3. Application of the digital Intelligent operational network architecture to the SATH Technology

Part I – SATH Technology philosophy based on DemoSATH case study

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saitec offshore technologies

Saitec Offshore Technologies

Saitec Offshore Technologies emerges as a spin-off from Saitec Engineering. Our primary emphasis revolves around:

SATH TECHNOLOGY

We started in 2016 focused on developing an innovative and economically efficient technology known as SATH (Swinging Around Twin Hull). An innovative and competitive concrete floating concept for offshore wind turbines suitable for shallow and deep waters (35m depth, onwards).

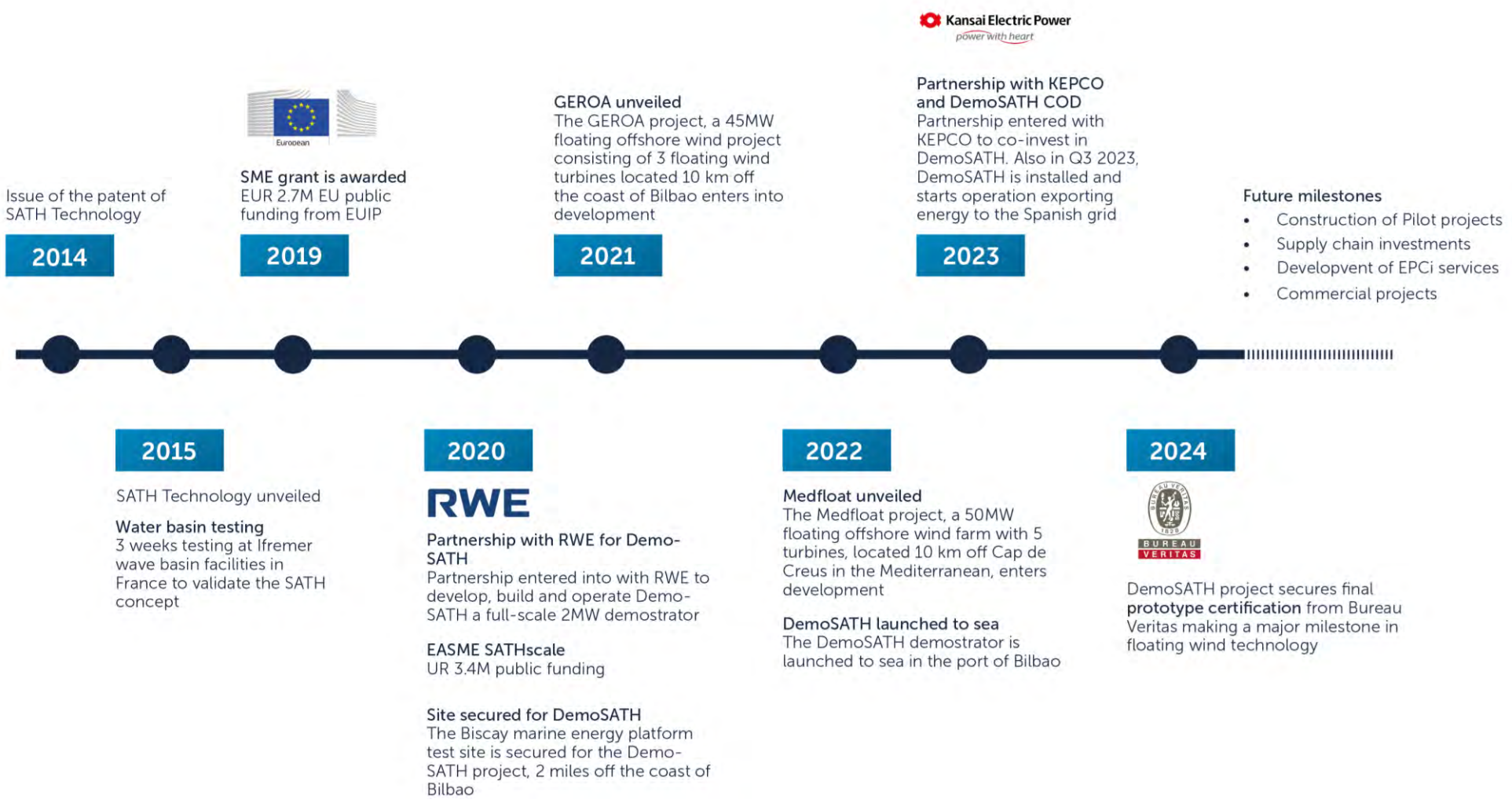
INDUSTRIAL PRODUCTION

Our company is ready to produce SATH platforms, enabling the achievement of energy transition goals through large-scale production and establishment in strategic port locations across the globe. We are ready to deliver turnkey solutions for the floating wind market.

CONSULTANCY SERVICES

In addition, we provide a wide range of engineering services related with the offshore wind. We bring deep knowledge and expertise to provide customized assessment to the floating offshore wind sector and stakeholders. Our approach ensures precise evaluations, empowering you to make informed decisions.

SATH technology development



SATH Technology description

Concrete A durable material that allows CAPEX & OPEX reduction	**Floaters** Its geometry leads to a reduced concrete shell thickness	**Reduced draught** Less than 10.5m, suitable for both shallow and deep waters
Plug & Play solution Easy installation suitable for quick disconnection	**Single point mooring system** The platform can rotate like a weathervane facing the wind	**Meets damaged stability criteria** Internally compartimentalized
Self-Stable Large water plane area, not requiring ballast	**Industrialized construction** Modular pre-cast elements	**Onshore construction & assembly** Reduced investment costs and risks

Saitec starts in 2014 the design of a new type of floating platform to support wind turbines, called SATH® (Swinging Around Twin Hull), using proven technologies already tested in Oil&Gas projects, but adapted to give a satisfactory answer to the challenges related to harvest a natural resource with a different nature and energy intensity such as the wind.

