Ocean Energy: The Start of Industrialisation

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Ocean Energy Technology and Trends

SEII Society Presentation

Soenke Jordan

Largest ocean energy network in the world

- Over **120 members**
- Including **leading utilities**
- Source for **science & policy**

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Agenda

1. Why Europe needs Ocean Energy
2. Resource – 21% of Europe's Electricity
3. Tidal & Wave Technology
4. Energy System & Decarbonisation
5. Environmental Protection

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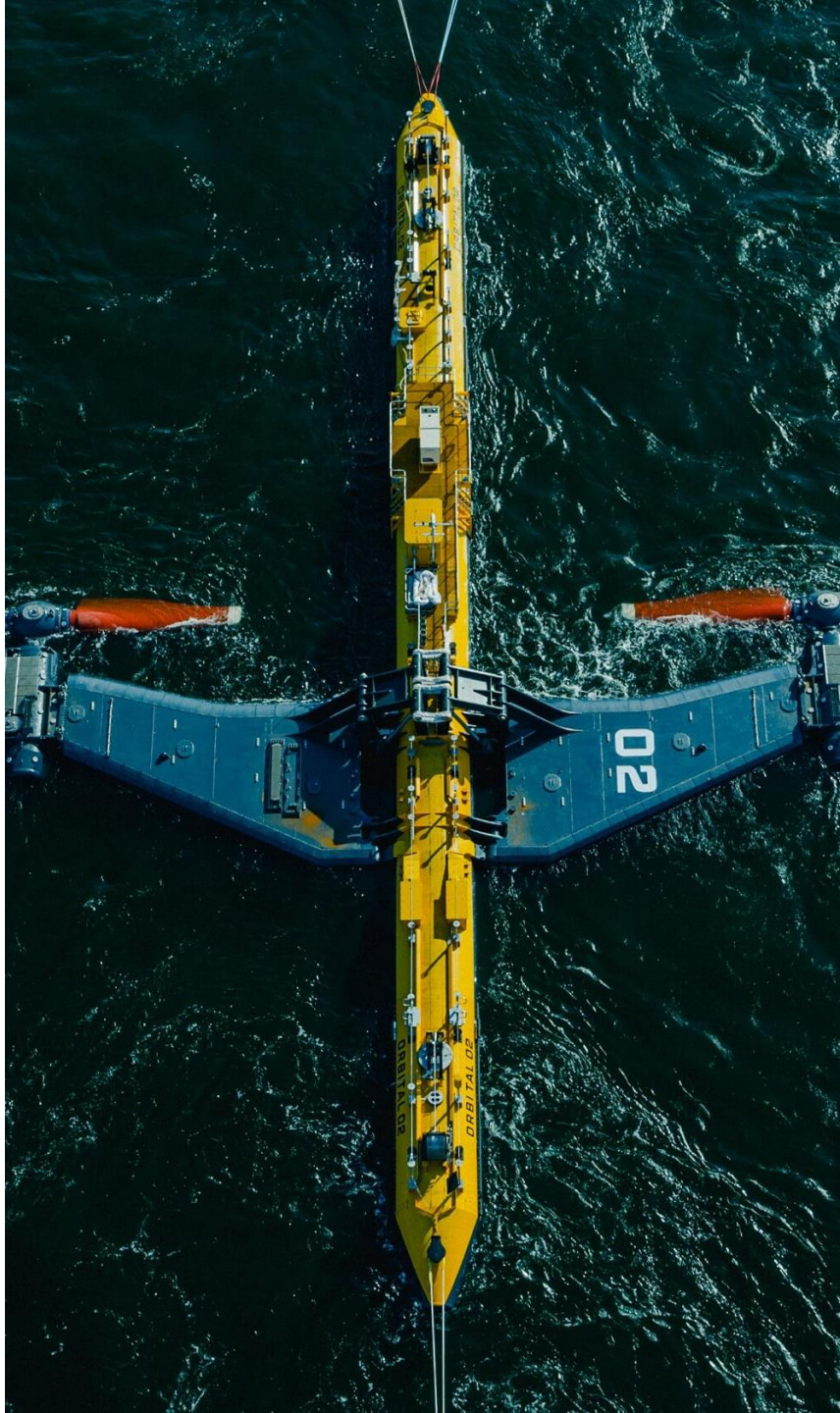
Why ocean energy?

- **Local Resource –** Putin can't stop the supply
- **Europe is the leader** – Trump tariffs ineffective
- **100% Made in Europe** – Xi Jinping can't destroy our manufacturing capacity (yet)



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100% Made in Europe

- 80% local country manufacturing
- 17 European countries in supply chain
- Europe is global leader
- Investment in deployment
  = Investment in manufacturing

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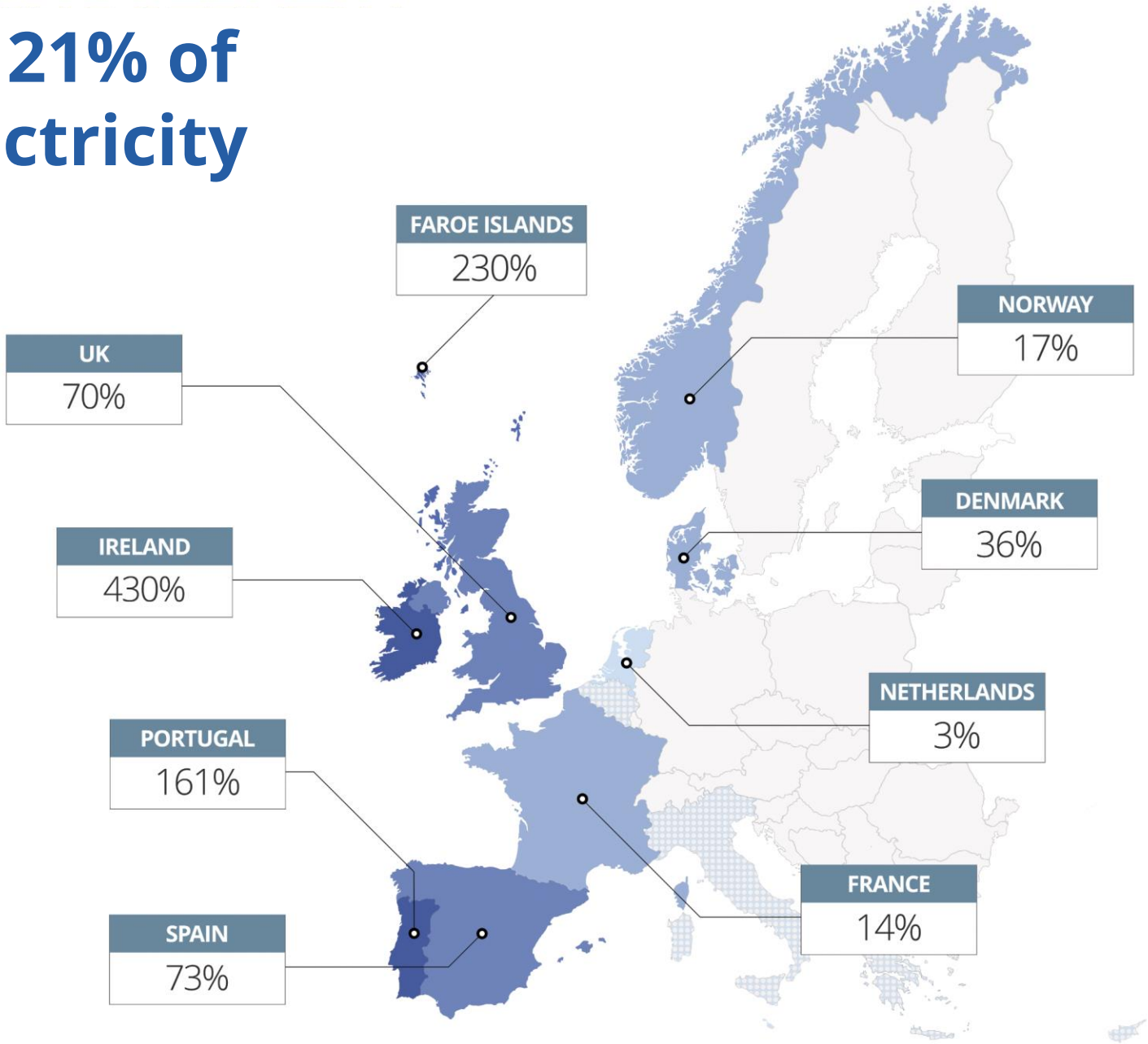
Resource – power of waves and tides

What do you see?

