational and optimized design as well as production procedures since those aspects are critical to achieve a significant reduction in the building costs.



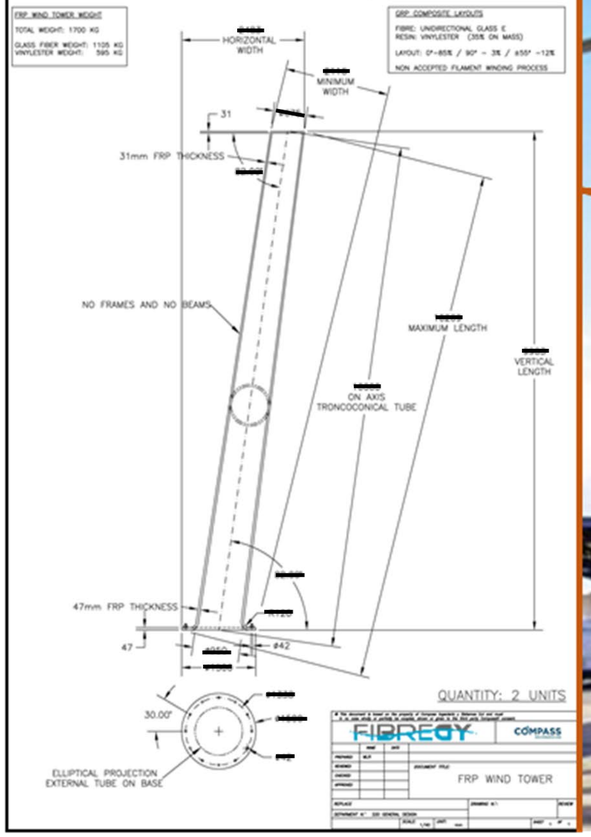
# VALIDATION AND DEMONSTRATION PLAN (1 / 3)

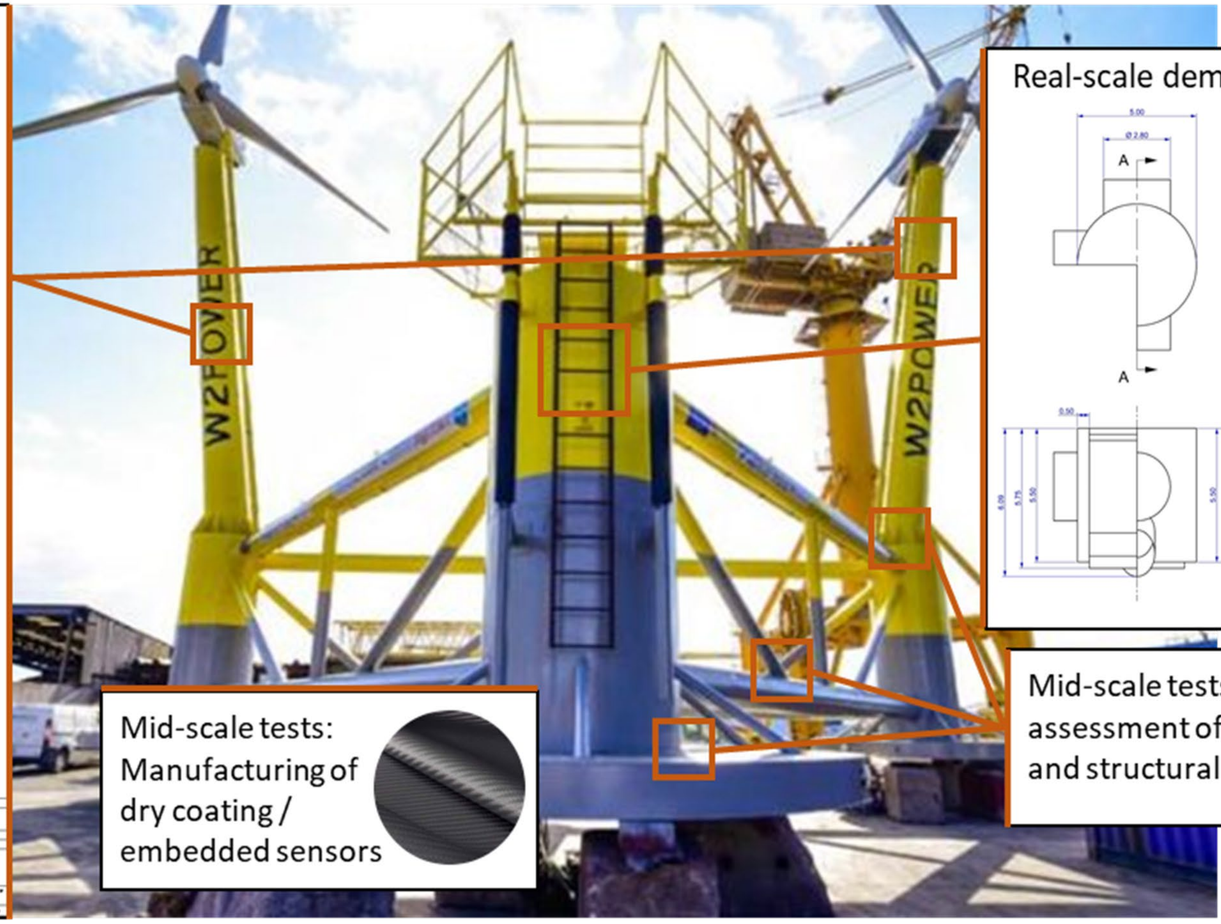
- FIBREGY has conceived an extensive three-tier testing, validation and demonstration plan, which includes a comprehensive ‘coupon level’ and mid-scale experimental campaign, the testing of different large-scale prototypes and the building of a real-scale demonstrator.
- The validation and demonstration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