SATH Technology description

1. Floaters geometry

- Two identical horizontal cylindrical elements
- Circular cross section
- Modular pre-cast elements
- Shell structures-of reinforced & post-tensioned concrete
- Self-stable by large water plane area: no ballast required (concrete structure itself lowers center of mass).
- Internally compartmentalized (watertight compartments): damaged stability
- The floaters are linked between them through vertical frames made of reinforced and post-tensioned concrete.

Provide buoyancy and stability

SATH Technology description

2. Heave plate

- Submerged slab
- Stiffened plate of reinforced & post-tensioned concrete
- Connected to floater through beam structures
- Increase natural oscillation periods (hydrodynamic added mass) - pitch and roll out of wave-frequency band
- Hydrodynamic damping: increases for harsher sea states
- Lower center of mass of global system

Reduce dynamic motion response

SATH Technology description

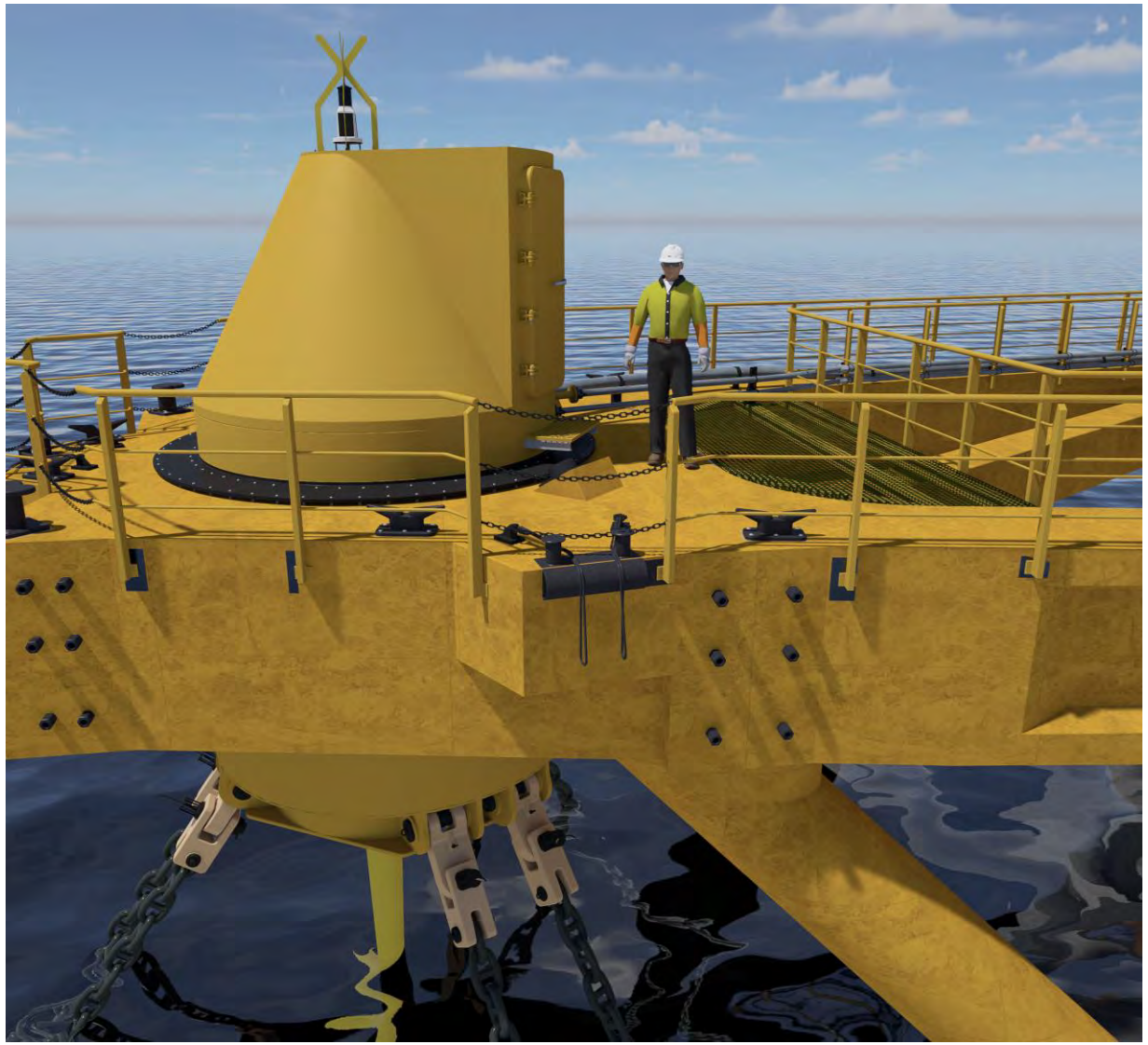
3. Transition piece

- Structural link between floater & tower
- Different shaped depending on tower type, lattice or tubular.
- For tubular tower the transition piece is a hybrid structure of post-tensioned concrete & steel.
- Offset from center to increase weathervaning arm & maintain a horizontal COG (compensate SPM-turret).