Potential for 21% of European electricity



Ocean Energy potential as percentage of electricity demand

- BELOW **10%**
- ABOVE **10%**
- ABOVE **50%**
- OVER **100%**
- EXPECTED RESOURCE

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EURO

OE can meet 21% of electricity demand in Europe

- OE = 573 TWh/Y
  - More than gas
- UK, Portugal, Ireland, Spain, France are top 5 wave resource
- Opportunity to lead global market

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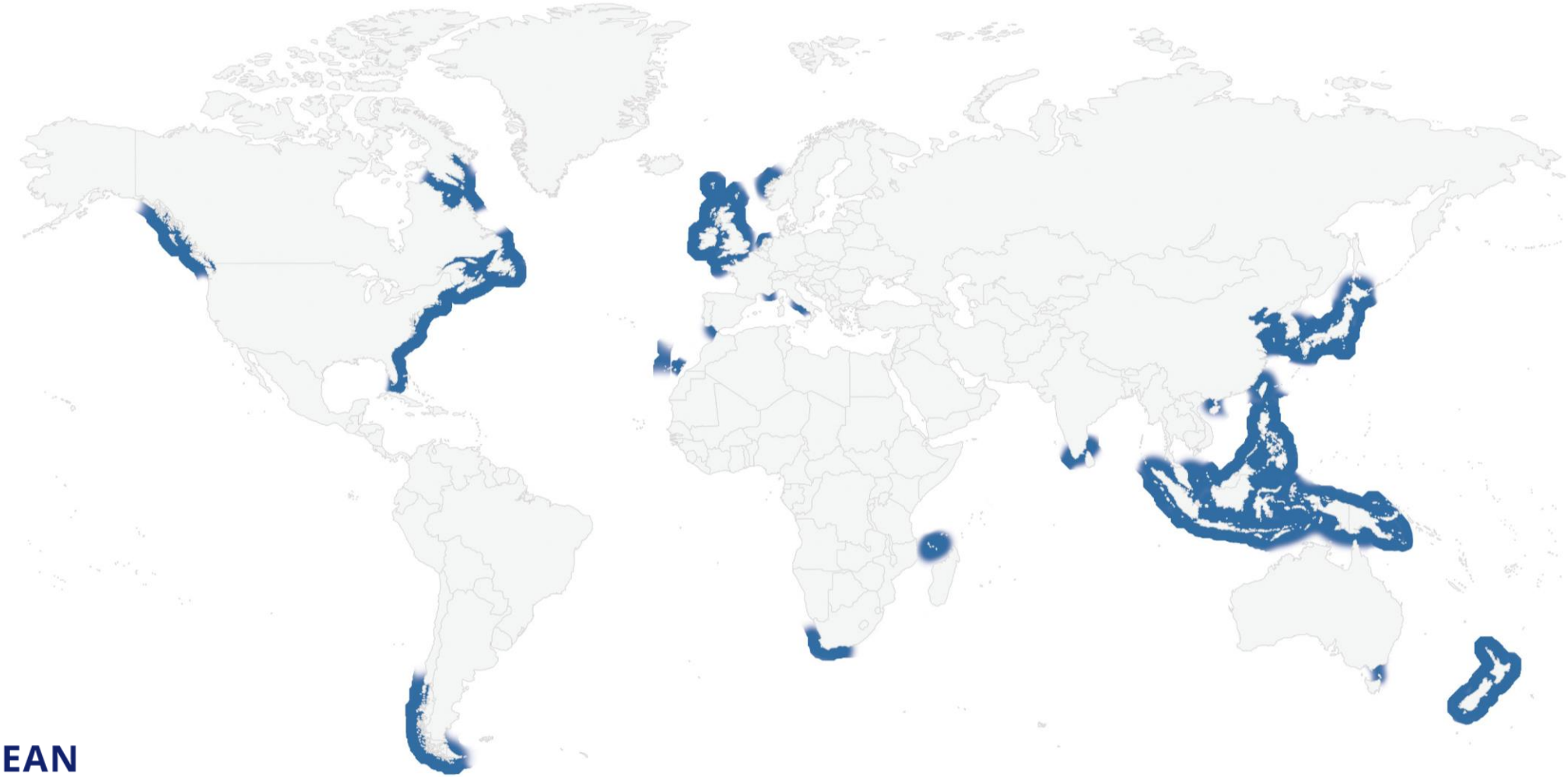
Global Tidal Resource



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Wave Energy: largest untapped renewable resource

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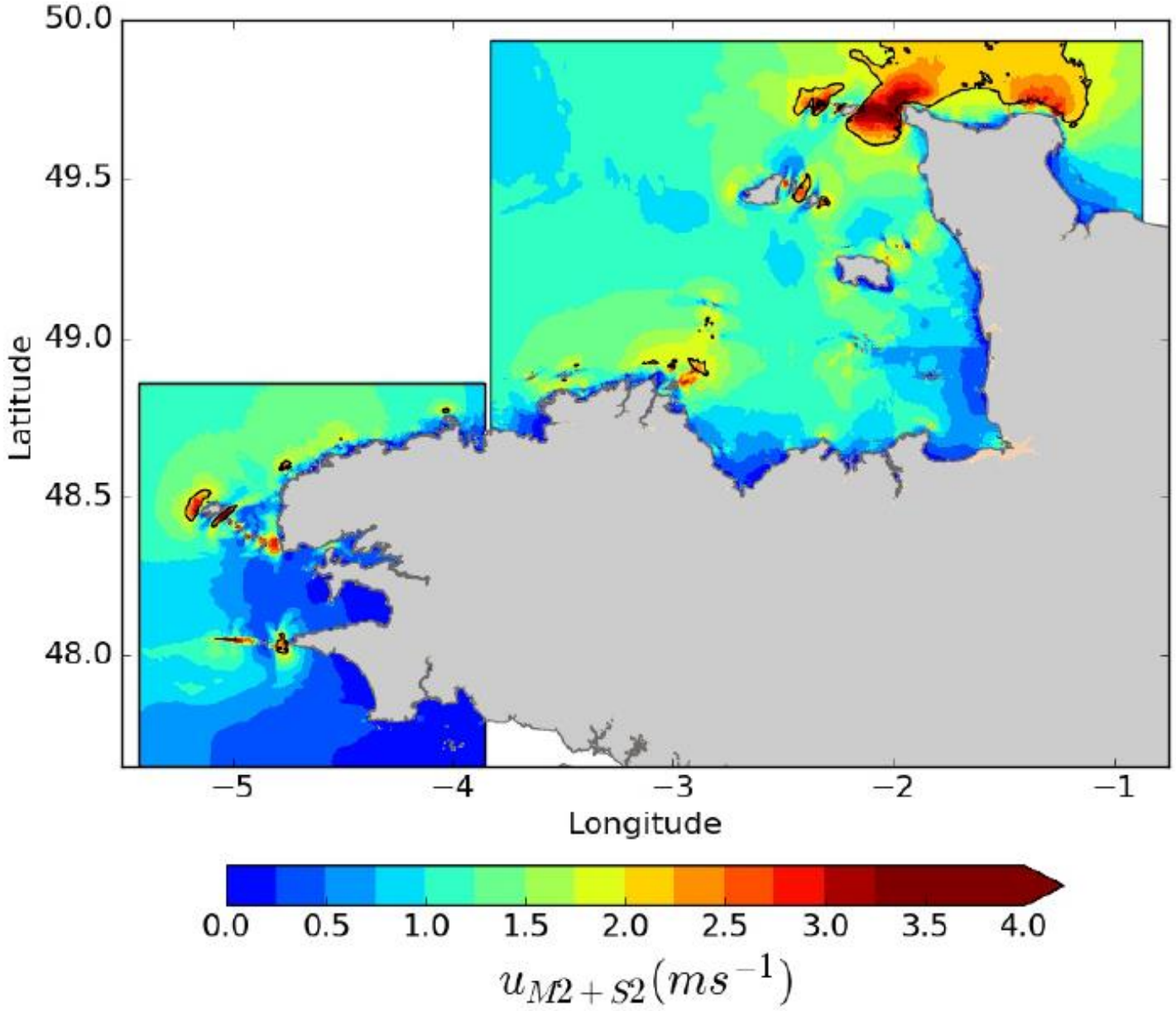
UK & France have best tidal resource

- More geographically limited than wave
- Tidal current speed (m / sec)
- 14 million litres pass thru 1m³ in 1 hour at max speed
- ~6 Olympic swimming pools



Source: Renewable resource assessment, European region (December 2022), EU-Scores project

