



Tidal turbines corrosion resistance strategy and maintenance cost reduction

21/10/2020





GENERAL PRESENTATION

OUR CORE TECHNOLOGY

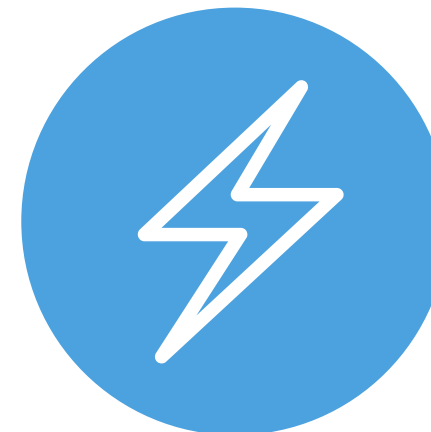
A UNIQUE TURBINE CONCEPT



Two vertical, counter-rotating columns

Reliable in harsh conditions

Performant in turbulent flows



Suitable for a range of applications

Adaptable in size and power output



Reaching competitiveness

Strictly following the learning curve & LCOE evolution of wind turbine technologies

HydroQuest is a leading technology provider thanks to superior field performance

10 YEARS OF TECHNOLOGY DEVELOPMENT

MILESTONES



TIDAL POWER – A 100GW MARKET

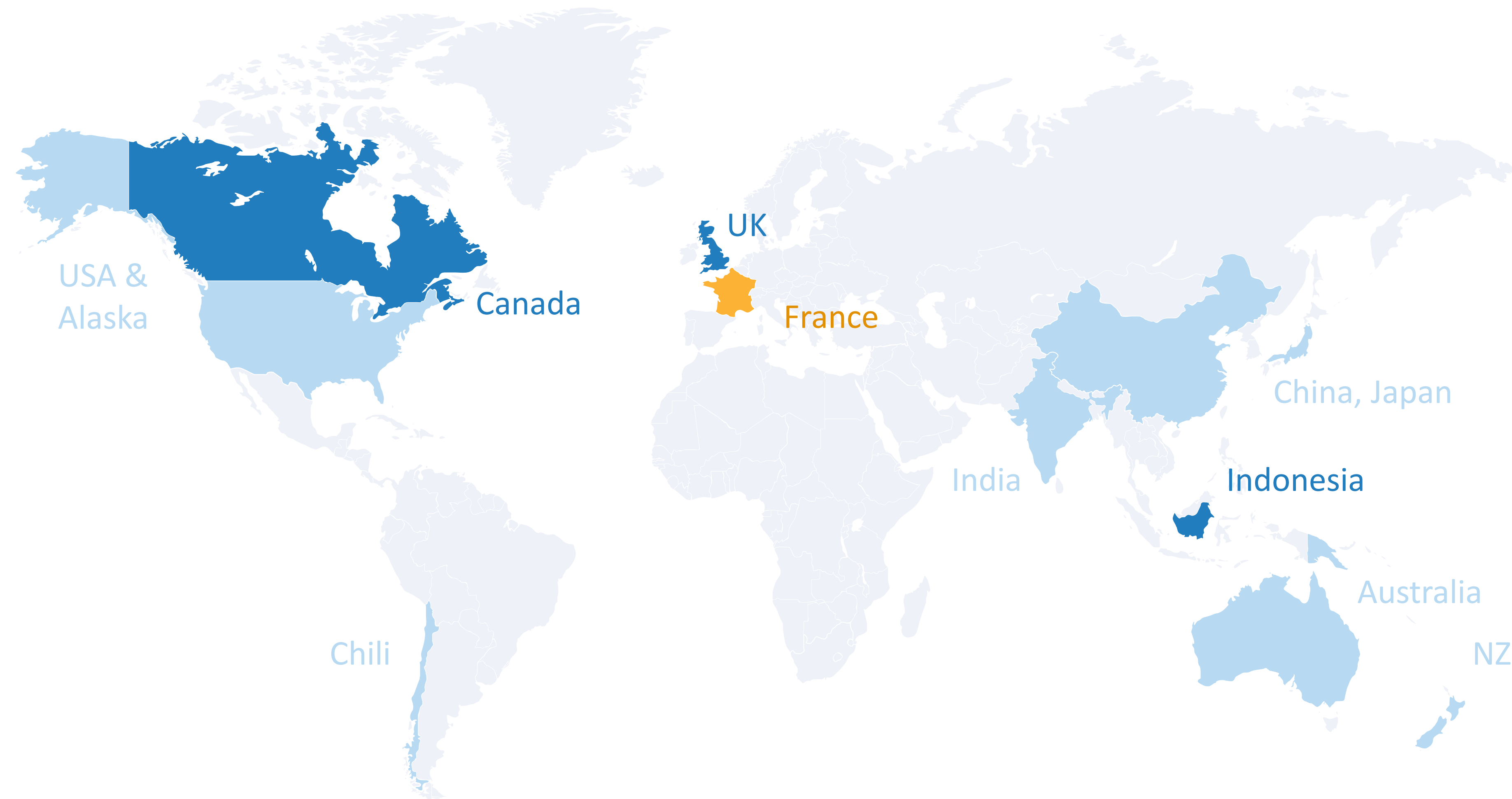
FRANCE FIRST, WORLD SECOND

▶ **Step 1 – France**
3 sites - 3.5GW (equ. 15bn€)