Adaptable to any tower

4. Single Point Mooring (SPM)

- Hybrid structure of post-tensioned concrete & steel.
- It is an “external turret” located in the bow of the platform.
- The turret is supported by a cantilevered spatial frame structure
- Slewing bearing to allow weathervaning.
- Weathervane helps turbine yaw-control system and reduces mooring stresses
- External turret: widely used in Oil & Gas with the FPSO´s installations



5. Mooring system design

- Conventional catenary system- Soft system attached to SPM.
- It can consist of 3 or 6 mooring lines (if redundancy criteria is applied).
- Site specific design: chain or fiber rope

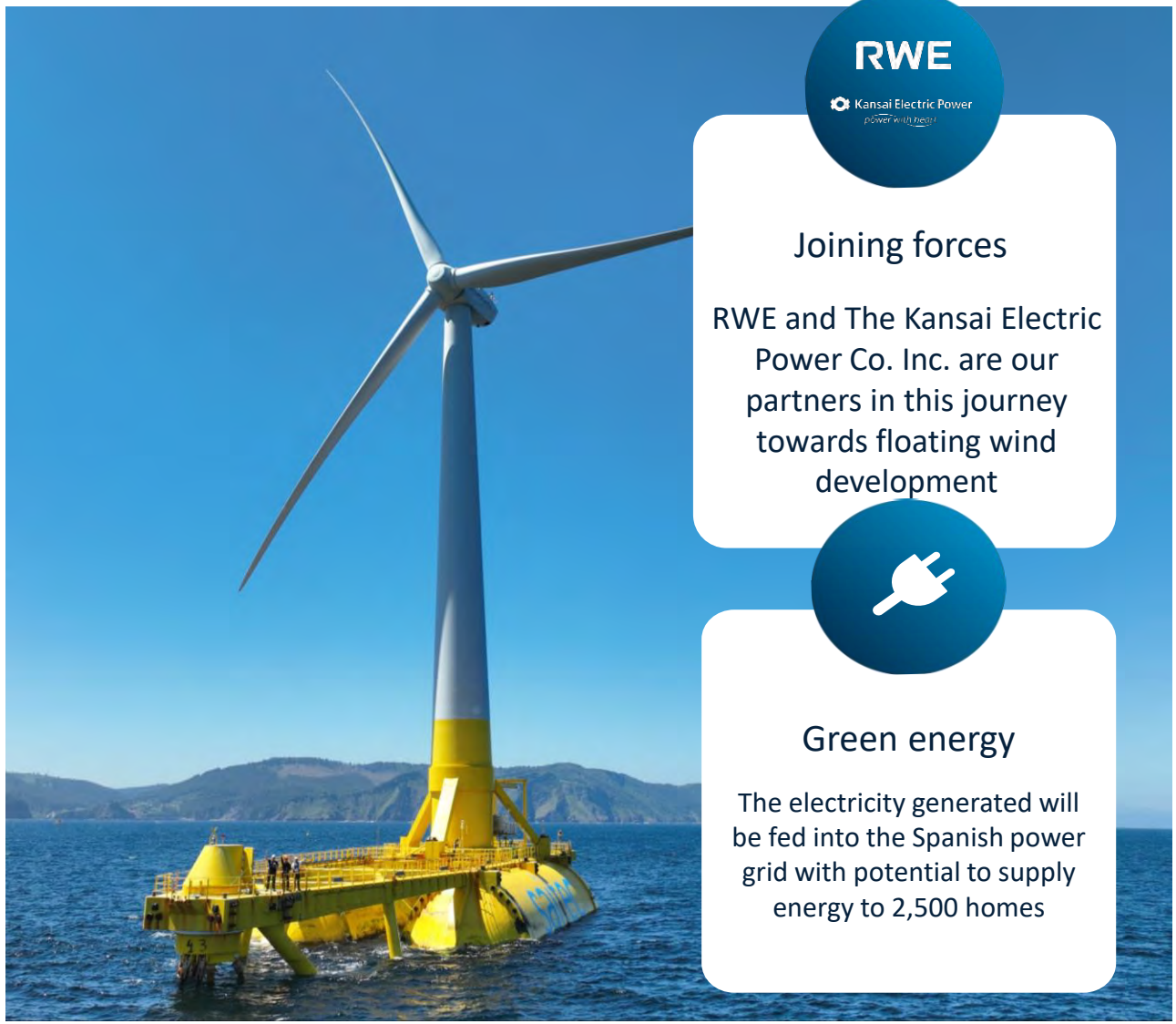
DemoSATH project

1st grid-connected FOWT in Spain

- Turbine: 2 MW wind turbine
- Base of the structure: 30 m. x 64 m.
- Installation: 2 miles off the coast in BIMEP
- Sea deep: 85 m.
- Mooring: Hybrid mooring lines (chains and fibre)

Local supply chain < 25km | 75% of construction budget

BiMEP Biscay Marine Energy Platform · Bilbao PORT · ferrovial construcción · VICINAY marine · GRI · haizea wind · AUXEMA stemmann · prosertek · ORMAZABAL velatia · euskalforging · CMA COMECARAN S.A. · SOVERIN CONTROL · GABOTEK MONTAJES INDUSTRIALES · TAMOIN · SPARBER GROUP



RWE · Kansai Electric Power

Joining forces

RWE and The Kansai Electric Power Co. Inc. are our partners in this journey towards floating wind development

