Ocean energy – State of the industry and Ocean Energy Forum Roadmap

Remi GRUET, CEO, Ocean Energy Europe

Who we are

- 117 member companies
- Our Lead Partners:

Ocean Energy

5 Resources – 5 technologies – 5 opportunities

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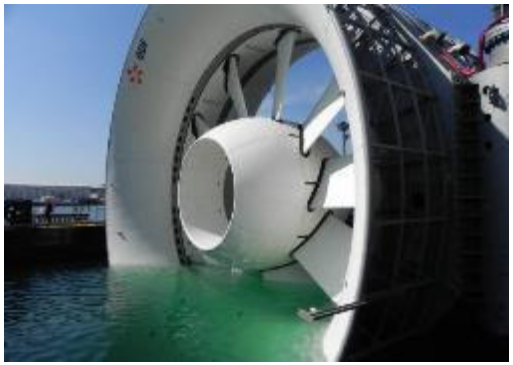
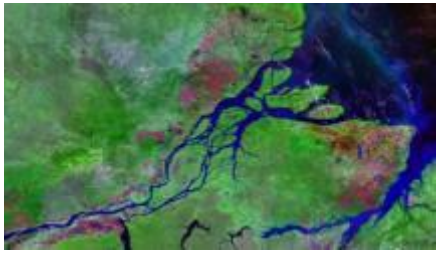
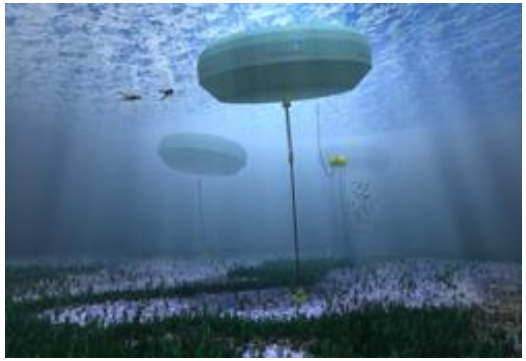


Tidal stream

Ocean Thermal Energy Conversion



Salinity gradient



Wave

Tidal range

Worldwide potential for ocean energy

- Global potential (IEA)
  - 29 500 TWh for wave devices
  - 7 800 TWh for Tidal energy
  - 44 000 TWh for OTEC
  - 1 650 TWh for salinity gradient
- Plausible buildout by 2050
  - 337 GW ocean energy by 2050
  - 1180 TWh/year electricity generation
- EU electricity consumption = 3,000 – 3,300 TWh/year

Source: IEA-OES Annual Report 2015

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Key benefits

- Renewable
  - No health/climate/envi impacts
  - Indigenous economic dev
- For all
  - centralised or decentralized
- Very predictable
  - works well with other RES
- Affordable
  - By 2030 100€/mWh for tidal
  - Average price of electricity in EU = 200€/MWh

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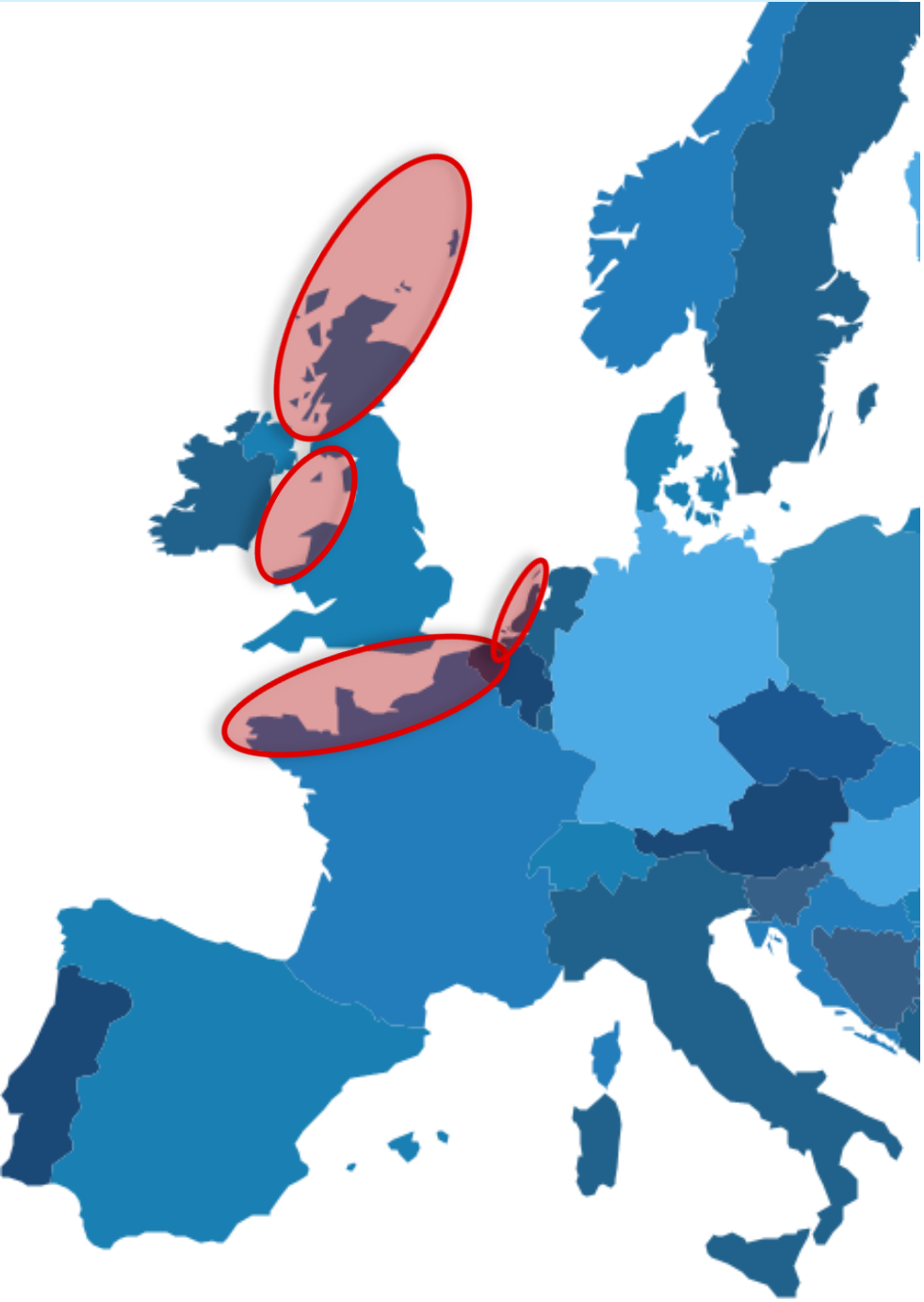
2050 Target for Europe