# VALIDATION AND DEMONSTRATION PLAN (2 / 3)

Large-scale 1:6 demonstrator: Towers
Embeded SHM system / open sea tests

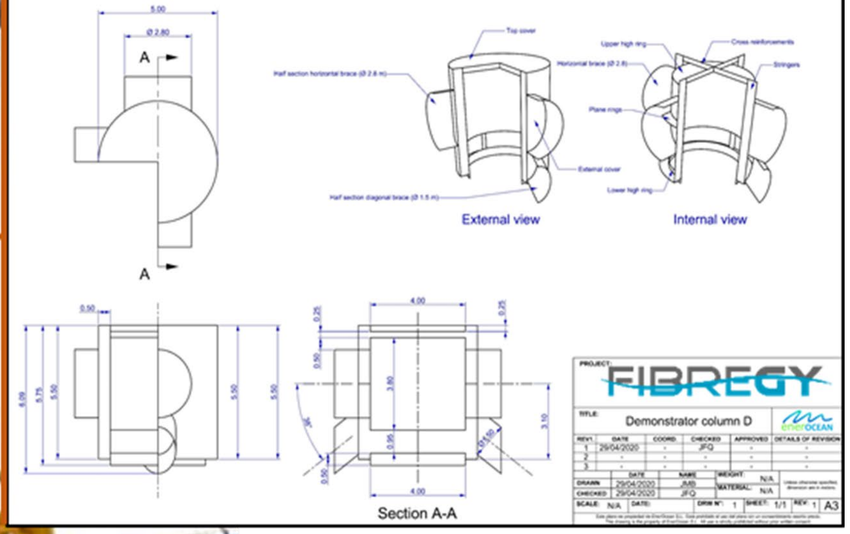


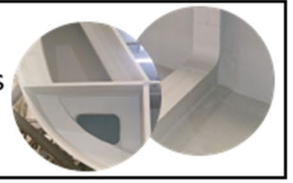

Mid-scale tests:
Manufacturing of
dry coating /
embedded sensors



Real-scale demonstrator: D column module