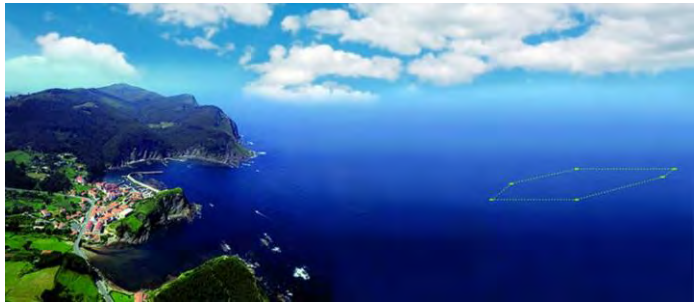
Green energy

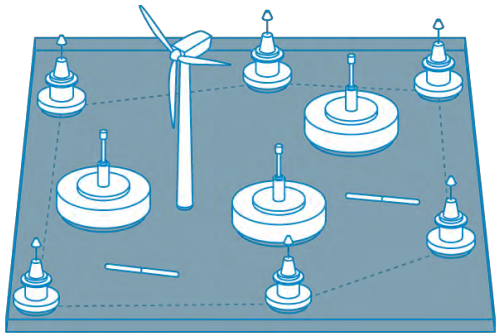
The electricity generated will be fed into the Spanish power grid with potential to supply energy to 2,500 homes