▶ **Step 2 – Replicating success with Canada, UK, Indonesia**
Once first French site signed.
Opening 12GW (equ. 50bn€)

▶ **Step 3 – Diffusing technology**
Smaller sites, 20GW (equ. 100bn€)

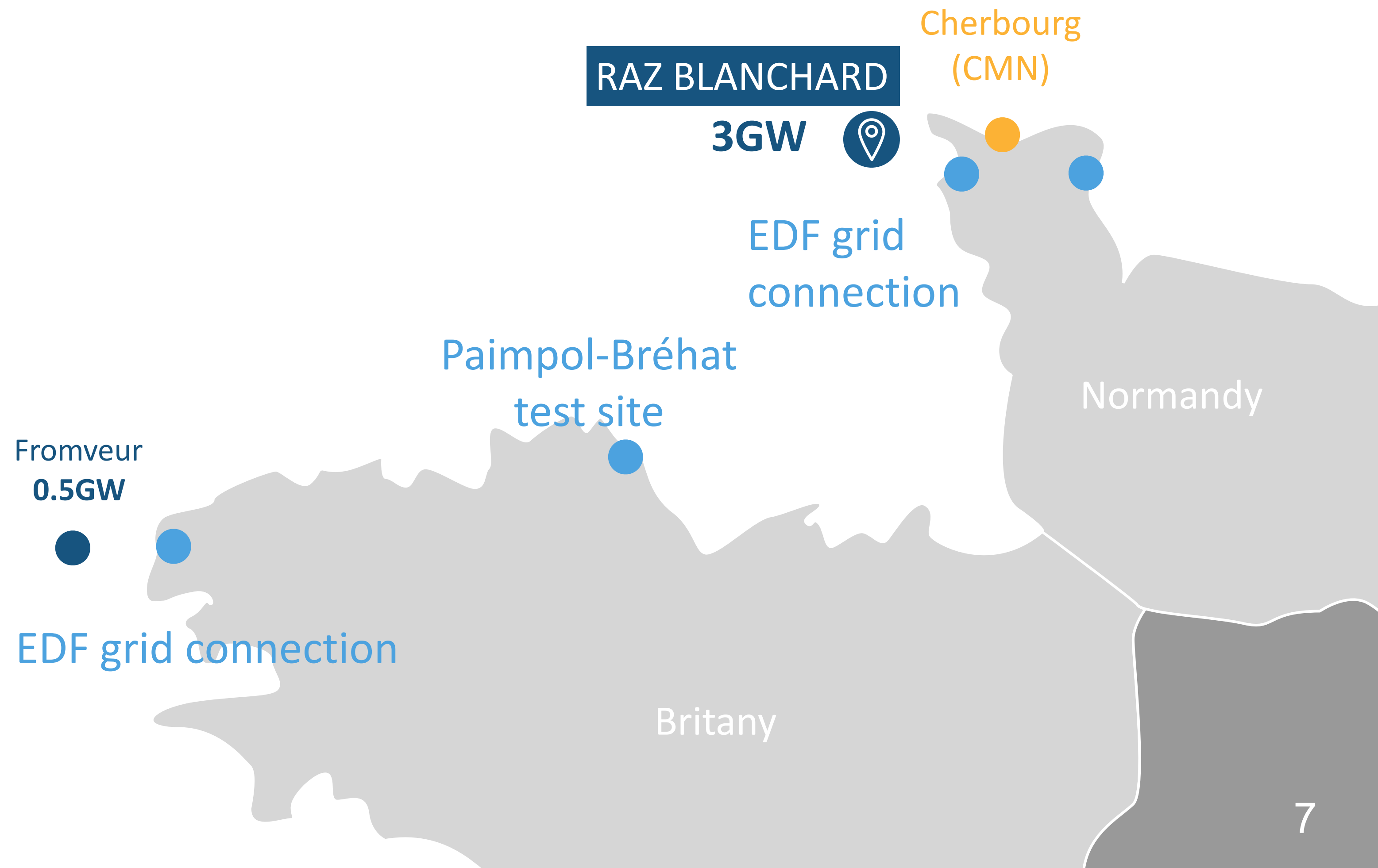
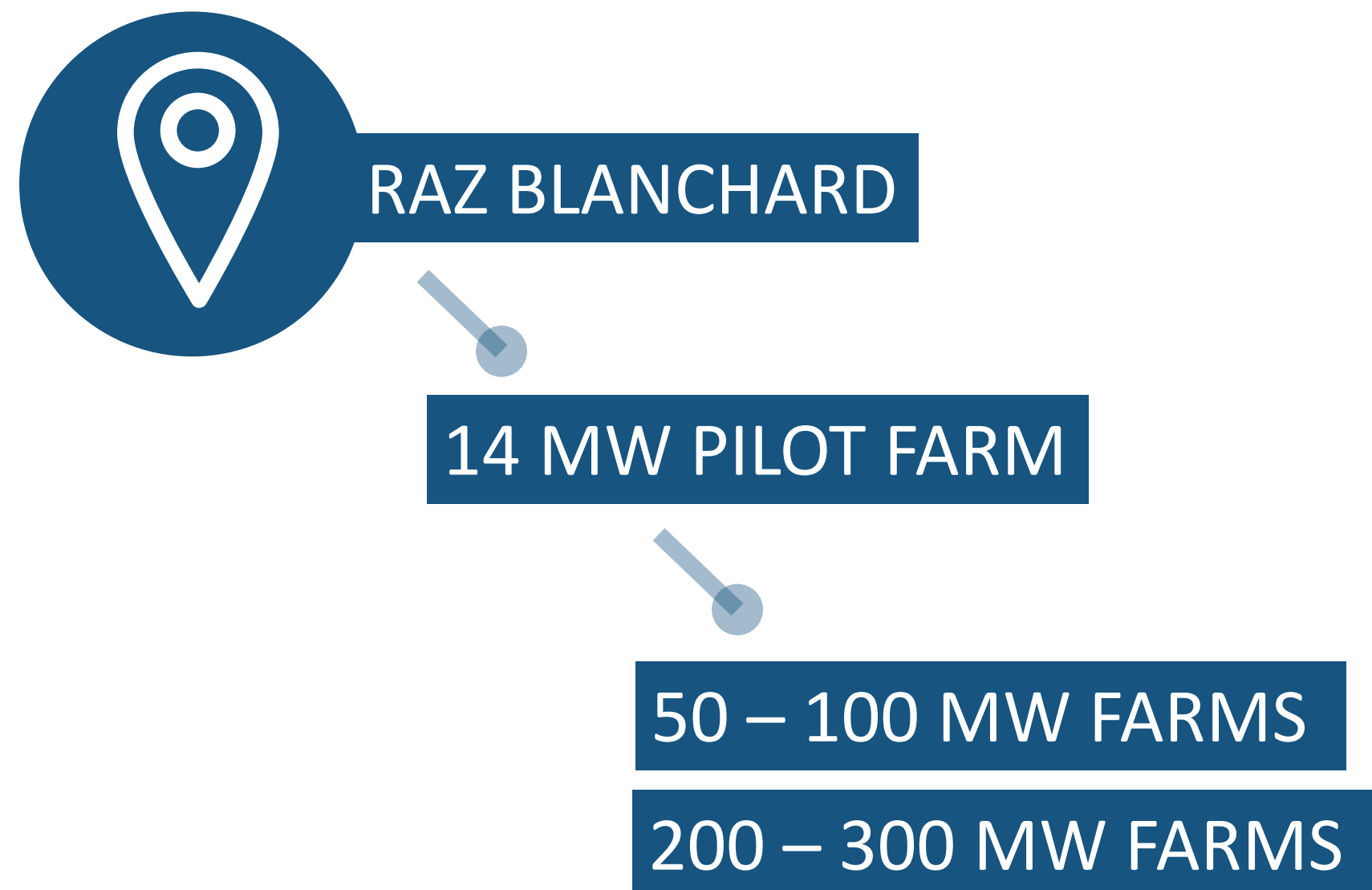
▶ **Step 4 - Rest of the world**
60+ GW