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Tidal & Wave Technology

Tidal Energy

Technology Introduction

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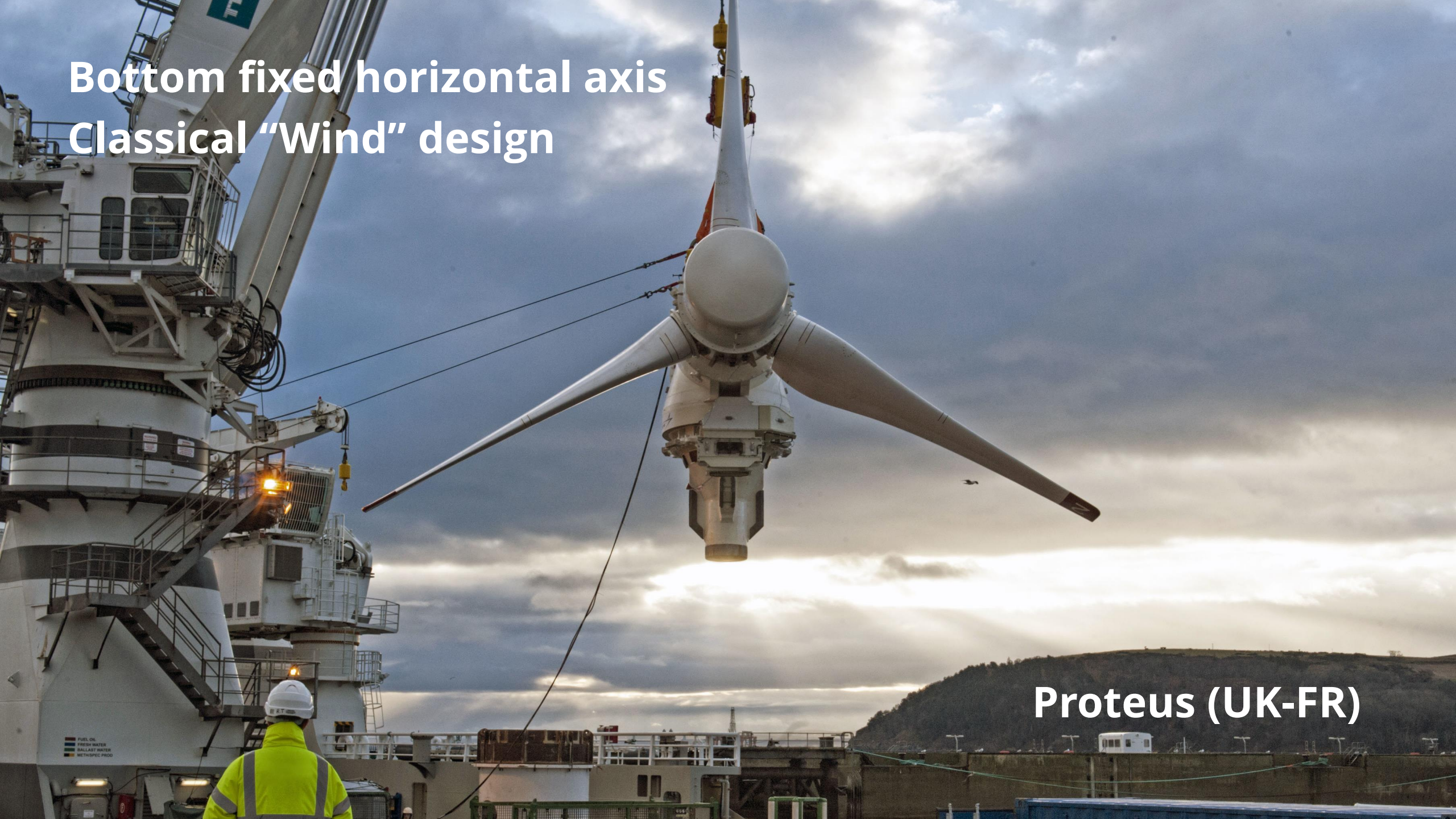

Bottom fixed horizontal axis
Classical “Wind” design
Proteus (UK-FR)


2 or 3 blades,
Steel foundation,
Ballasted or drilled in
Nova Innovation (UK)

Only one cable to shore
Less cables = less costs

Co-funded by the European Union

UK Research and Innovation

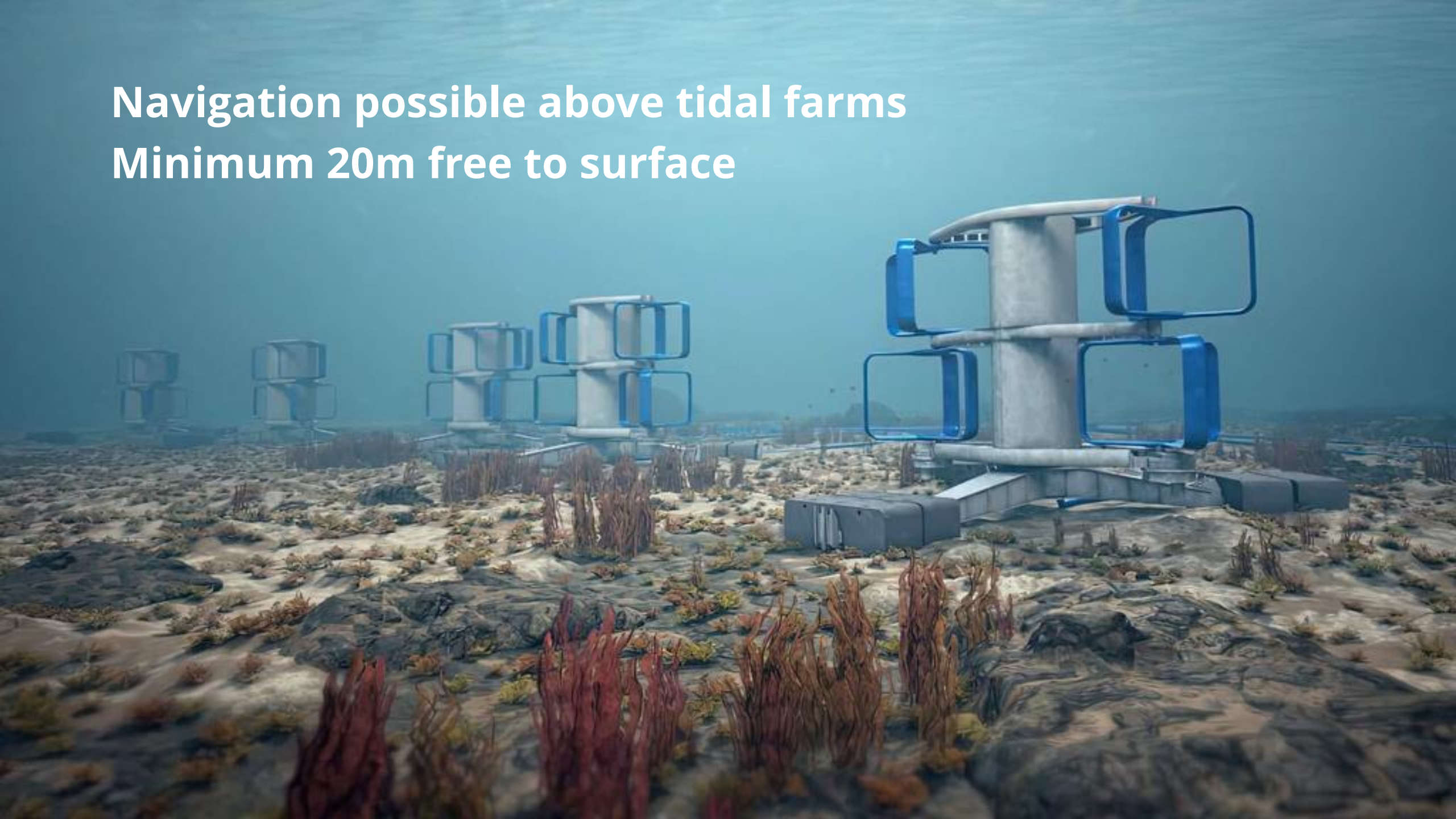
This project has received funding from UK Research and Innovation and the European Union's Horizon Europe research and innovation programme under grant agreement 101136149.

Underwater tidal farm, invisible from surface

Vertical axis – Alternative design

Hydroquest (FR)

Navigation possible above tidal farms
Minimum 20m free to surface



Floating designs

Orbital Marine Power (UK)

Floating tidal farms will be more spaced apart than seabed devices

Tidal Kite – New concept
Low tidal speeds
Minesto (SE, Faroes)

Low-speed tidal kite technology could open wider resource potential beyond UK / FR

What we're not pursuing at present: tidal range

- Same principles as hydropower
- Main plants in FR (La Rance) & South Korea (Sihwa)
- No developments

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WAVE ENERGY

Technology Introduction

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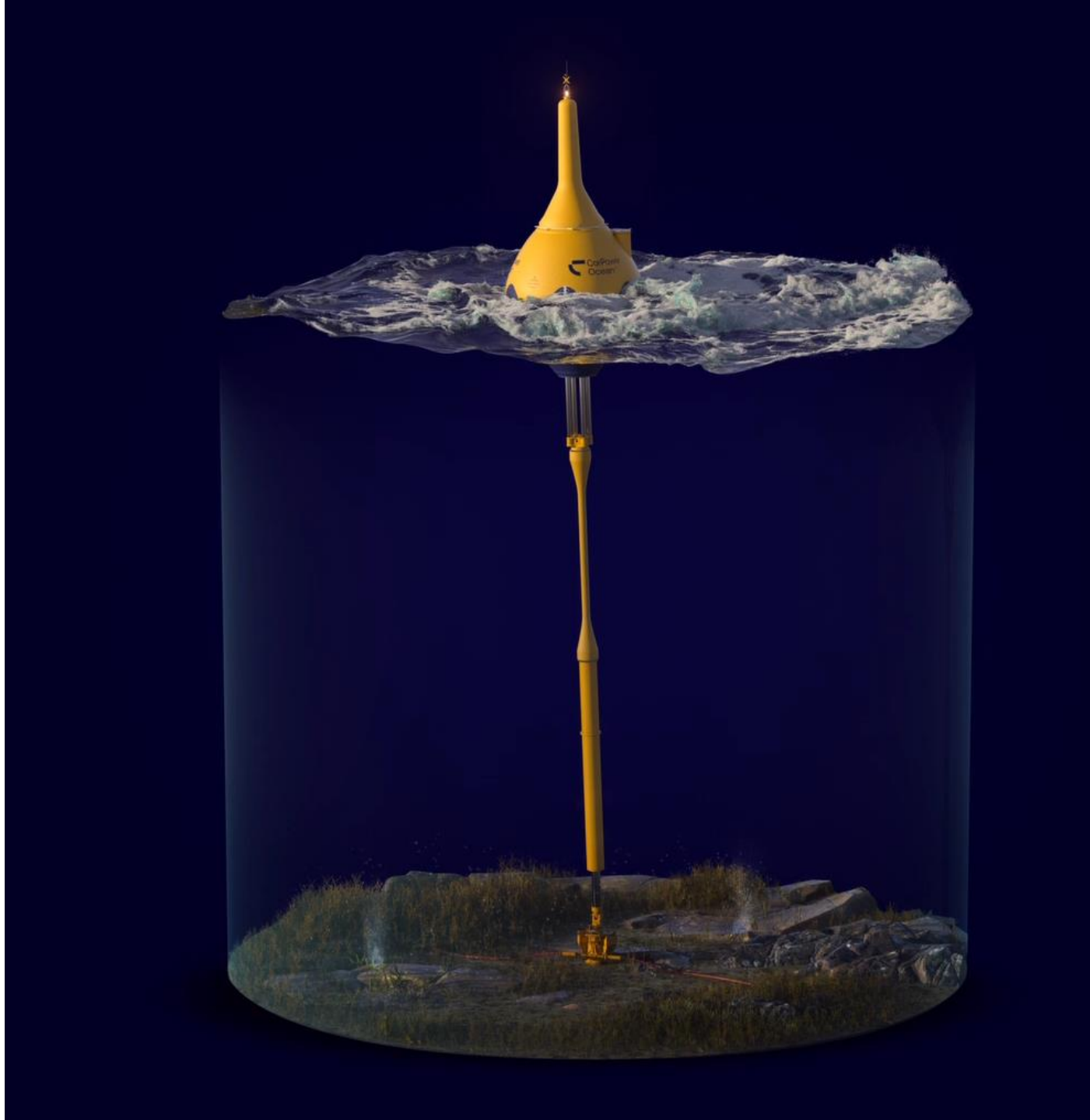
From prototype to farms
CorPower
Ocean
CorPower Ocean – farm projects in Portugal & Ireland