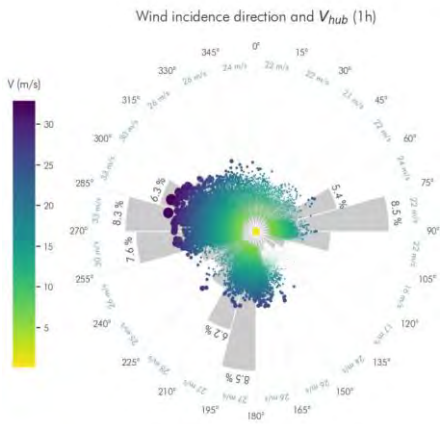
DemoSATH project

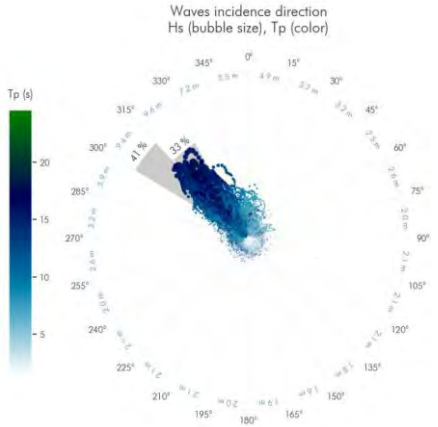
1. Site conditions

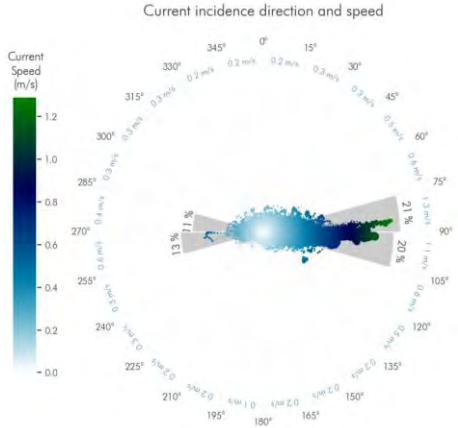
BiMEP Biscay Marine Energy Platform











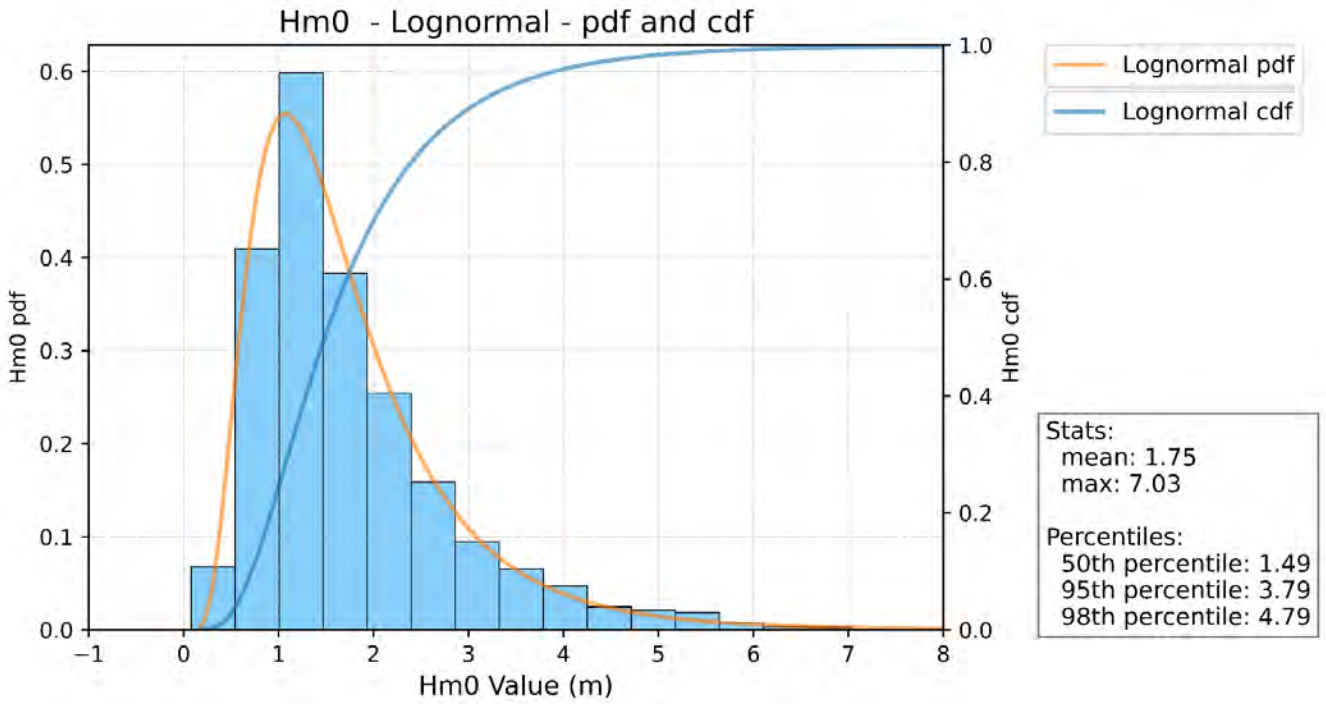
2. Monitoring

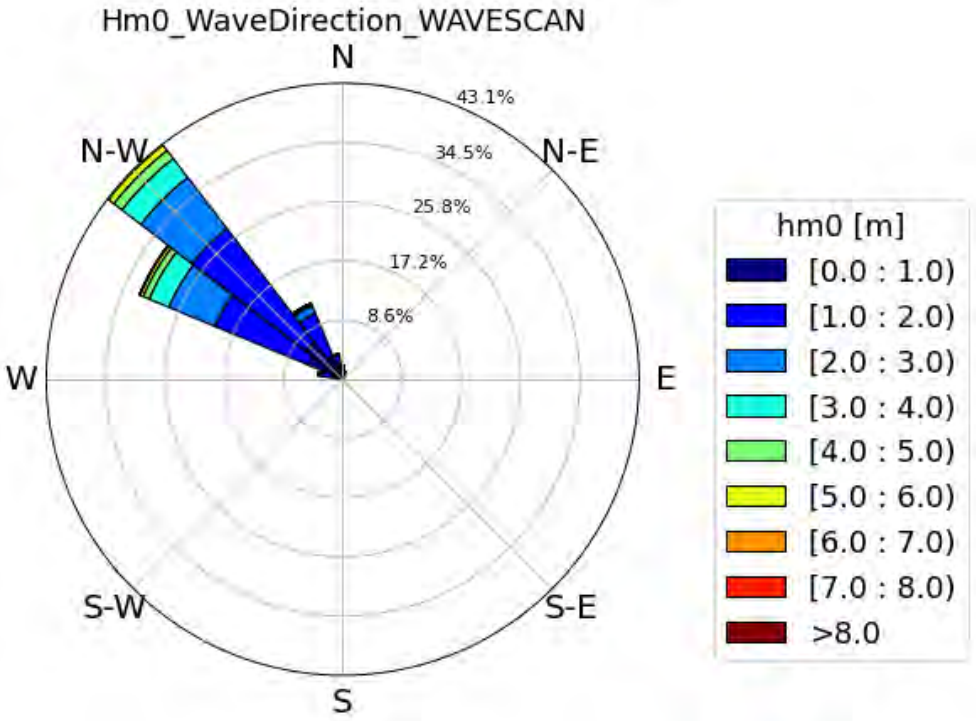
- **Metocean monitoring**
- Wind turbine anemometer, wind vane and nacelle encoder
- LiDAR
- Anteia Wave Buoy (Buoy 38)
- WAVESCAN Buoy (Buoy 34) owned by BiMEP's facilities.
- **Hydrodynamic and global floater behaviour monitoring**
- Dynamic MRU
- Accelerometers (in SPM and WTG)
- **Structural monitoring**
- Strain sensors embedded in the concrete.
- **Mooring system monitoring**
- 6 load pins (one per mooring line)

- **Hulls and SPM status**
- Humidity and temperature sensors
- Swivel has an encoder to measure position, velocity and temperature.
- **Wind turbine and tower monitoring**
- Extensometer technology for Tower Top and Main Shaft.
- FBG technology for blades
- CMS
- **Environmental Impact monitoring**
- DT Bird and DT Bat

DemoSATH – 2023-2024 Performance

3. Environmental conditions after one year of operation





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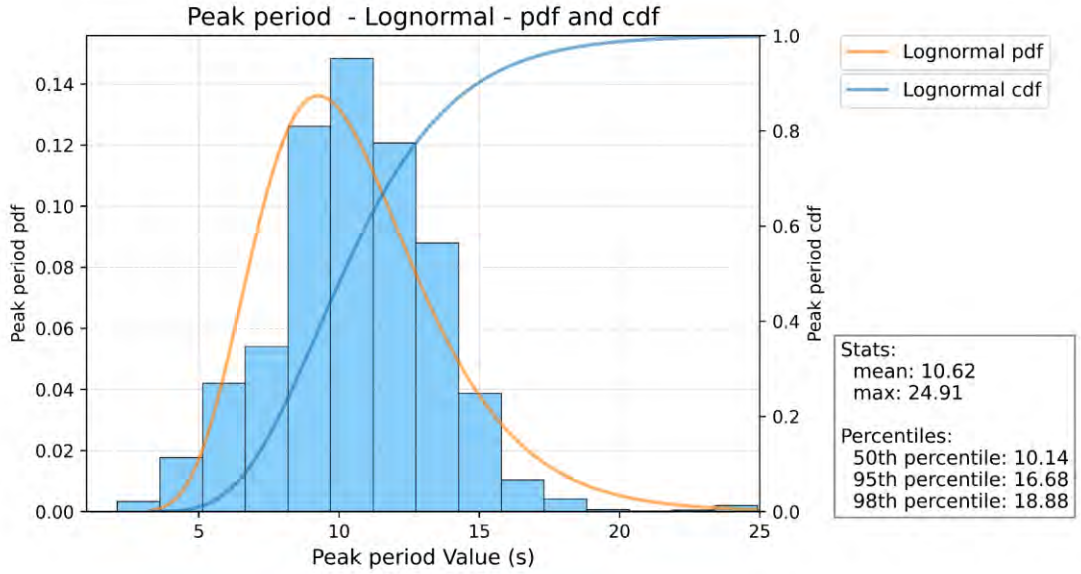

