



ETIP Ocean webinar "Mooring, foundations and cabling"

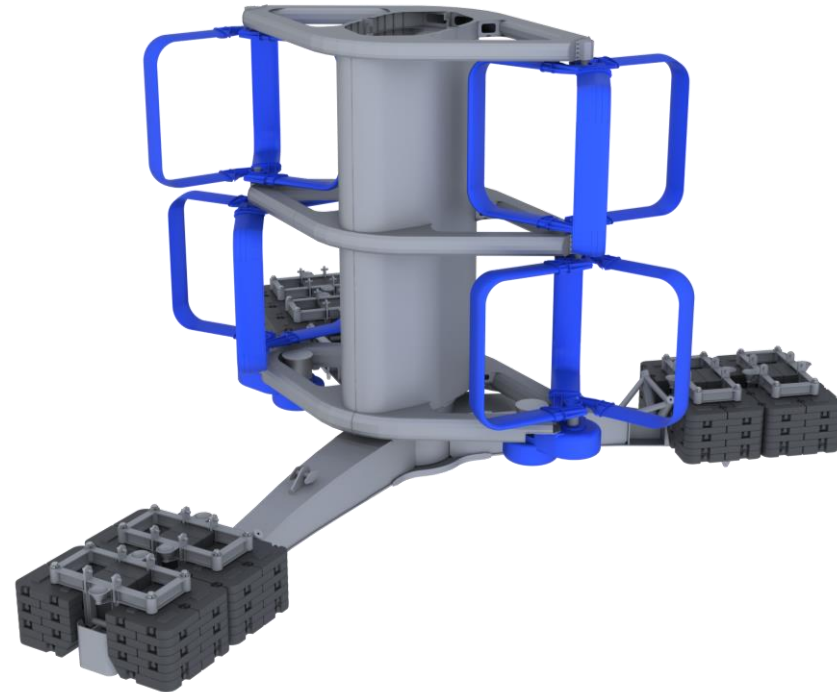
June 2025

Turbine design and construction

Hydroquest

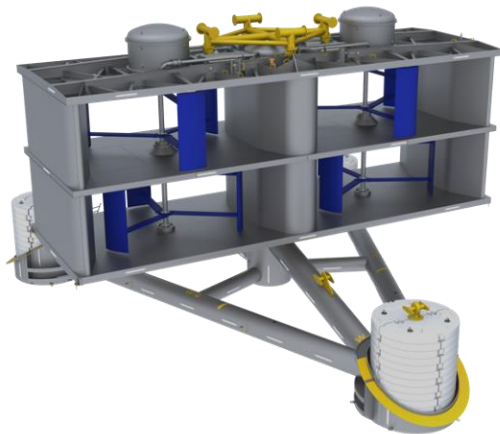
A simple and robust design

- **Vertical axis turbine**
Power coefficient $>0,5$ and low wake effect
- **High efficiency in tidal flow**
In turbulent flow
- **Reliable by design and easy maintenance**
No yaw and no pitch
- **15 years of R&D to develop a mature technology**



Hydroquest

A proven technology



- 1 MW prototype operated for 2 years off the coast of Paimpol-Bréhat, France
- 2 years of operation
- Power curve certified by Bureau Veritas following IEC
- Operational feedback and environmental monitoring

DESIGN
Robust and efficient



INSTALLATION
And connection to the grid



RECOVERY AND DECOMMISSIONING
Learnings and confirmation of design and engineering