Wave for main grid electricity

Mass manufacturing in the local port

Buoy attached to seabed with rock anchor

- Mooring under tension for power production
- Cables connect to substation
- 1 grid export cable per wave farm



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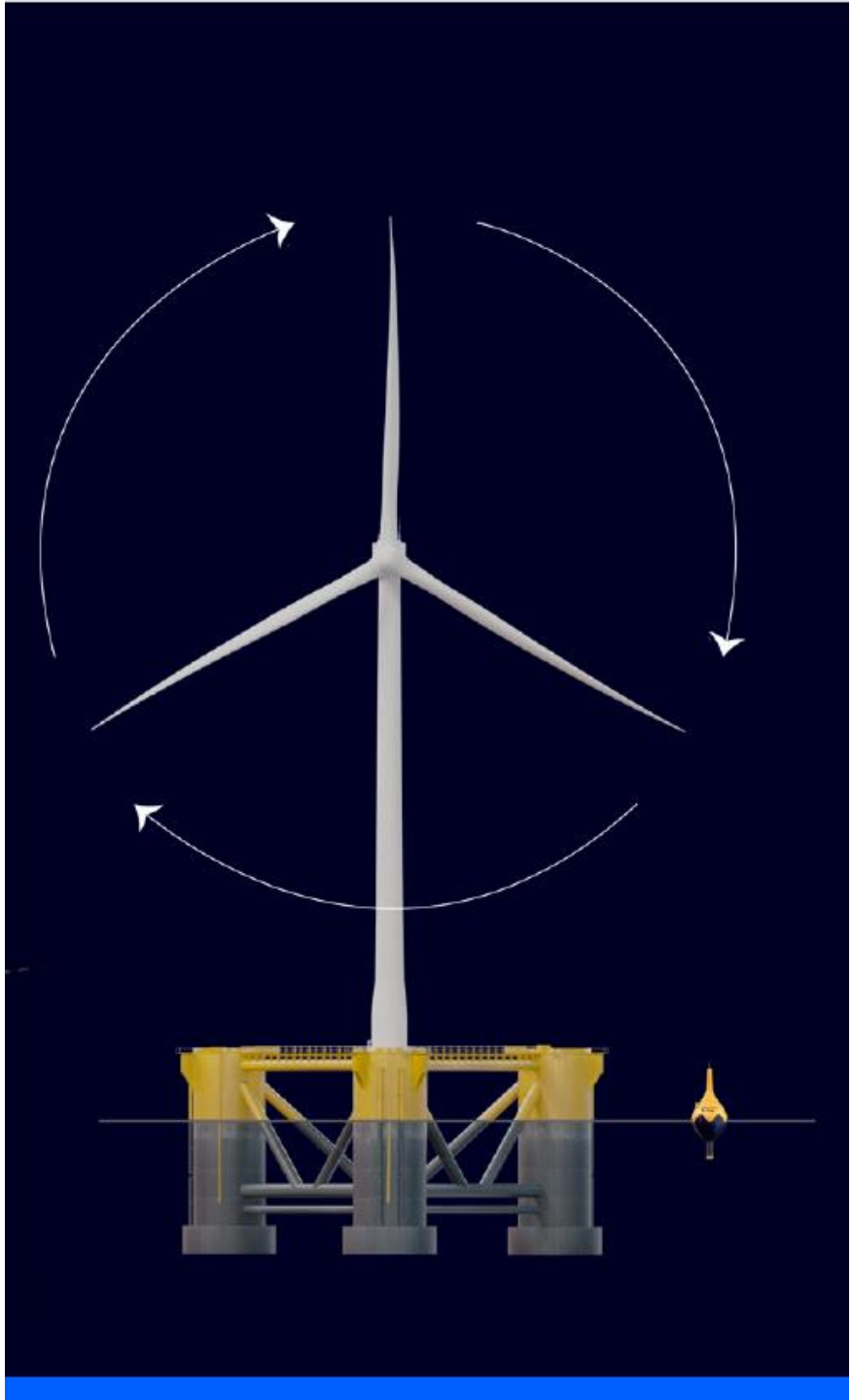
Small devices for mass manufacturing

- High replicability
- Installation doesn’t need huge expensive ships



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IDOM – Spanish developer: deployment in the Basque Country


Air Chamber Turbine
SIEMENS
Ocean Energy Ireland – (IE, US)

Wave prototypes validated, pilot farms in development


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160 devices pipeline until 2030

- 19 farm projects
- EU + UK
- Publicly supported
- Accelerating towards industrialisation

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Growing interest from energy majors and institutional investors

Qair

sev

TotalEnergies

SEB

Santander Asset Management

ESB Energy for generations

ENGIE

equinor

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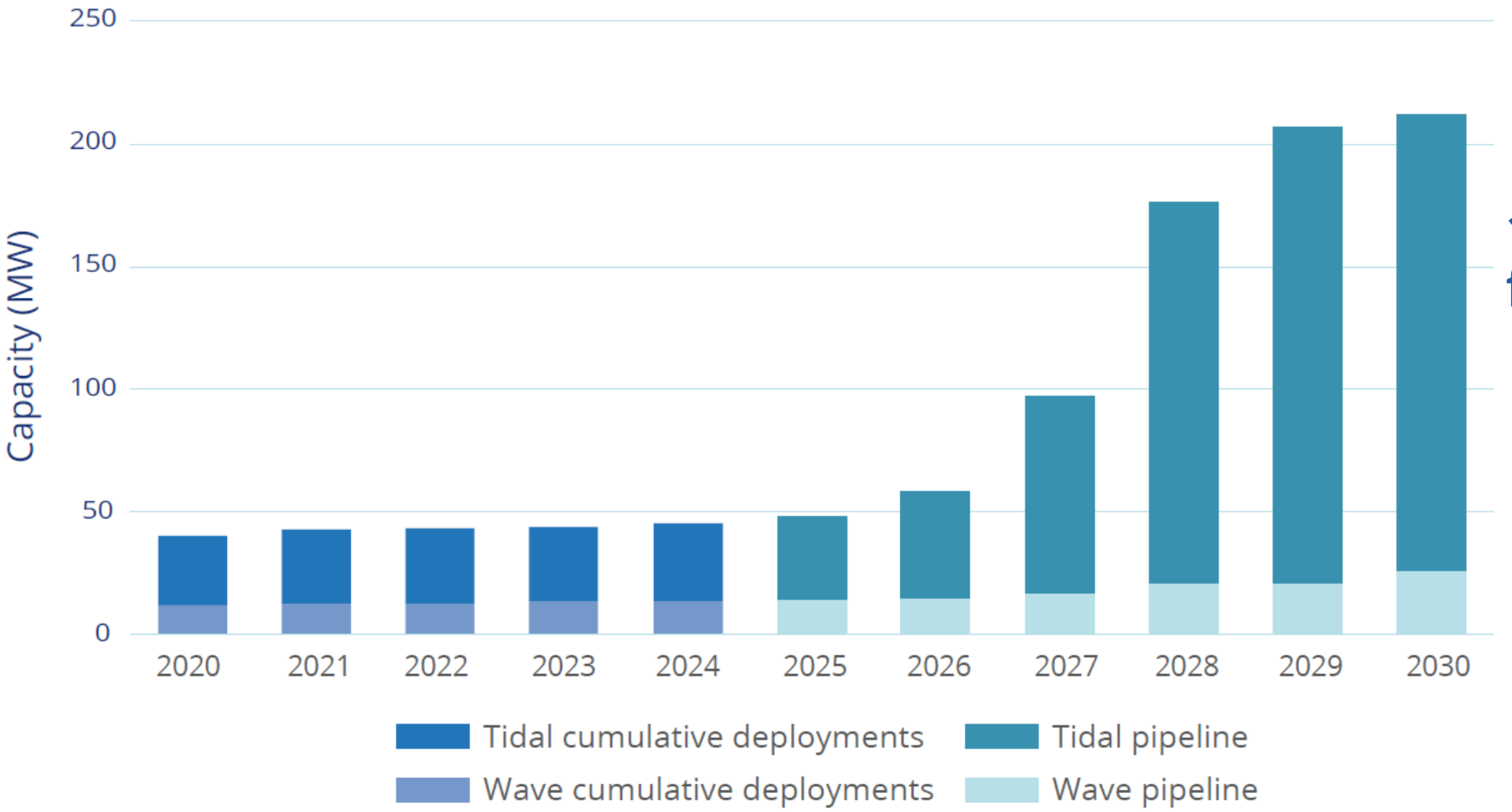
New generation of farms kick-starts large-scale deployment