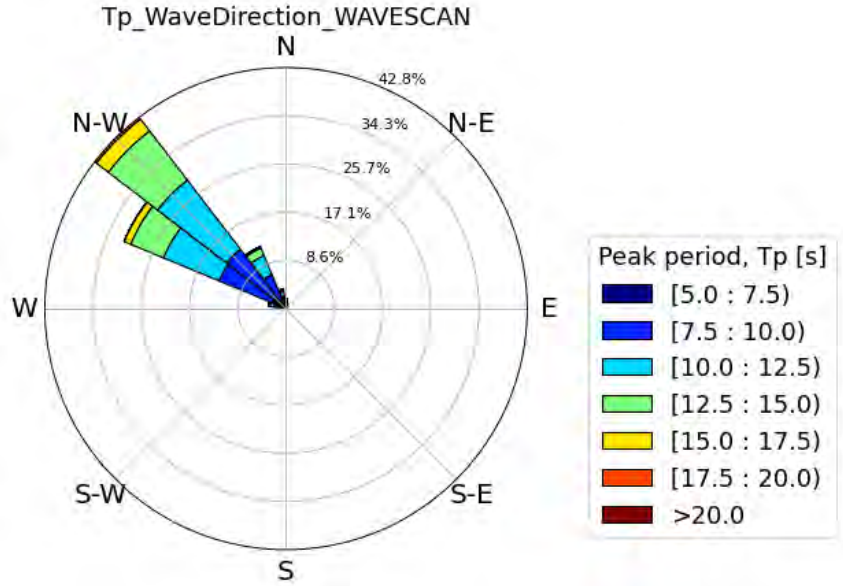

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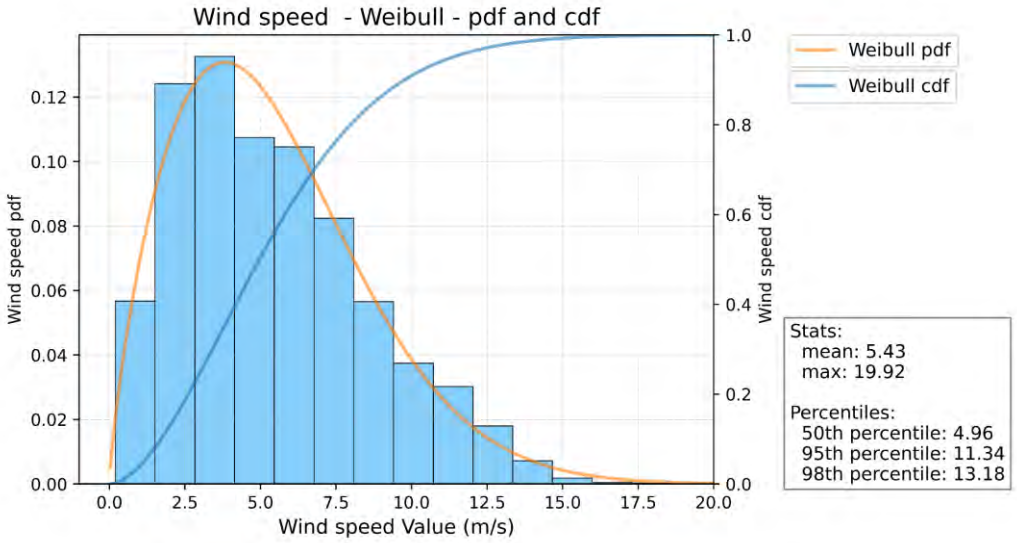