MANUFACTURING
In CMN shipyard, France



OPERATING OFF FRANCE FOR OVER 2 YEARS
Power Curve Certified by 



Tidal turbine design

OceanQuest 2 data

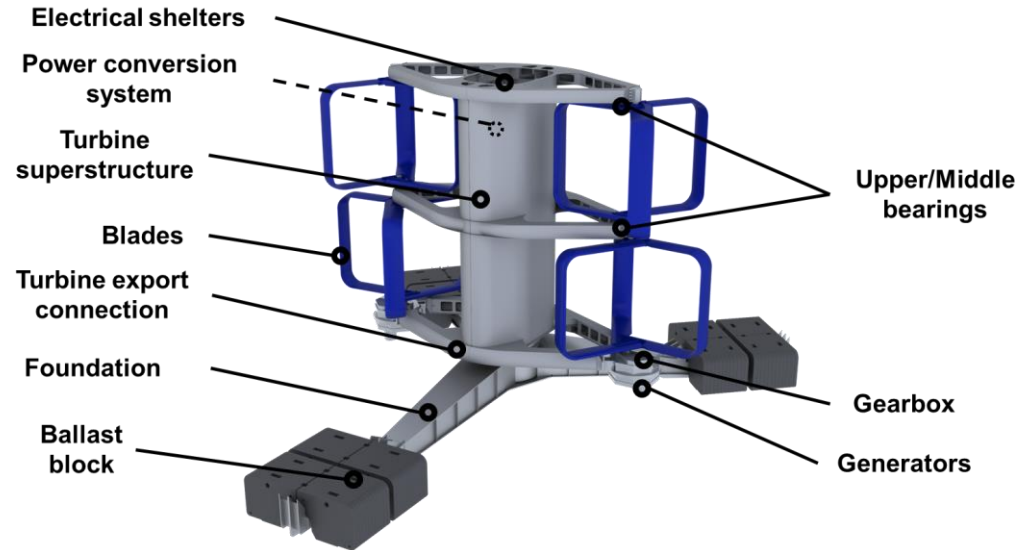
Turbine data

- 4 rotors (9 x 6 m)
- 16 m heigh
- 2,8 MW
- Dry weight : 280 T

Foundation data

- 180T tripod
- 6 x 330T cast iron counter weights
- Center distance between pins : 24 x 21 m

Offshore installation with DP400T

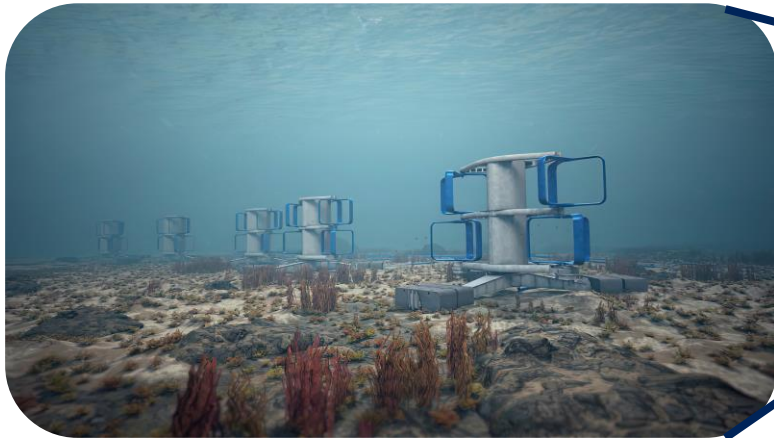


Flowatt pilot farm project

FloWatt

Project features

- Location : **Le Raz Blanchard** (Normandy) - 3km off the coast of Normandy
- Concession : **0.28 km²**, assigned in 2017, bought to EDF in 2020
- Total power : **17 MW** – 6 x 2.8 MW tidal turbines
- Energy production : **41 GWh / year** – equivalent to the electrical consumption of **20 000 residents**
- Water depth : **30-35m**
- Start of construction : Q1 2026 / Entry into operation : Q3-Q4 2028