190 MW over 19 farms by 2030 = 160 Devices

Figure 1: Ocean energy cumulative deployments and pipeline

Source: Ocean Energy Europe, UK & FR governments, Horizon Europe and Innovation Fund call results.

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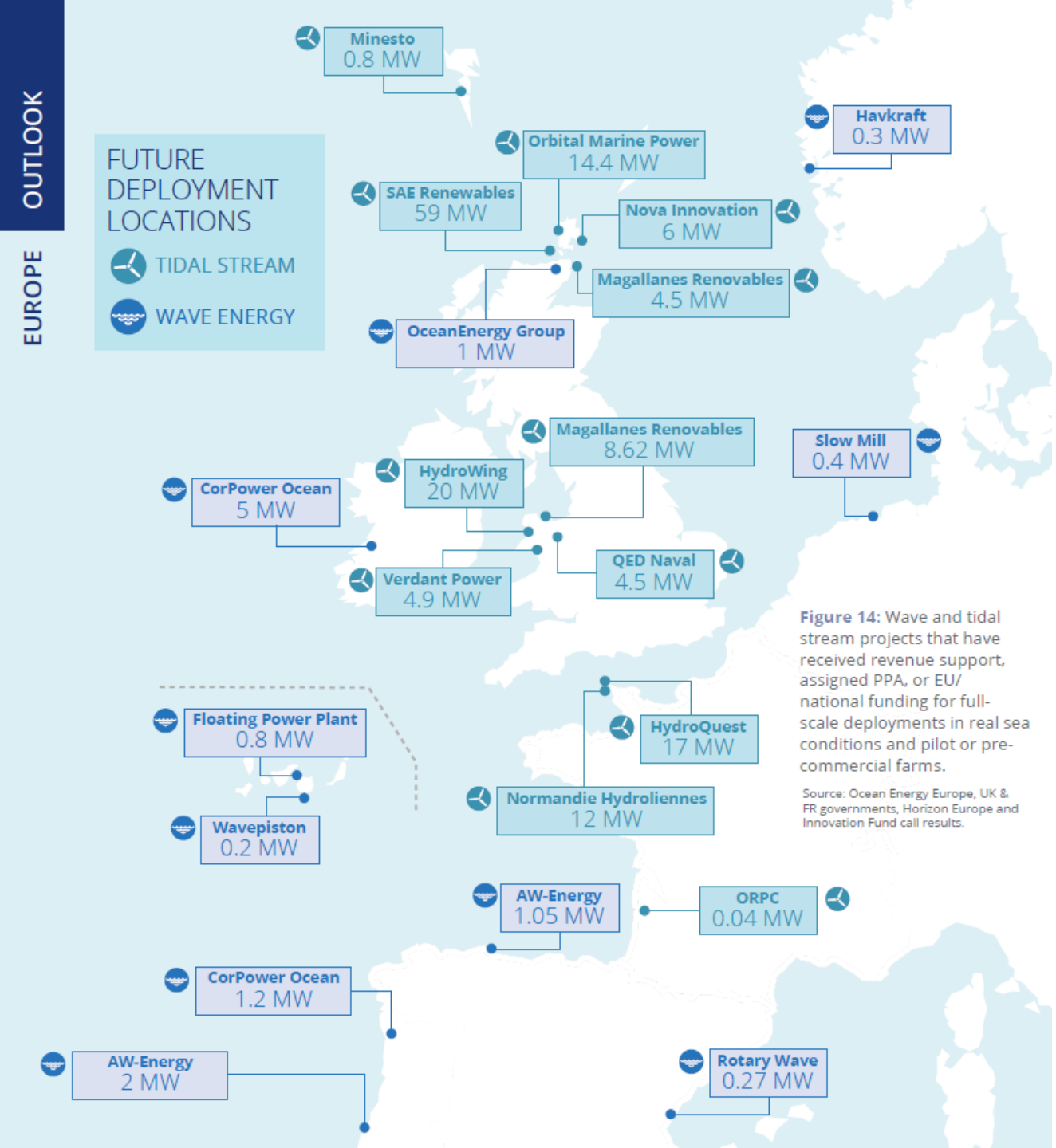

Figure 14: Wave and tidal stream projects that have received revenue support, assigned PPA, or EU/ national funding for full-scale deployments in real sea conditions and pilot or pre-commercial farms.

Source: Ocean Energy Europe, UK & FR governments, Horizon Europe and Innovation Fund call results.

19 Farms
160 Devices
Project Pipeline
→ 2030

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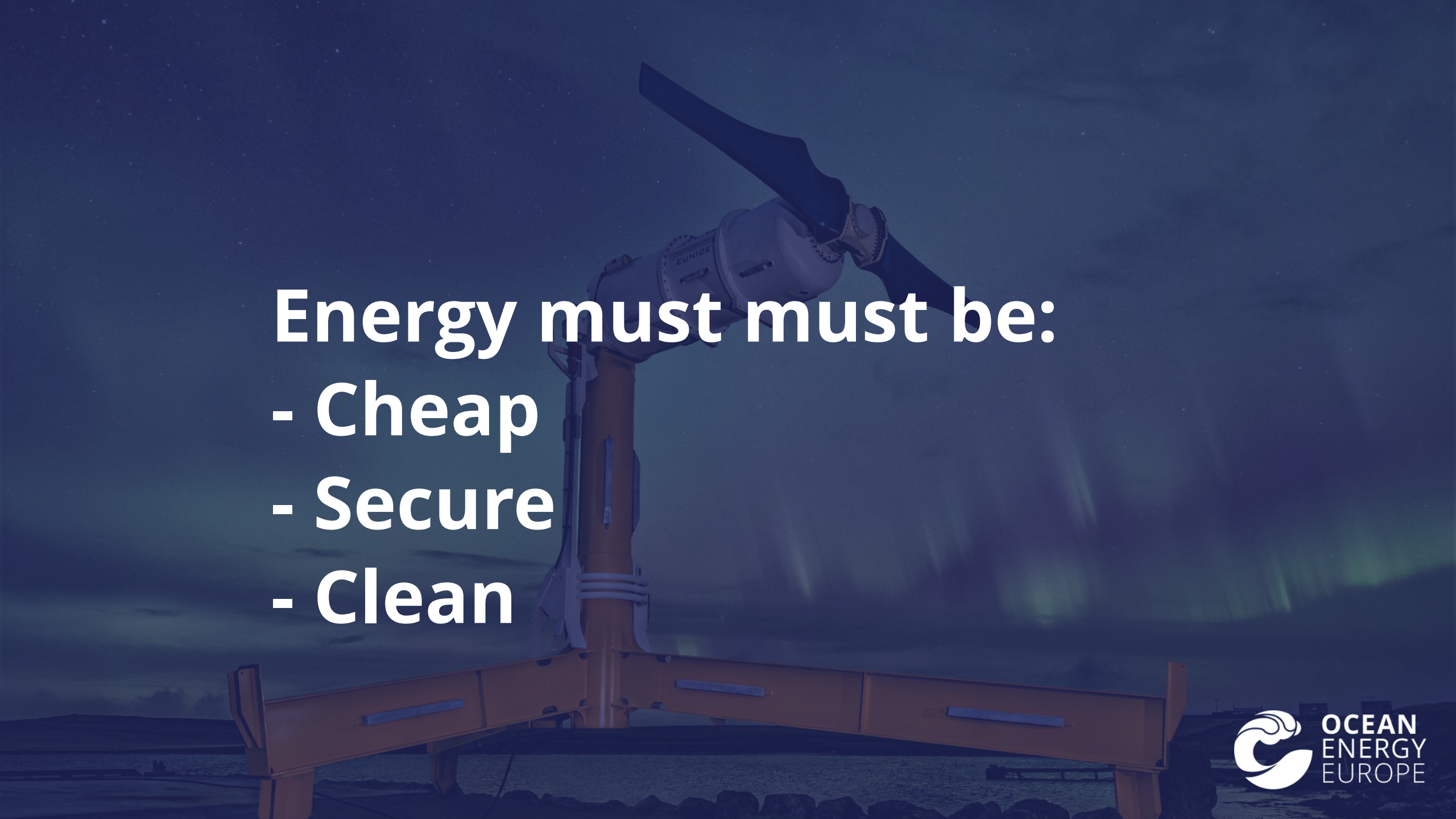
Why Europe needs ocean energy
System benefits and other advantages