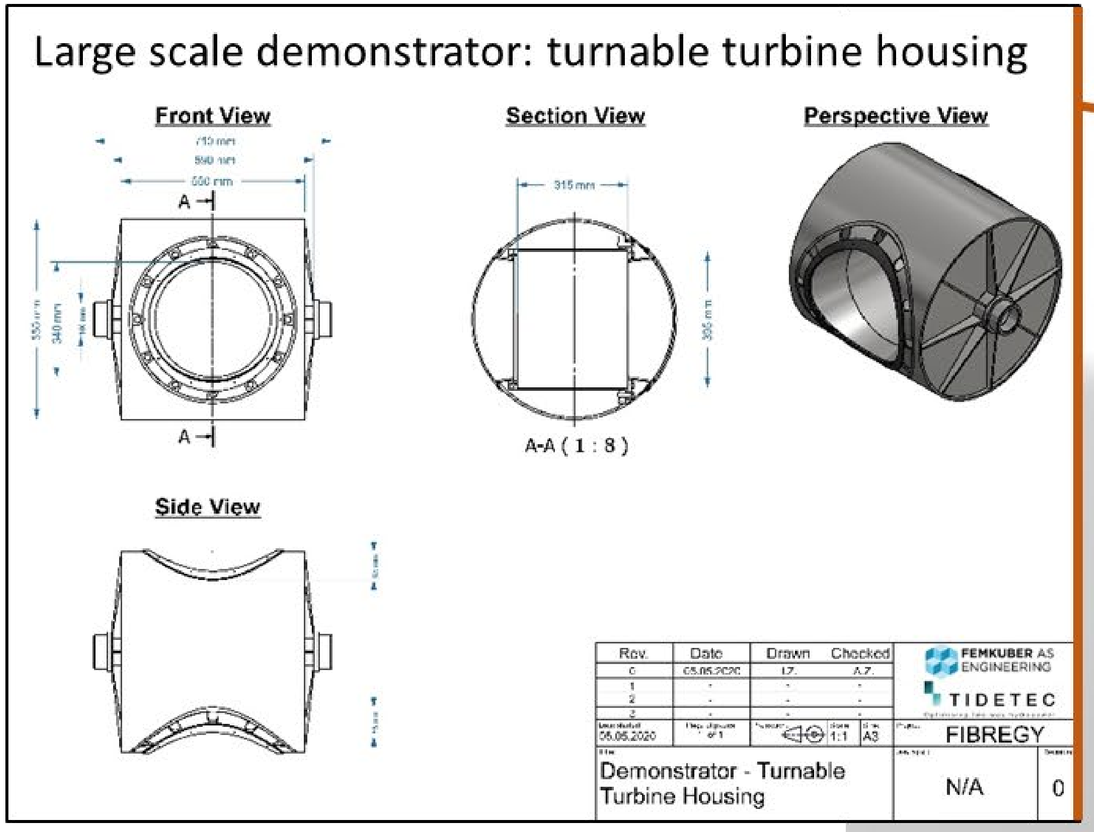


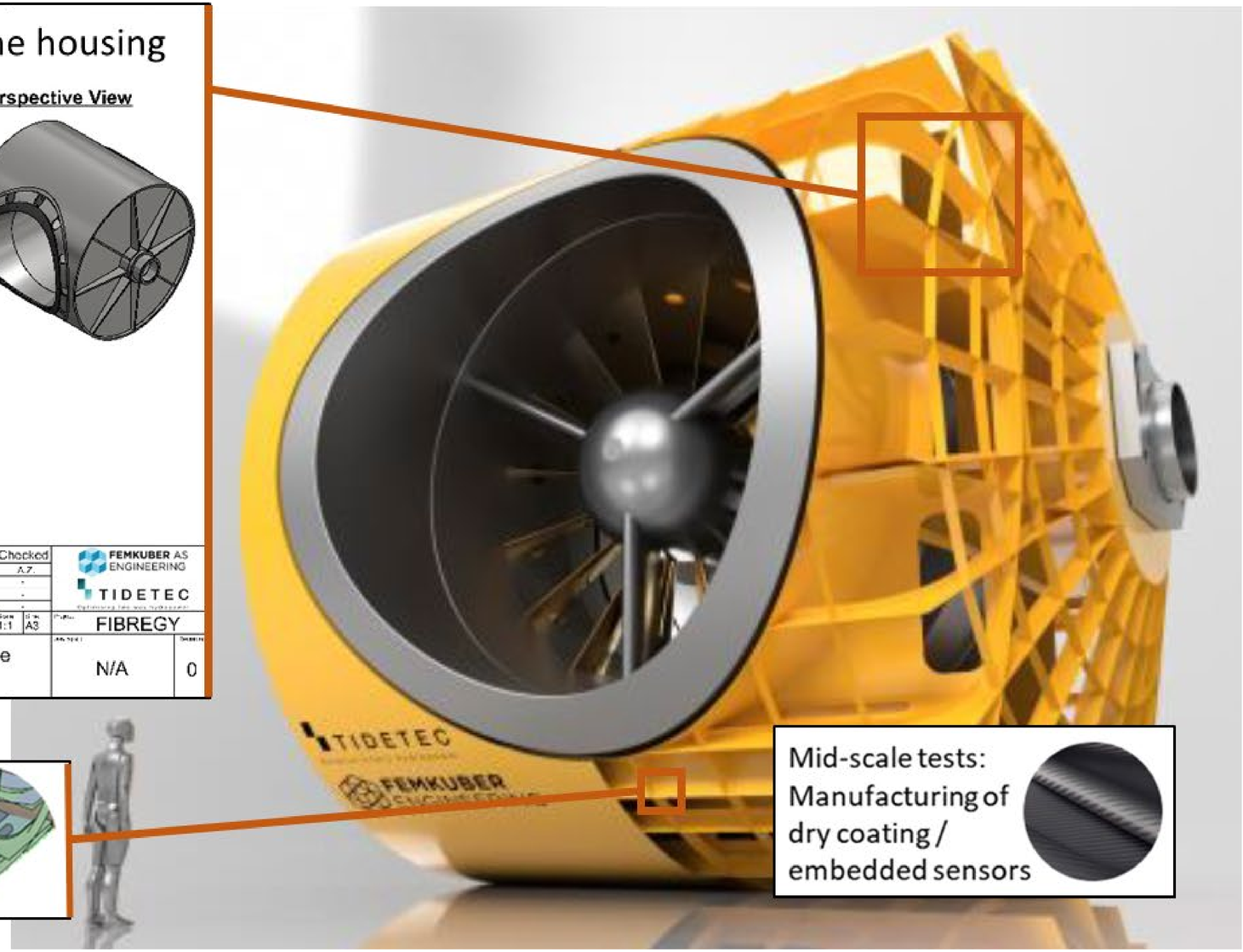

Mid-scale tests: fatigue/strength assessment of connections/hot-spots and structural (reversible) adhesive



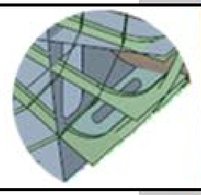
# VALIDATION AND DEMONSTRATION PLAN (3 / 3)