Foundations

Foundation design

FloWatt timeline

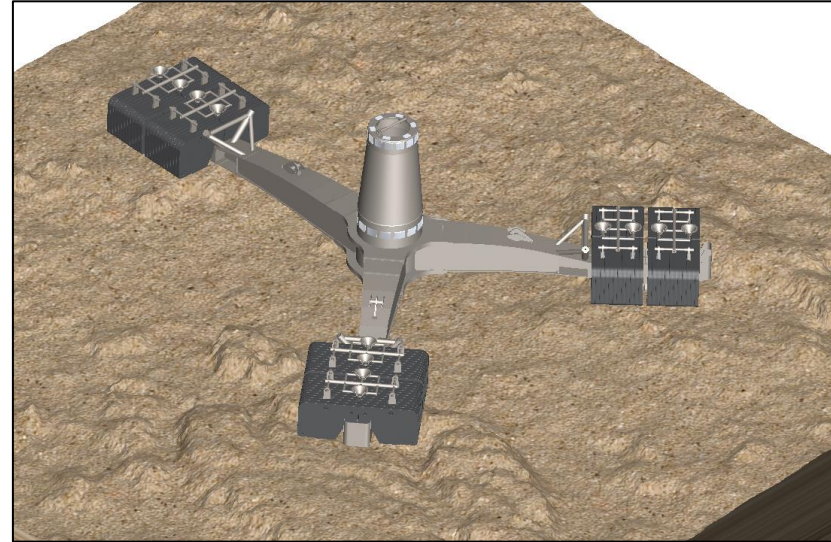
Foundation data

- 180T tripod
- 6 x 330T cast iron counter weights
- Center distance between pins : 24 x 21 m

Design requirements

- Overturning verification
- Sliding verification
- Micrositting (horizontality)

Project certification ongoing



Foundation design

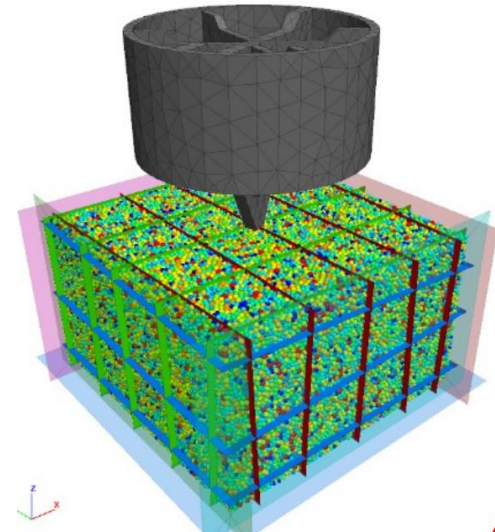
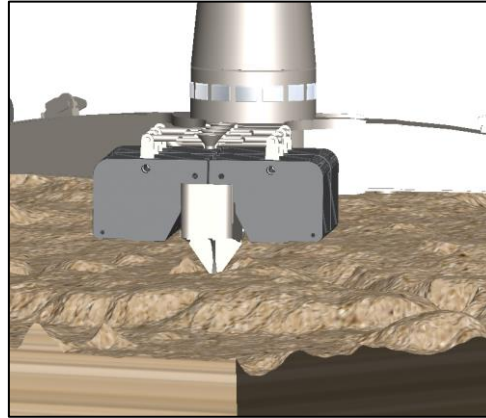
Sliding verification

Soil data

- Geophysical surveys and investigations
- Video survey and analysis
- Geotechnical surveys and investigations

Sliding verification study

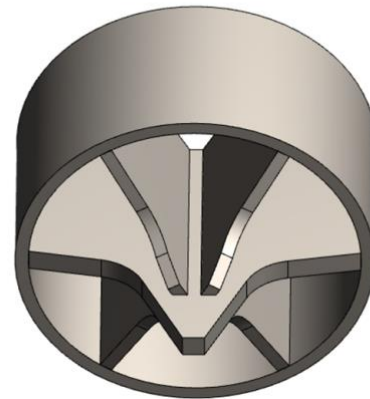
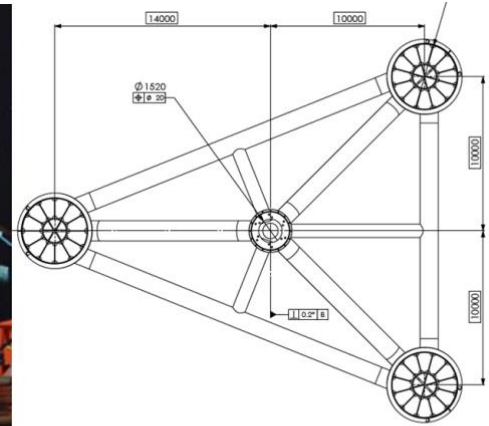
- Numerical analysis
- Effect of gravel layer
- Effect of bedrock layer
- Study performed by Cathie Associates