THE *FRENCH CONNECTION*



- ▶ **2 sites = equivalent to 2 nuclear plants**
Generating power night & day
- ▶ **Easy connection to the grid**
Reduced deployment costs
- ▶ **Local high tier industry partner**
With proven track record & easy access to sites



SUPPLY CHAIN



► The CMN partnership

- CMN: French leading shipbuilder (civil & military)
- Decades of industrial manufacturing expertise
- Adequate production capabilities
- Located in Cherbourg – facing Raz Blanchard
- Industrial partnership, especially for Raz Blanchard deployment (30 km)

► Local supply chain specific features

- To reduce costs, final assembly always to be performed as close as possible to tidal sites
- Manufacture close to quay side, able to receive Offshore Construction Vessel
- Adequate production capabilities



1MW prototype project

 Turbine description

1

OceanQuest 1 turbines

4 rotors of 8 m diameter x 4 m high

1 MW

Nominal output power / unit

280 T

Dry weight

Overall dimension of 21 m long x 16 m high

20 month

Total fabrication duration

6 month for final assembly in CMN workshop

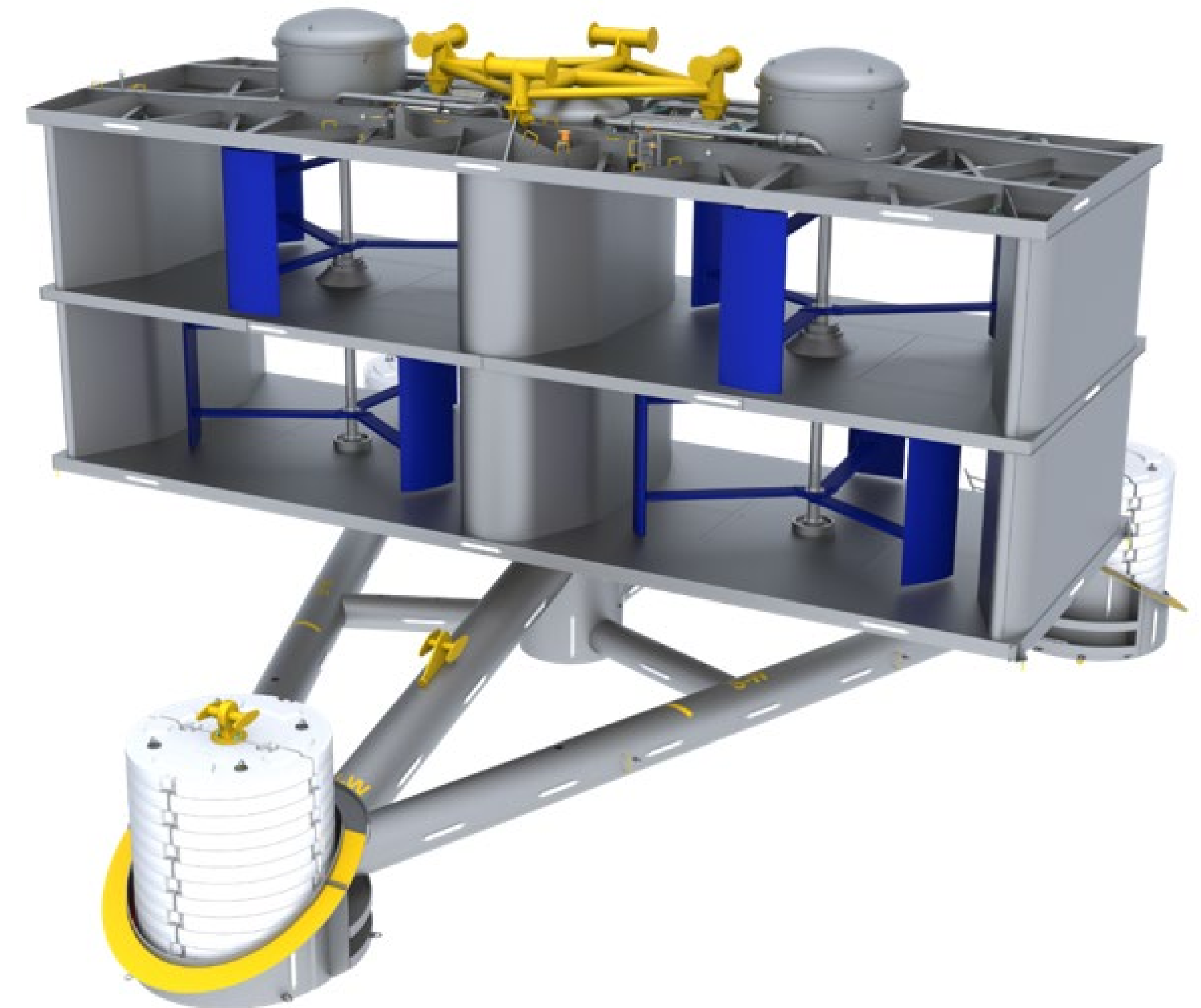
 Foundation description

250 T

Foundation Dry weight

Overall dimension of 28 m x 24 m

1000 T

Cast iron Ballast Dry weight