## Large scale demonstrator: turnable turbine housing

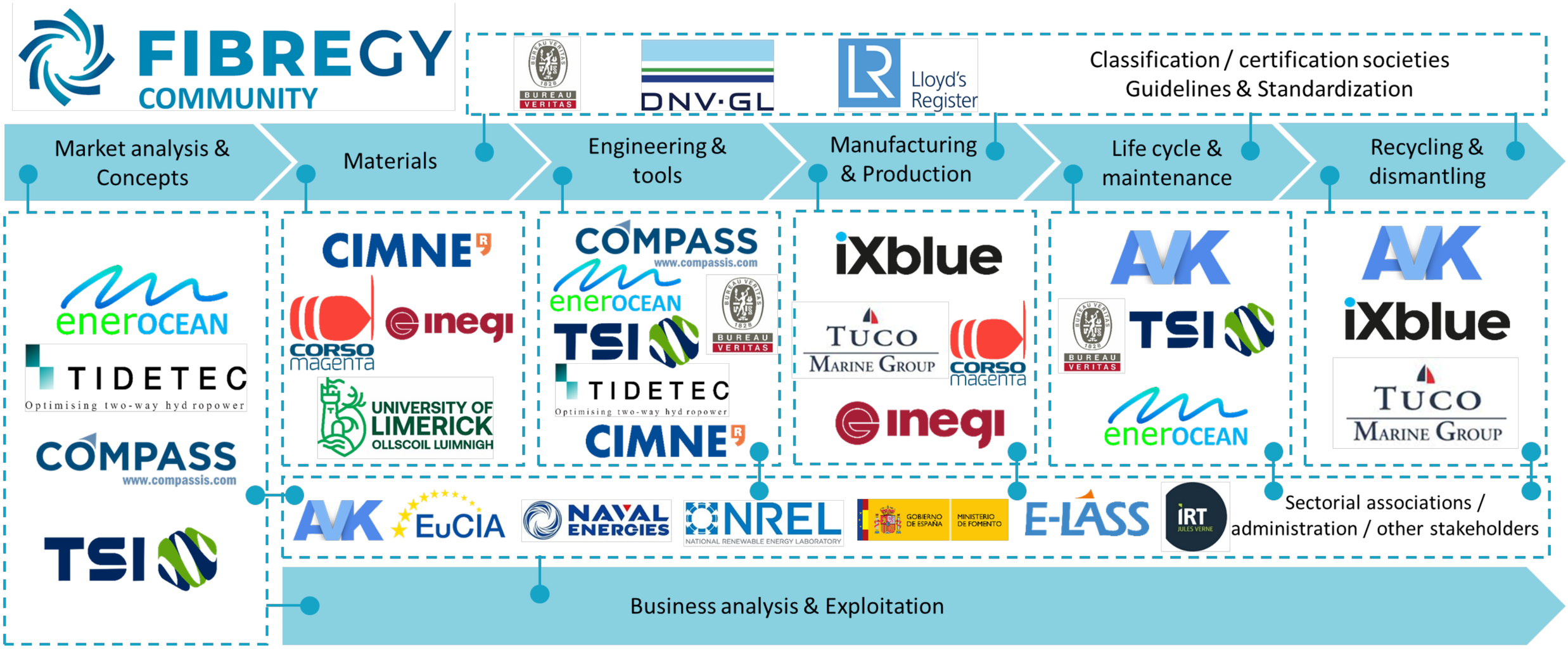



Mid-scale tests: fatigue/strength assessment of connections/hot-spots and structural (reversible) adhesive



Mid-scale tests: Manufacturing of dry coating / embedded sensors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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

# STANDARDIZATION COMMITEE

- One of the objectives of the project is to generate new design, performance criteria and production guidelines for large Offshore Wind and Tidal Power platforms.
- The project experience, acquired in the development of the FRP-based Offshore Wind and Tidal Power (OWTP) concepts, will be translated into a set of design, assessment and production guidelines.
- BV, will lead these tasks, and the outcome will be discussed and reviewed in a Standardization Committee (in which DNV-GL and LR take part).