Energy must must be:

- Cheap
- Secure
- Clean

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Ocean energy = flexibility

- Produce at different times than wind and solar
- Tidal is 100% predictable

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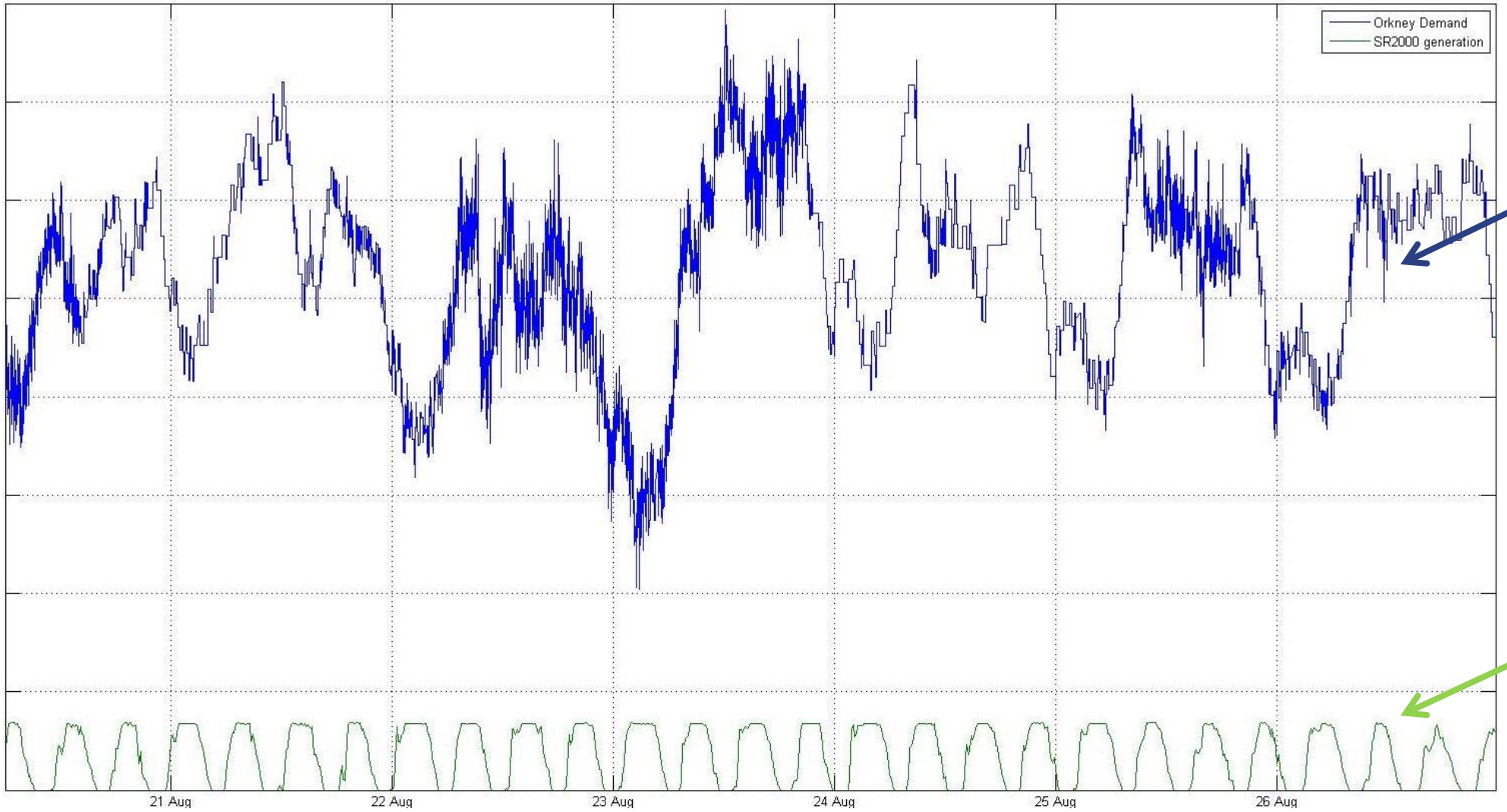
Tidal is 100% predictable and consistent



Orkney Islands grid demand

One 2MW turbine production

Source: Orbital Marine Power

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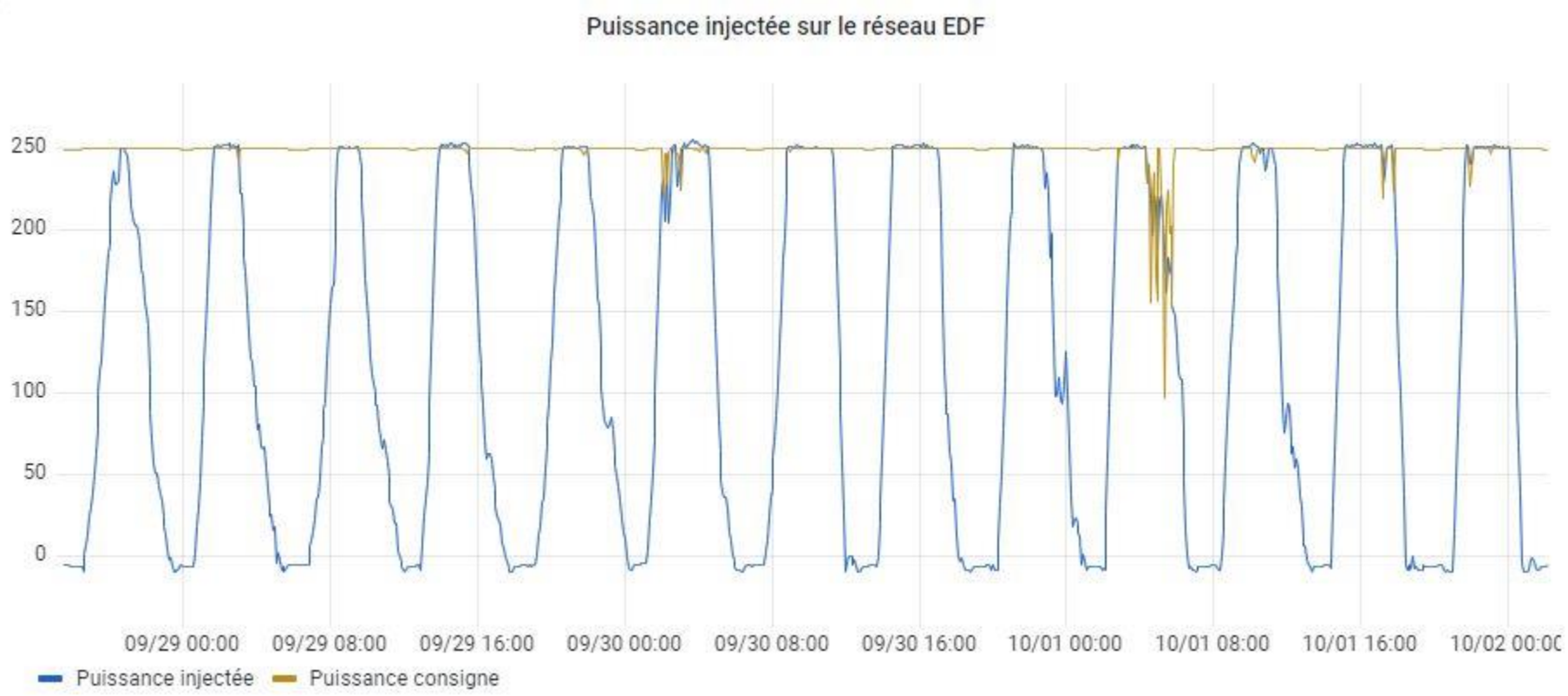
Consistent and predictable power from Tidal Energy (Ouessant Island)



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Ocean energy = flexibility

- Produce at different times than wind and solar
- Tidal is 100% predictable
- Wave highly predictable as created by wind with a 2-3h delay
- Smoother production profile & balanced power system
- **Lower system costs**

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Wave produces more in winter when solar is low