Foundation design

Experience from Oceanquest 1

- First pin design
- 20 cm penetration
- No displacement during 2,5 years of deployment



Foundation design

Micrositting verification

- Very accurate bathymetry
- Study includes:
 - Offshore work tolerances
 - Bathymetry accuracy
- Horizontality calculation ($<3^\circ$)
- Clearance calculation

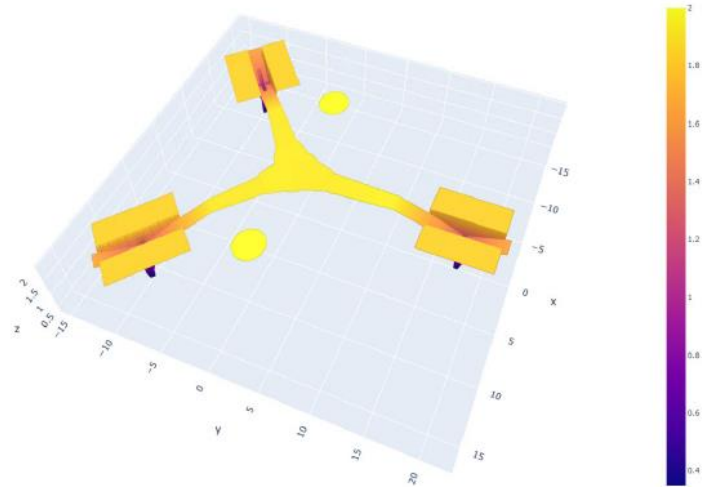


Figure 24 Foundation mesh

Foundation developments

For Flowatt / small projects:

- Gravity base foundations : Quick and easy deployment
- About 3 weeks to install the 6 foundations + counter weights
- No need of complex development

For commercial projects:

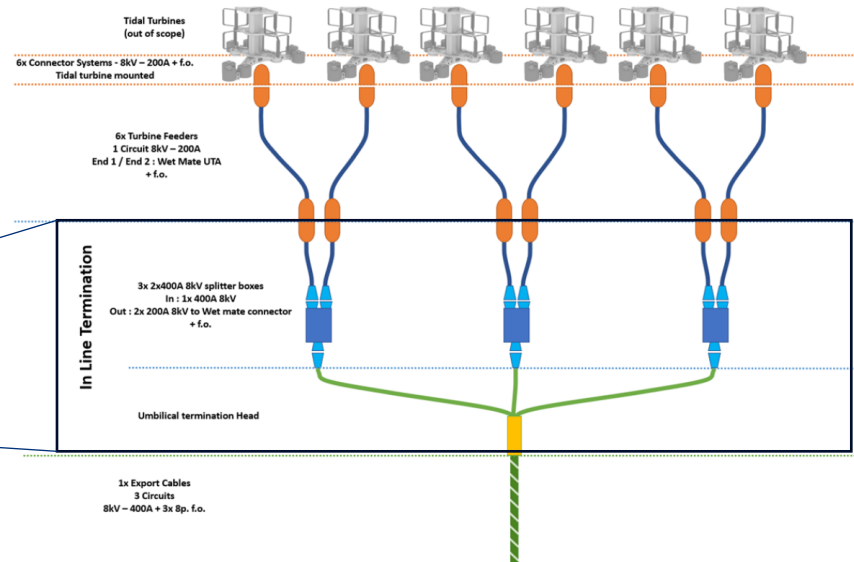
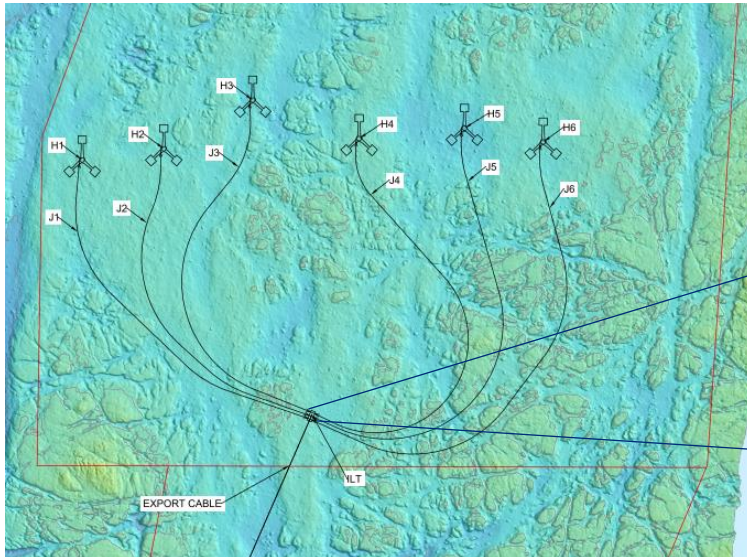
- Gravity base foundations vs drilled foundations
- Drilled foundations are cost effective for large scale projects but needs a lot of development (engineering, template, drill stability)