- Specific workshops (at least one every 6 months) will be organized for this purpose.

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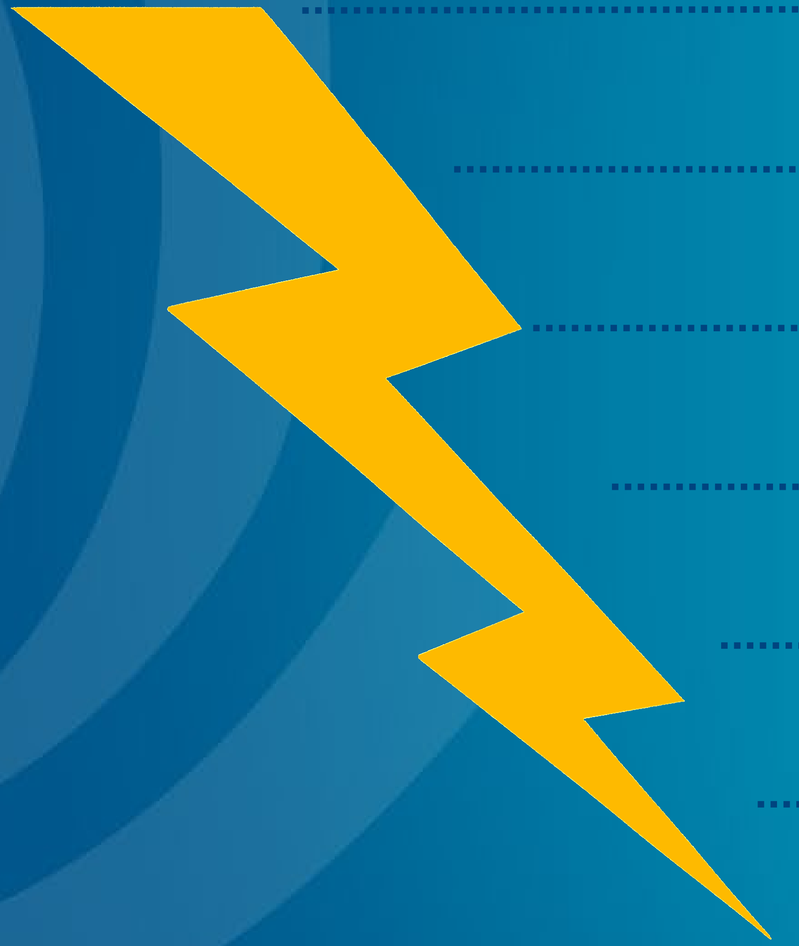
# EXPECTED IMPACT



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

## CAPEX REDUCTION

**GOAL ~10%**

- Reduction of engineering, development and testing time.
- Reduction of the weight of the structure and components.
- Optimized design and manufacturing processes (modular building strategy).
- Readiness of the concepts for serial and automated production.

## OPEX REDUCTION

**GOAL ~30%**

- Increase of reliability.
- Increase of fatigue life.
- Immunity to corrosion.
- Improved fouling release.
- Advanced predictive maintenance.

## INCREASE OF OPERATING LIFE

**GOAL >0,5%**

- Increase of fatigue life.
- Immunity to corrosion.
- Advanced predictive maintenance.
- Improved seakeeping.
- Reduced overhauling time.