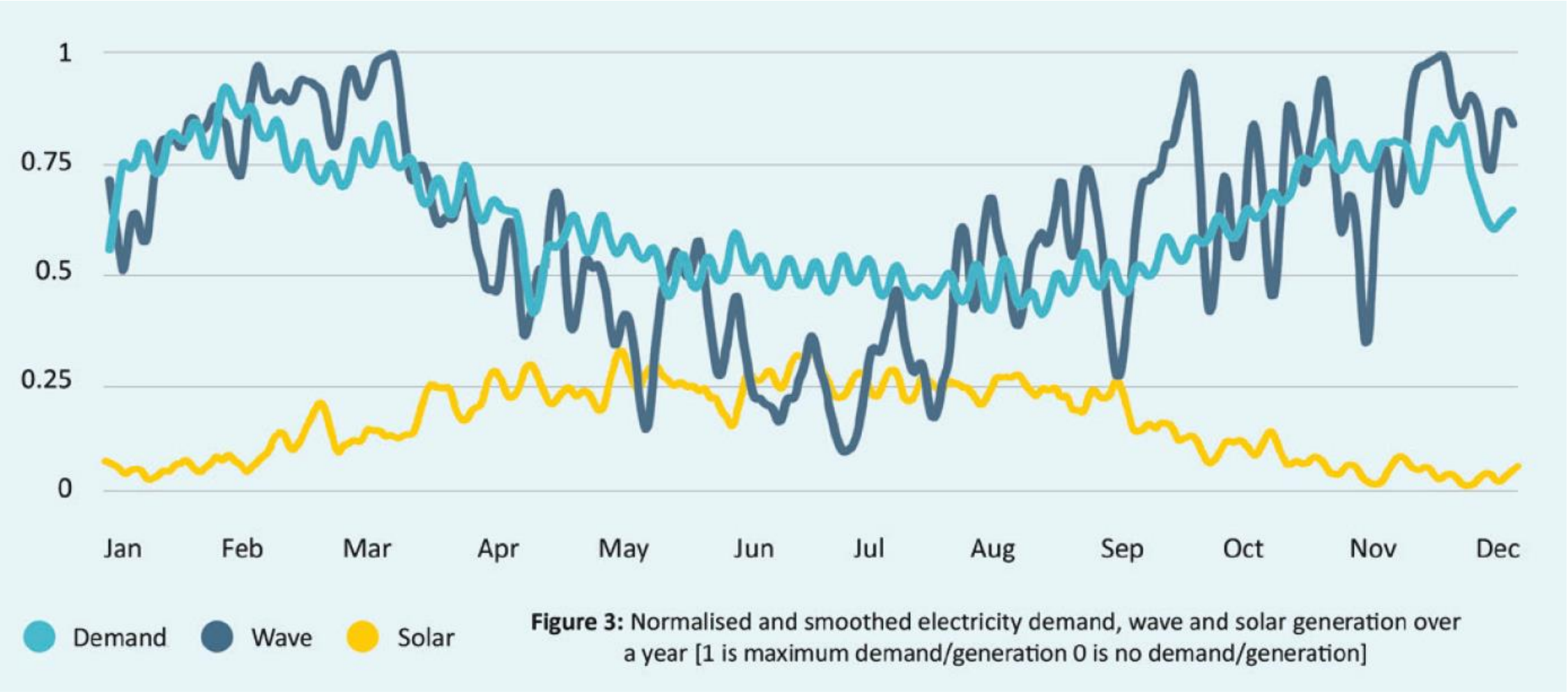

Figure 3: Normalised and smoothed electricity demand, wave and solar generation over a year [1 is maximum demand/generation 0 is no demand/generation]

Source: ETIP Ocean

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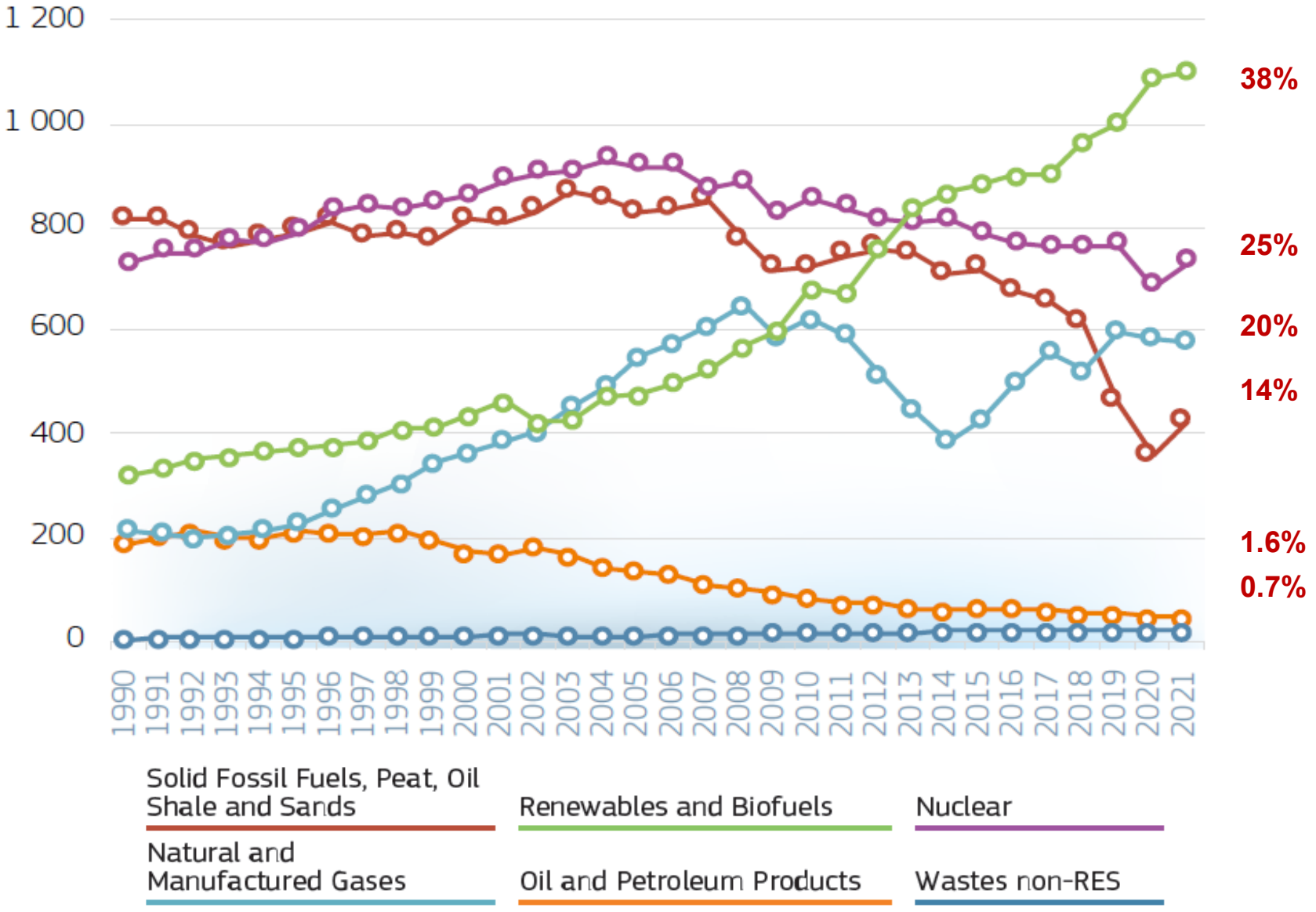
Energy system and decarbonisation

Ocean Energy contribution



2023

38% 44%

25%

20%

14%

1.6%

0.7%

Half of EU electricity is renewable in 2025

Eurostat: 2023 EU Statistical Pocketbook on Energy, in TWh

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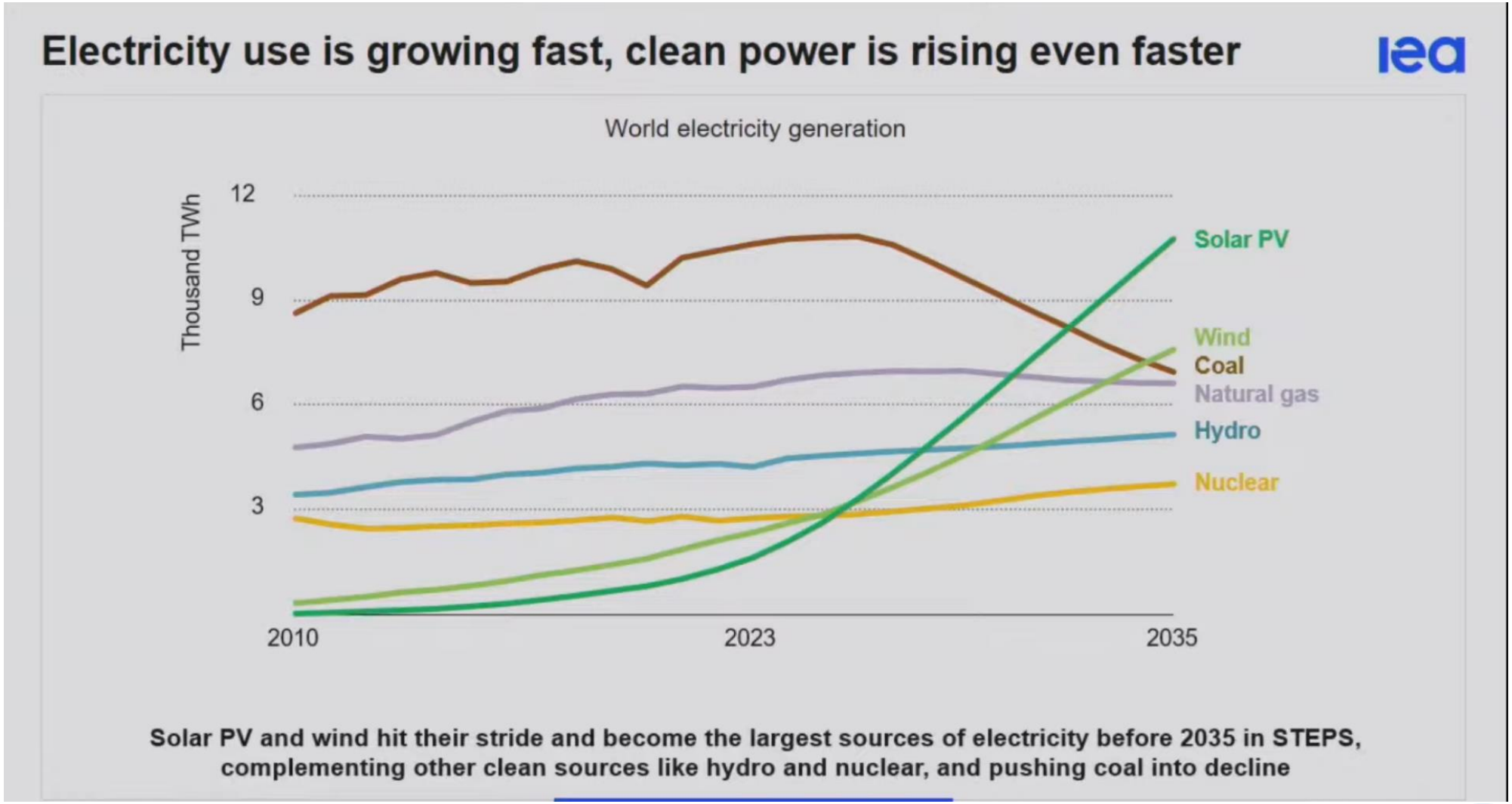
Renewables will be biggest power source by 2050



Source: IEA (2024), World electricity generation in the Stated Policies Scenario, 2010-2035

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But what about the environment?