► Installation

**April
2019** **Foundation, ballast, turbine**

DP 400T **Normand Vision**
4 days of operation

► Operation

91% **Availability rate**

IEC 62600 **Power curve certified by Bureau
Veritas**

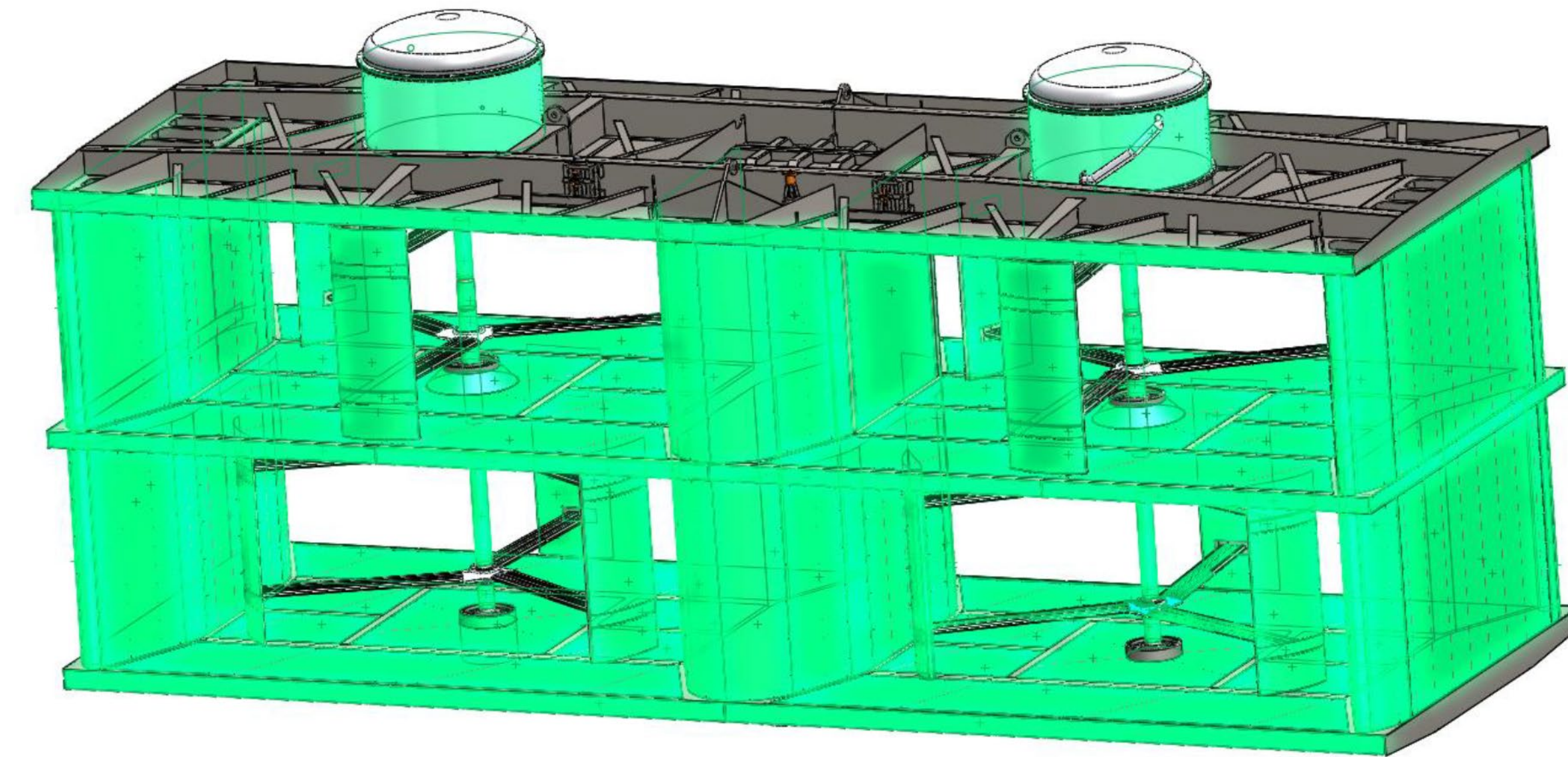
2021 **Decomissioning and inspection**



PROJECT PRESENTATION

► Coating

- Marine paint coating (epoxy layers)
- Antifouling coating on some parts
- Design life of 5 years



Antifouling coating surfaces

► Cathodic protection

- Design life of 5 years

 Coating

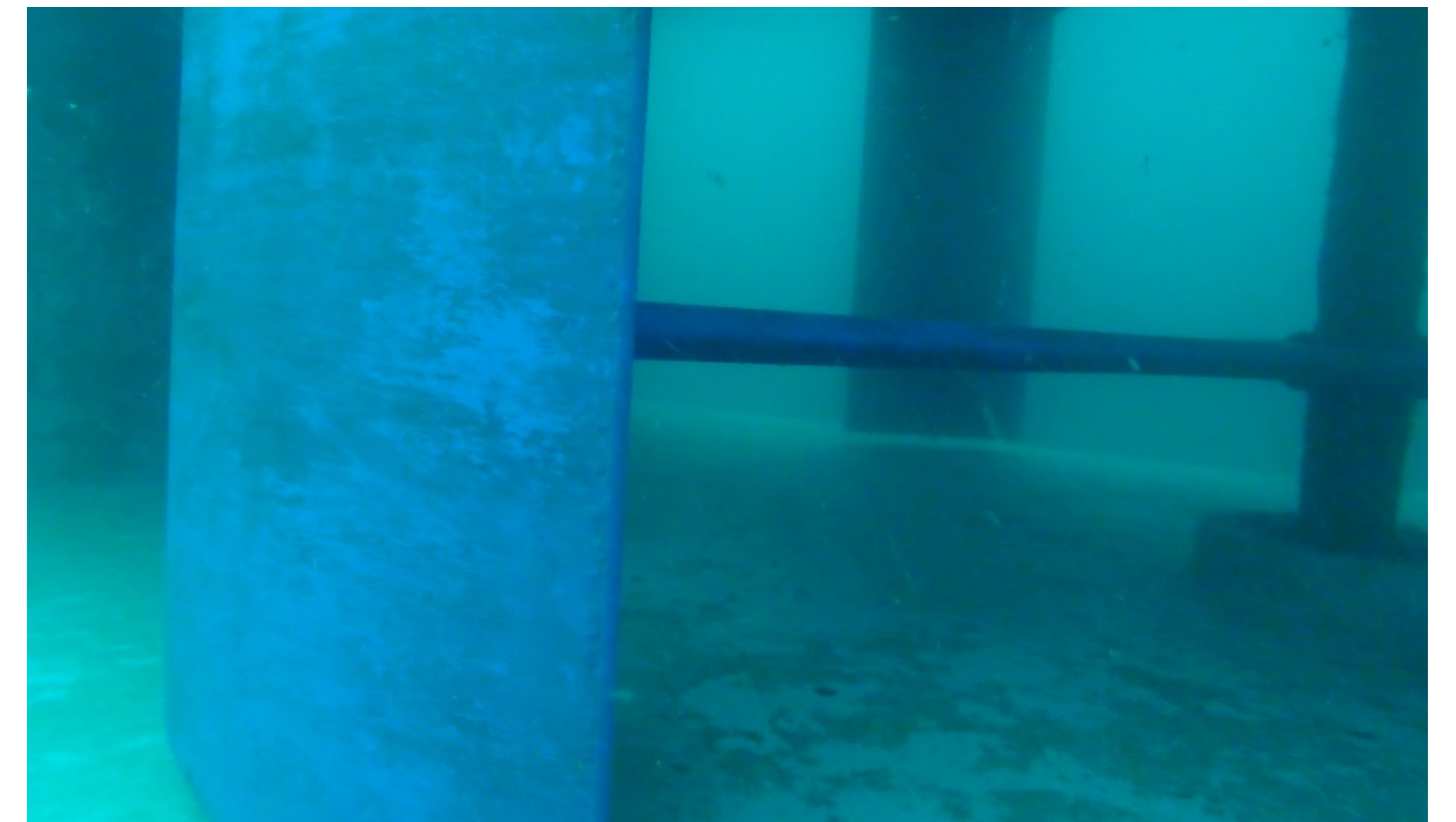
- Antifouling : still efficient after 16 month of immersion