## REDUCTION OF ENVIRONMENTAL IMPACT

**GOAL >35%**

- Higher efficiency.
- Lower equivalent GHG emissions.
- Increase of platform lifespan.
- Use of advanced dry coatings.
- Higher recyclability rate.

# LCoE REDUCTION

# COMMUNICATION & DISSEMINATION

- A total of five main open events have been planned during the project execution:
  - Two Information days open to the public (+ specific workshops addressed to the Advisory Board's members): 1 within the first 12 months and 1 within the first 18 months.:
  - Two open-door Industrial days:: One in Madrid or Las Palmas (Spain) within the last 12 months of the project to present the W2POWER's open sea trials and one within the last 6 months of the project to show the demonstrator in La Ciotat (France).
  - A specific session to present the outcome of the project will be organized at the International Conference of Computational Methods in Marine Engineering (MARINE).

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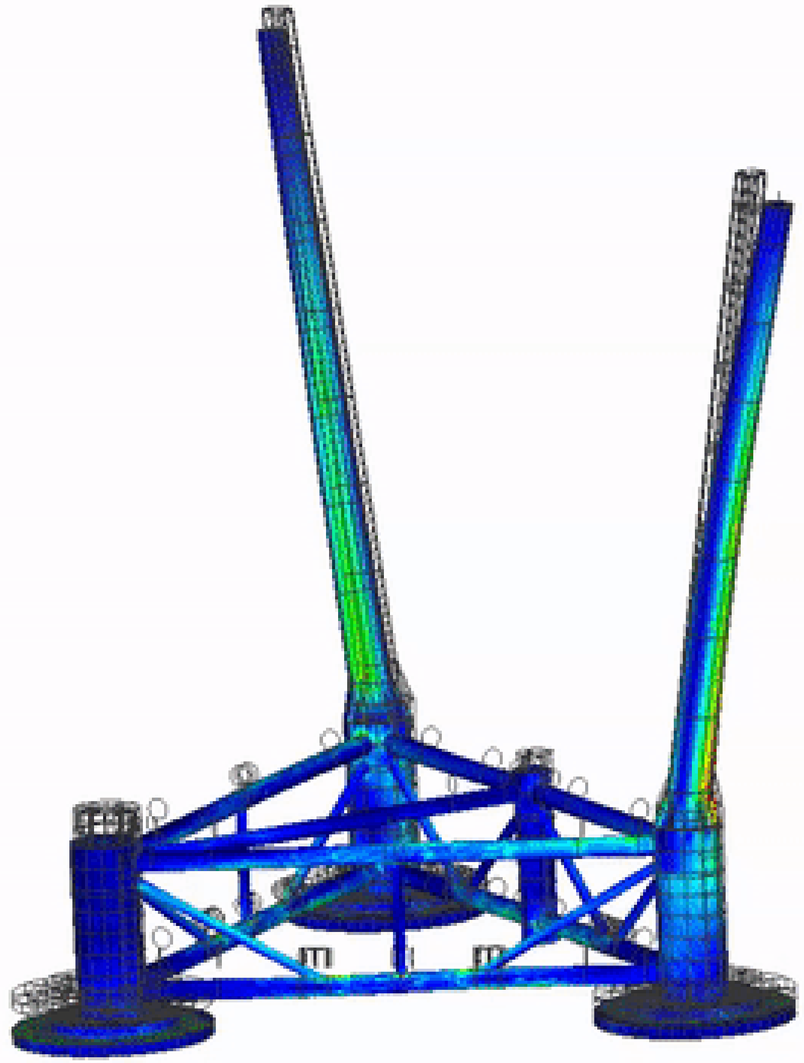
# SUMMARY


- 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 and adapted to the new production methodologies.
- The different technologies to be developed in FIBREGY will be demonstrated by using advanced simulation techniques and building a real-scale prototype.
- Throughout the project, different LCA studies will be carried out to evaluate the impact of the proposed options. Finally, a business plan will be elaborated, to prove the financial viability and economic advantage of the developed solution.

# FURTHER PRESENTATIONS

- Materials/Processes (for the TIDETEC’s turnable turret)
  Rui Marques (INEGI)

- Development and validation  of models for material degradation, strength assessment and structural health monitoring
  Ovidi Casals (Compass IS)

- Design and engineering of two concepts of large Offshore Wind and Tidal Stream platforms (OWTPs)
  Cristóbal García (TSI)

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# THANKS FOR COMING