No collisions ever recorded

- All projects do impact assessment and environmental monitoring
- 2024 State of the Science report shows **no risks** from:
  - Underwater noise
  - Electromagnetic fields
  - Habitat & system change
- Devices move slowly and predictably

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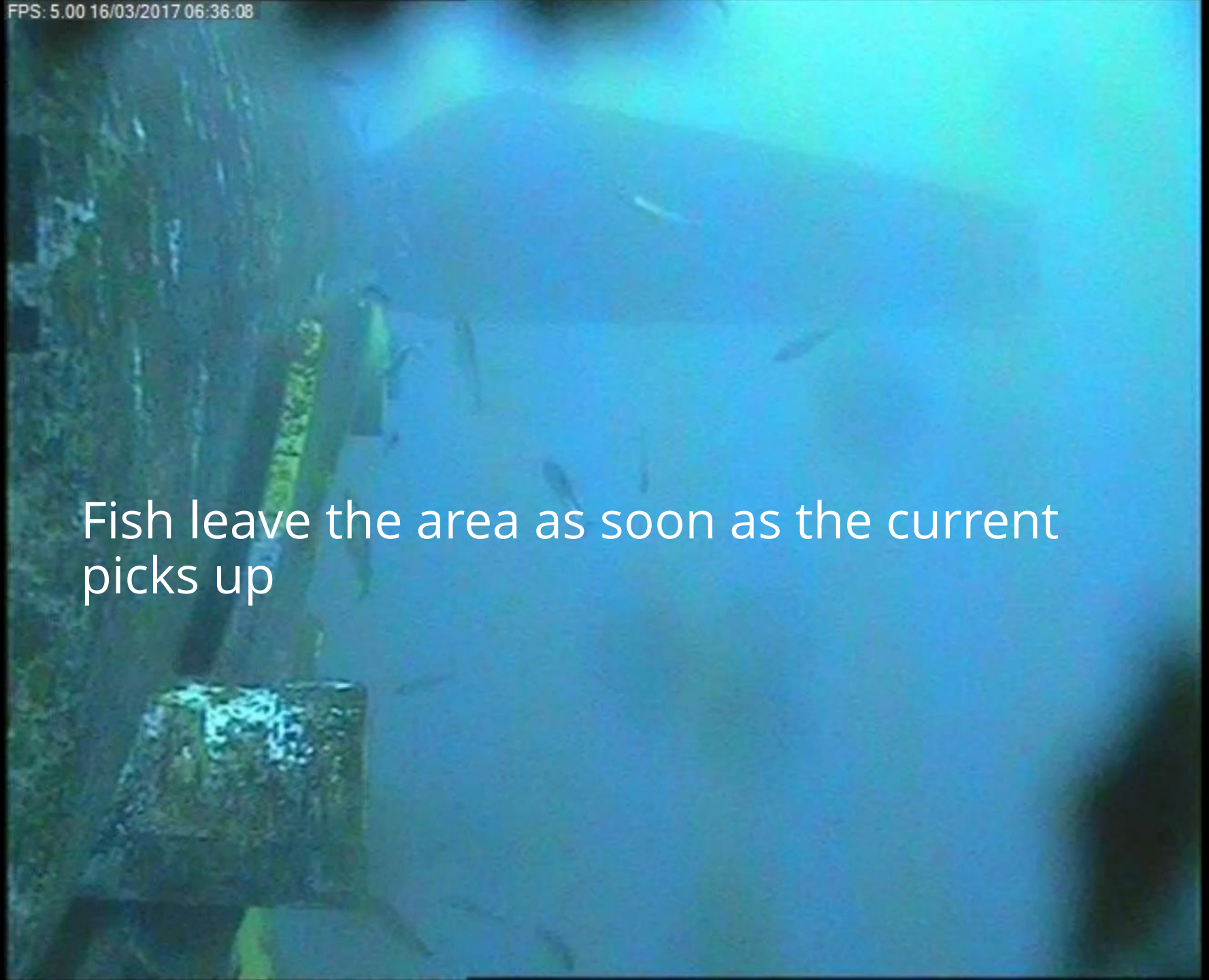
FPS: 5.00 16/03/2017 06:36:08
Fish leave the area as soon as the current picks up

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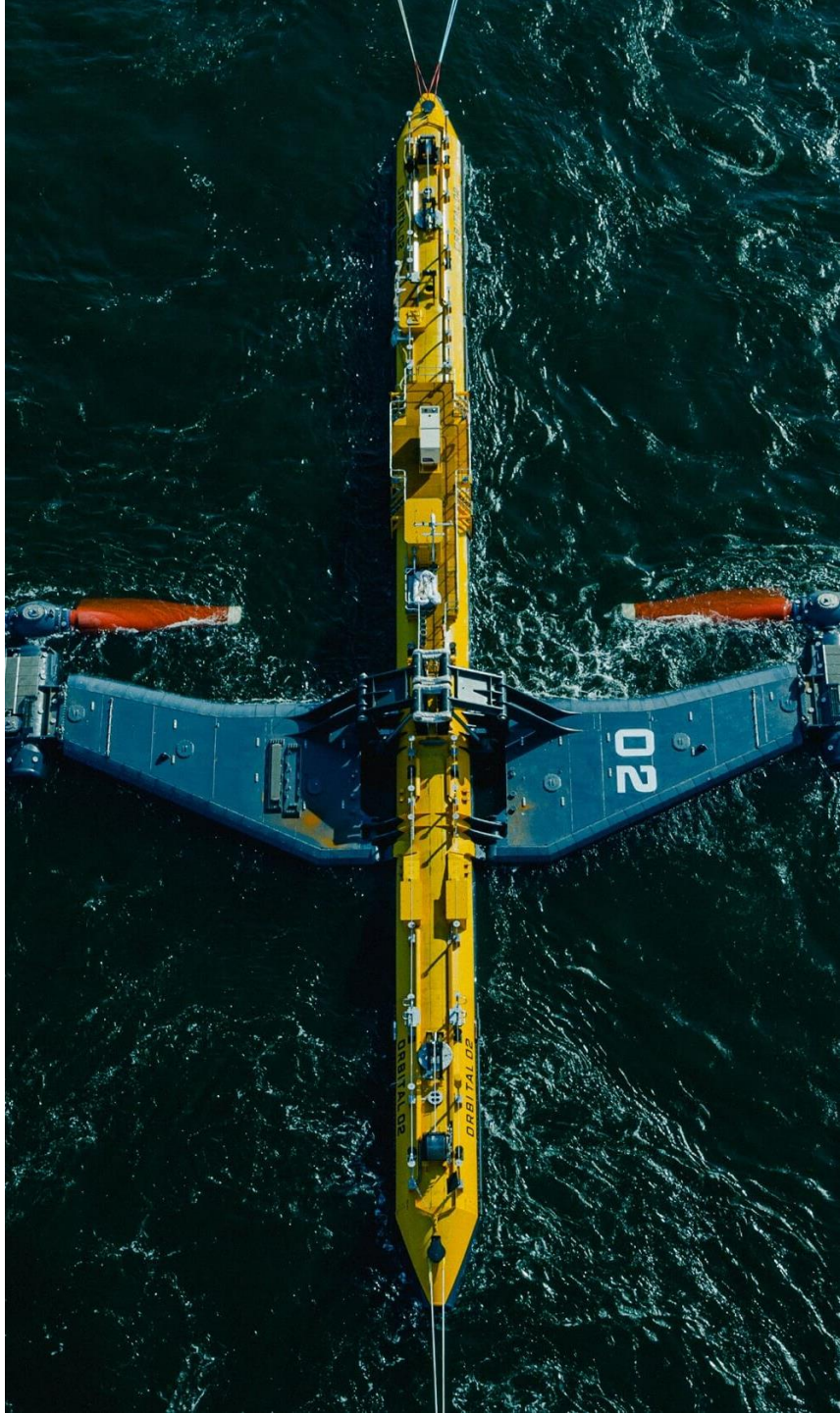

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