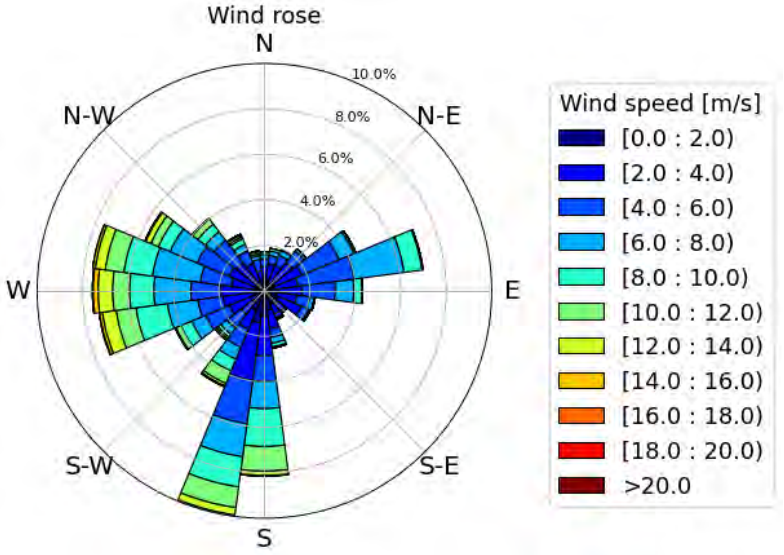

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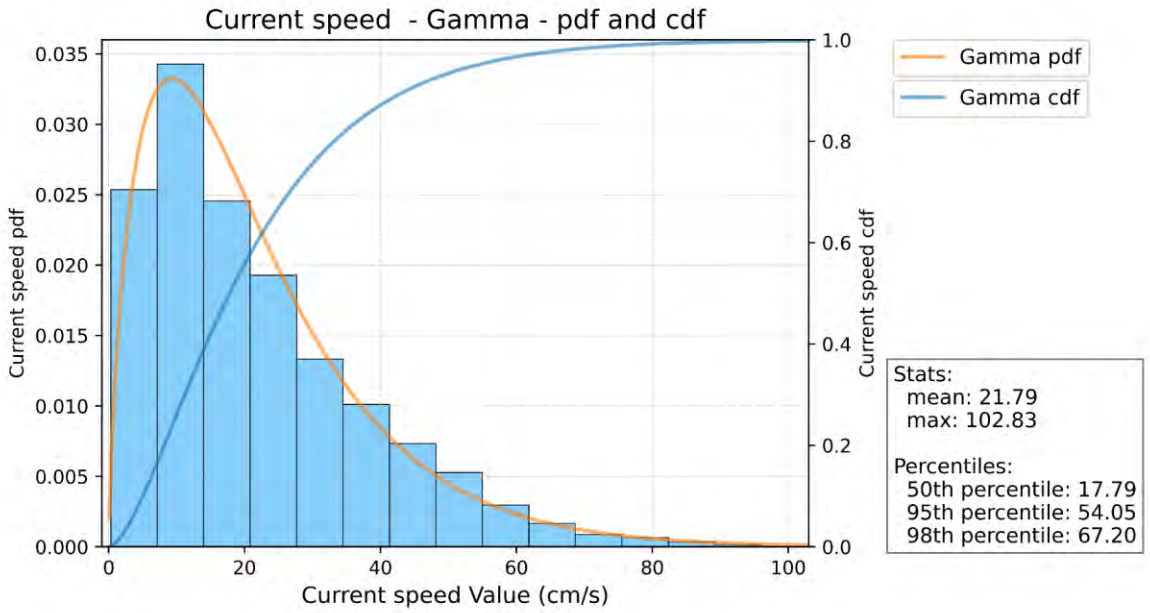
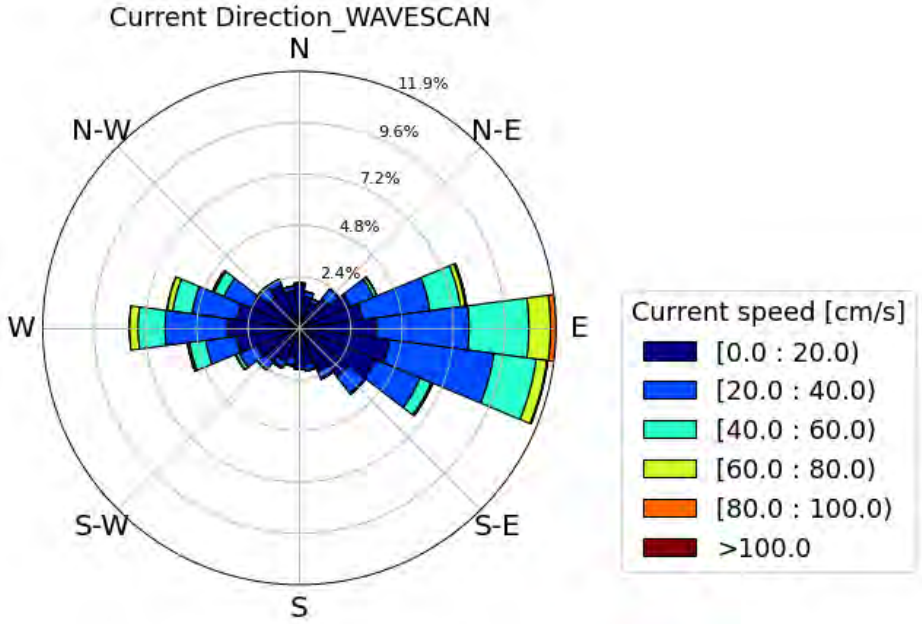
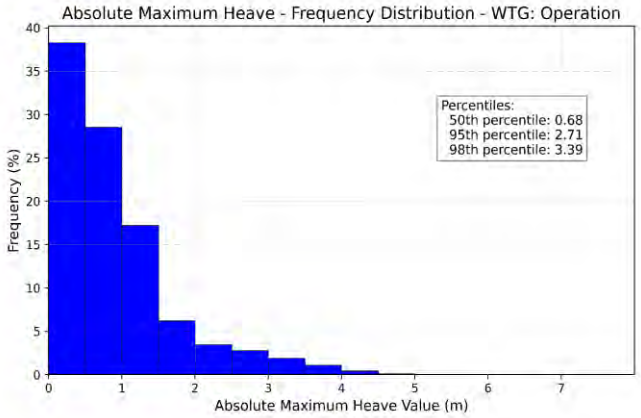
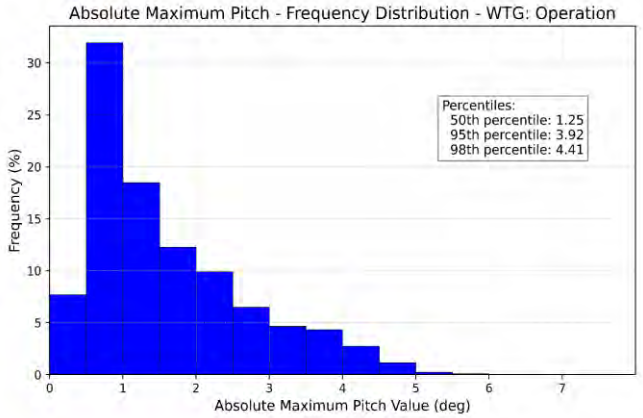
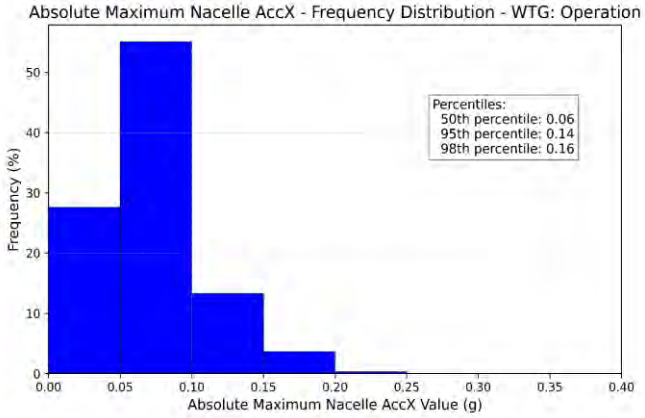