Parts with no anti-fouling coating – After 16 month

 Cathodic protection

- Consumption and wear a little lower as expected
- Design protection methodology appropriate



Antifouling on blades after 16 month



New generation : OceanQuest 2.5

► Turbine description

1

OceanQuest 2.5 turbine

4 rotors of 8 m diameter x 6 m high

2,5 MW

Nominal output power / unit

At rated speed of 3,7 m/s

200 T

Dry weight

Overall dimension of 21 m long x 16 m high

15 month

Total fabrication duration

3 month for final assembly

► Foundation description

250 T

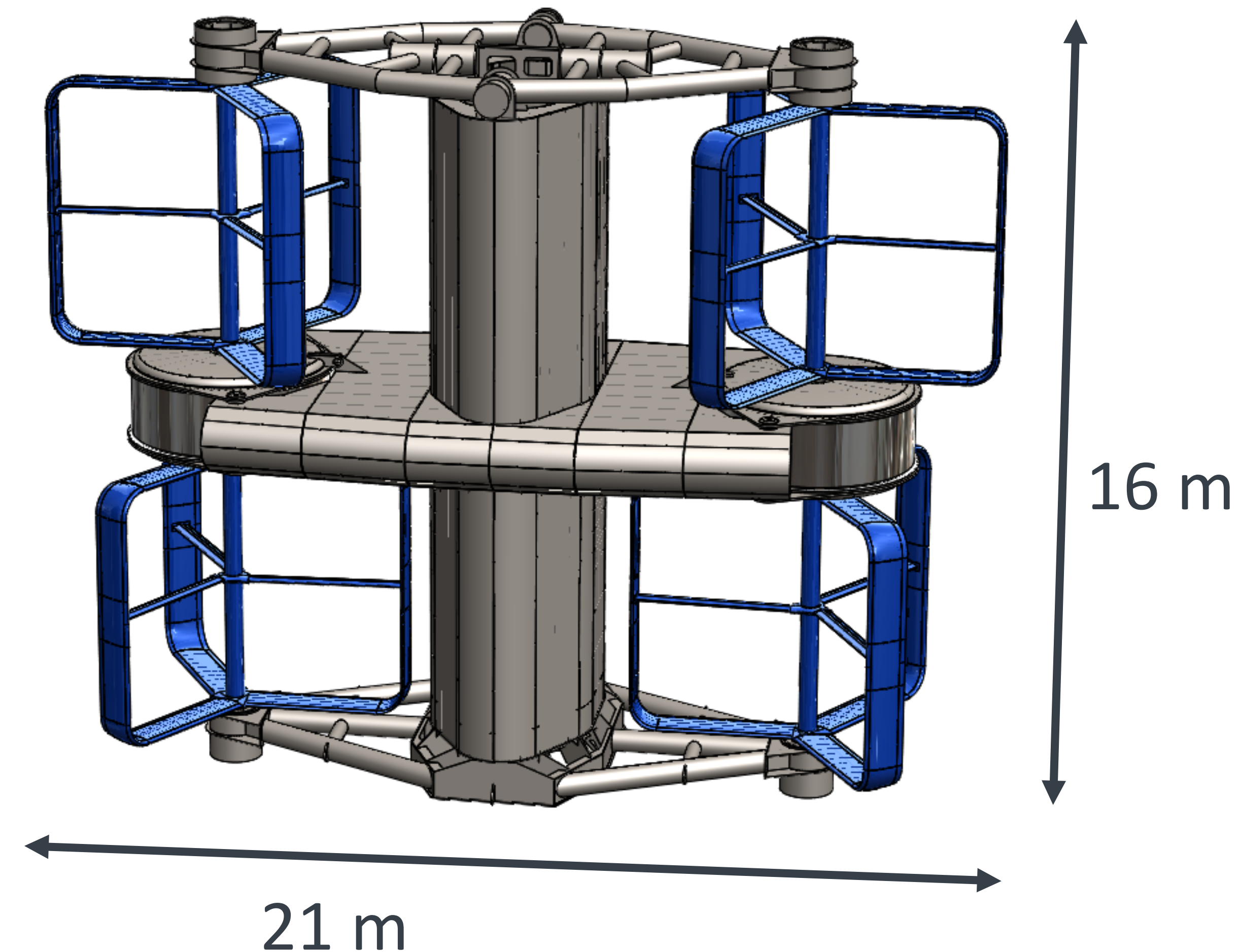
Foundation Dry weight

Overall dimension of 28 m x 24 m

1800 to
2400 T

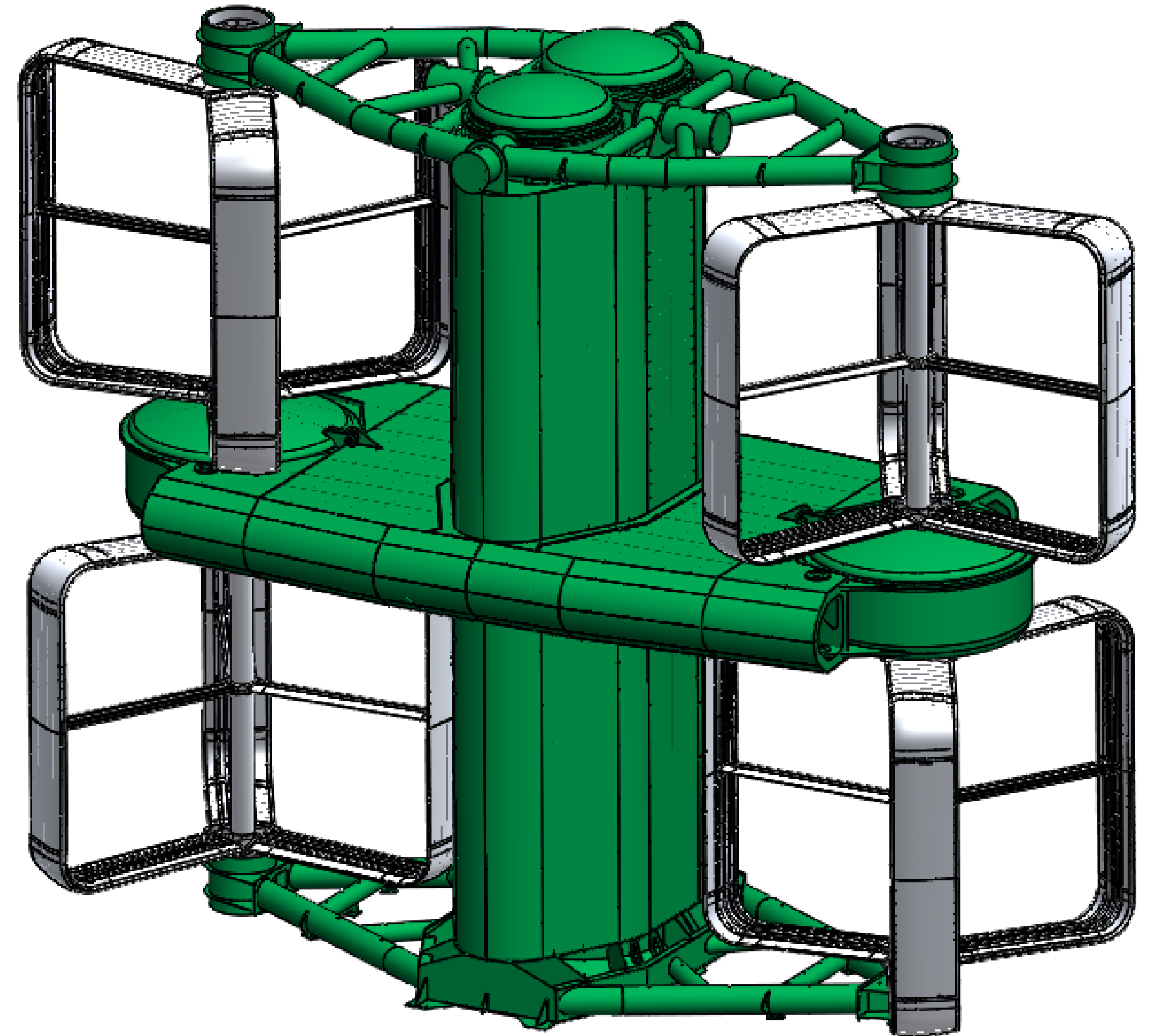
Cast iron Ballast Dry weight

Depending on site characteristics



► Coating

- Marine paint coating (epoxy layers)
- No antifouling or fouling release
- Coating layer with expected lifetime of 25 years, without any maintenance
- Selection of coating on-discussion with several suppliers