Grid connection



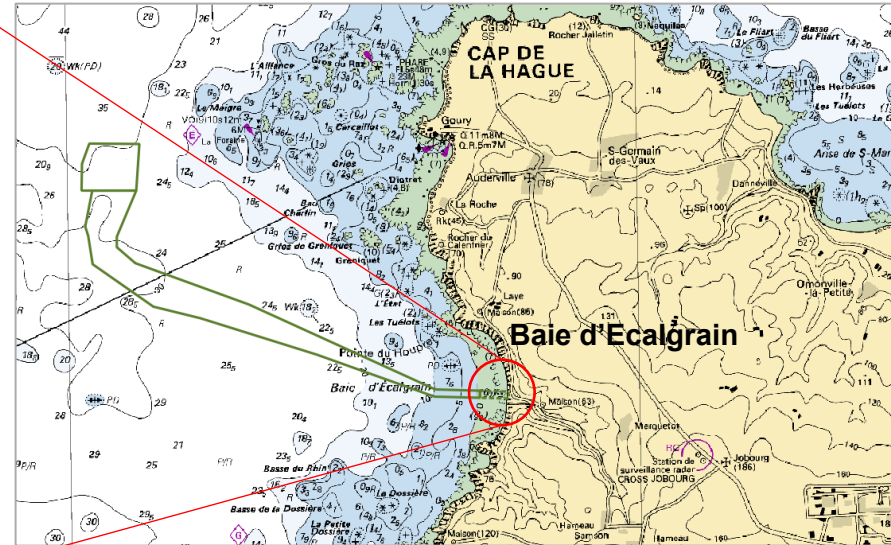
Grid connection – Offshore

- Voltage : 10kV
- Use of Wet-mate connectors
- 3 Circuits for 6 tidal turbines
- Passive components
- Static components
- Power and Optic Fiber architecture



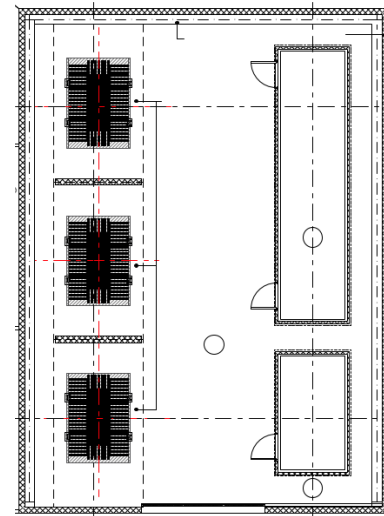
Horizontal directionnal drilling

- 550ml lenght
- End at -5m LAT



Delivery substation

- Tension elevation for grid connection (10kV → 20kV)
- Distribution elements following ENEDIS standards
- Supervision and PMS



Grid connection developments

For Flowatt :

- Cable deployment in high tidal current areas
- Passive system with no need of maintenance
- Cable stability cost effective solutions (Accurate meteocean data close to seabed + specific calculations) => Flowatt project certification

Contact

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FLOWATT