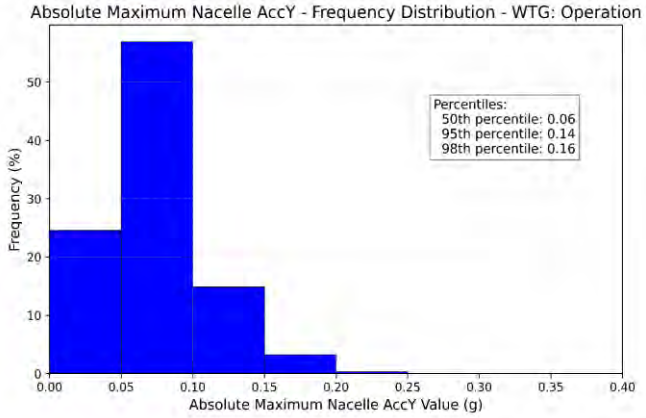


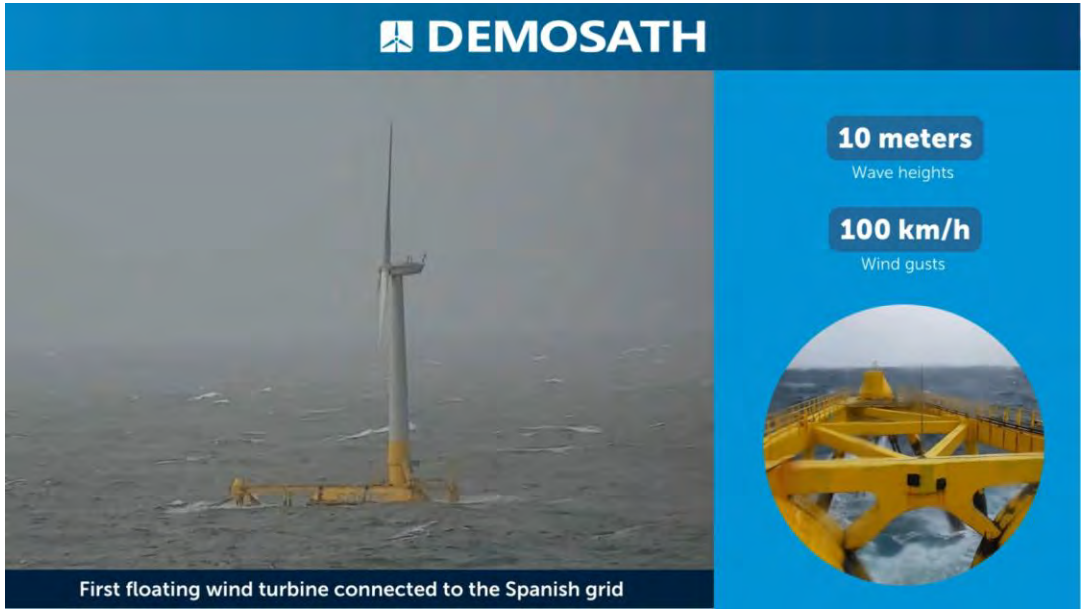
4. DemoSATH - performance









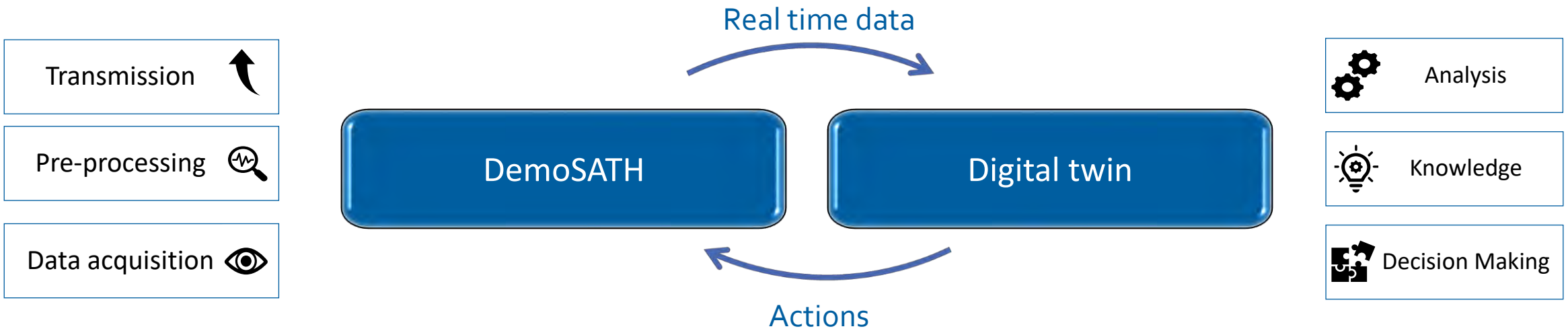


DemoSATH and FEM collaboration

Motivation of the collaboration

Creation of a digital twin

Integration of experimental data into a single post-processing tool



DemoSATH hits the small screen!

WARNER BROS. DISCOVERY

'Megastructures in the Sea. DemoSATH wind turbine' showcases all the details of the floating wind pioneering project in Spain.

WATCH NOW