Cathodic protection

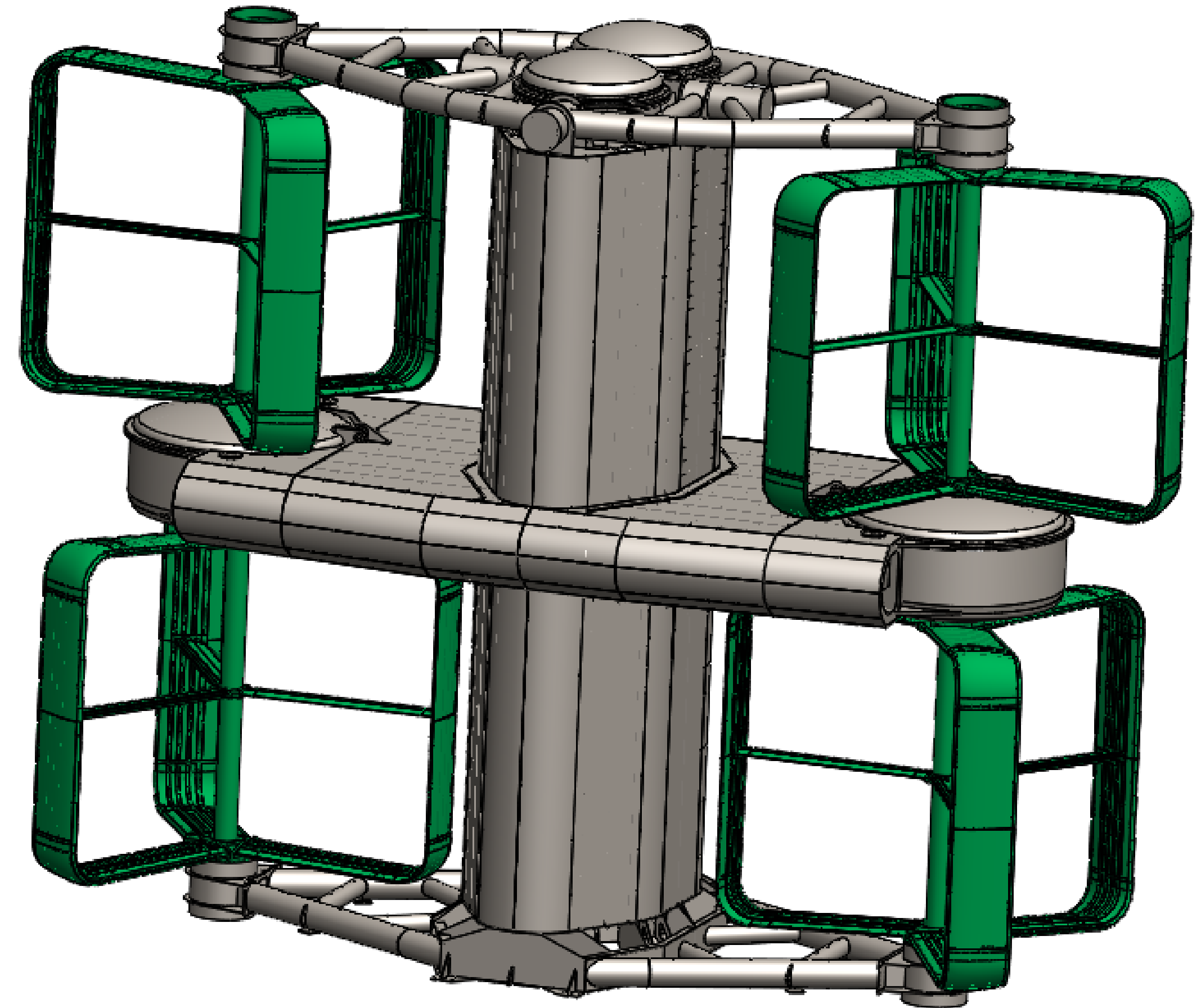


Cathodic protection

- Design performed following DNGL-RP-B401
- Standards anodes
- Design with a lifetime from 10 to 20 years
- Sensors on anodes to qualify the real consumption in field

► **Anti-fouling strategy**

- **Material and finishing surface confidential**
- **Optimization of surface roughness to avoid antifouling coating**
- **Qualification of surface roughness on going in tank test and on 1MW turbine**





CONCLUSION

 Coating strategy

- Marine coating with a design life of 20 years
- Cathodic protection with a design life from 10 to 20 years, study on going
- Development on going to avoid antifouling coating

 Maintenance cost reduction

- No maintenance of the turbine to be planned due to coating maintenance frequency
- No coating operation during maintenance is planned within 20 years
- Change of anodes is possible every 10 years

 Maintenance cost reduction

- Collaboration on going with Institut de la corrosion
- Hydroquest open to discuss about coating products, or any other topics linked with cathodic protection and antifouling



THANKS FOR YOUR ATTENTION

For any **information** or **quotation**, please
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