- 100GW wave & tidal energy by 2050
- 10% of EU electricity demand

Where are we today?



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Tidal take-off in Northern Europe

- Scotland
- Wales
- French Channel
- Netherlands

2016 Take-off year
Tidal: MW-size turbines

France
- Sabella 1 MW
  (Ushant Island)

Scotland
- Scotrenewables 2MW
  (Fall of Warness)

Netherlands
- Tocardo 1.25 MW
  (Eastern Scheldt dam)

2016 Take-off year
Tidal: first farms in the water

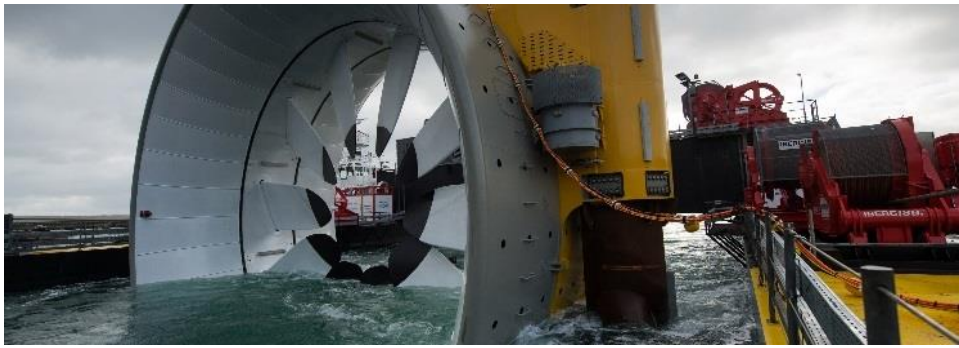
France

- DCNS/EDF (Paimpol-Bréhat)

Scotland

- Nova Innovation (Shetland Islands),

- MeyGen (Pentland Firth) 6 MW capacity (4 x 1.5 MW), biggest tidal energy farm to date.



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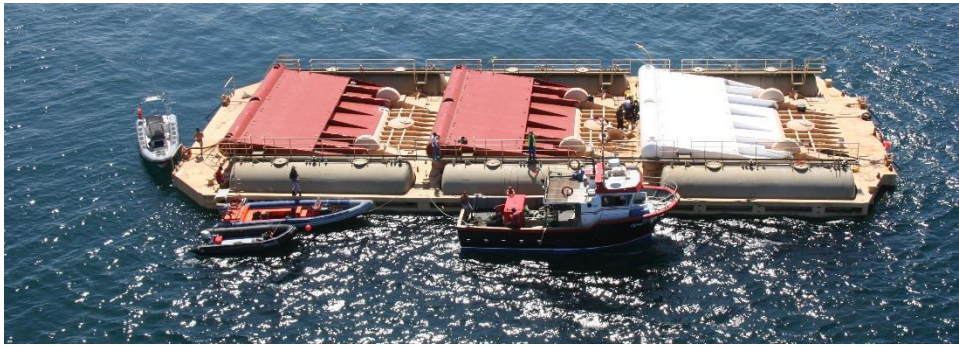
Early wave potential across Europe

- UK
- Ireland
- Portugal
- Spain
- Italian islands

2016 Take-off year
Wave: technology progressing

United Kingdom
- Wello, 1 MW, 2016

Portugal
- AW-Energy, 0.35 MW, 2016



Italy
- Wave for Energy, 0.2 MW, 2015

Global take-off for wave and tidal in coming years

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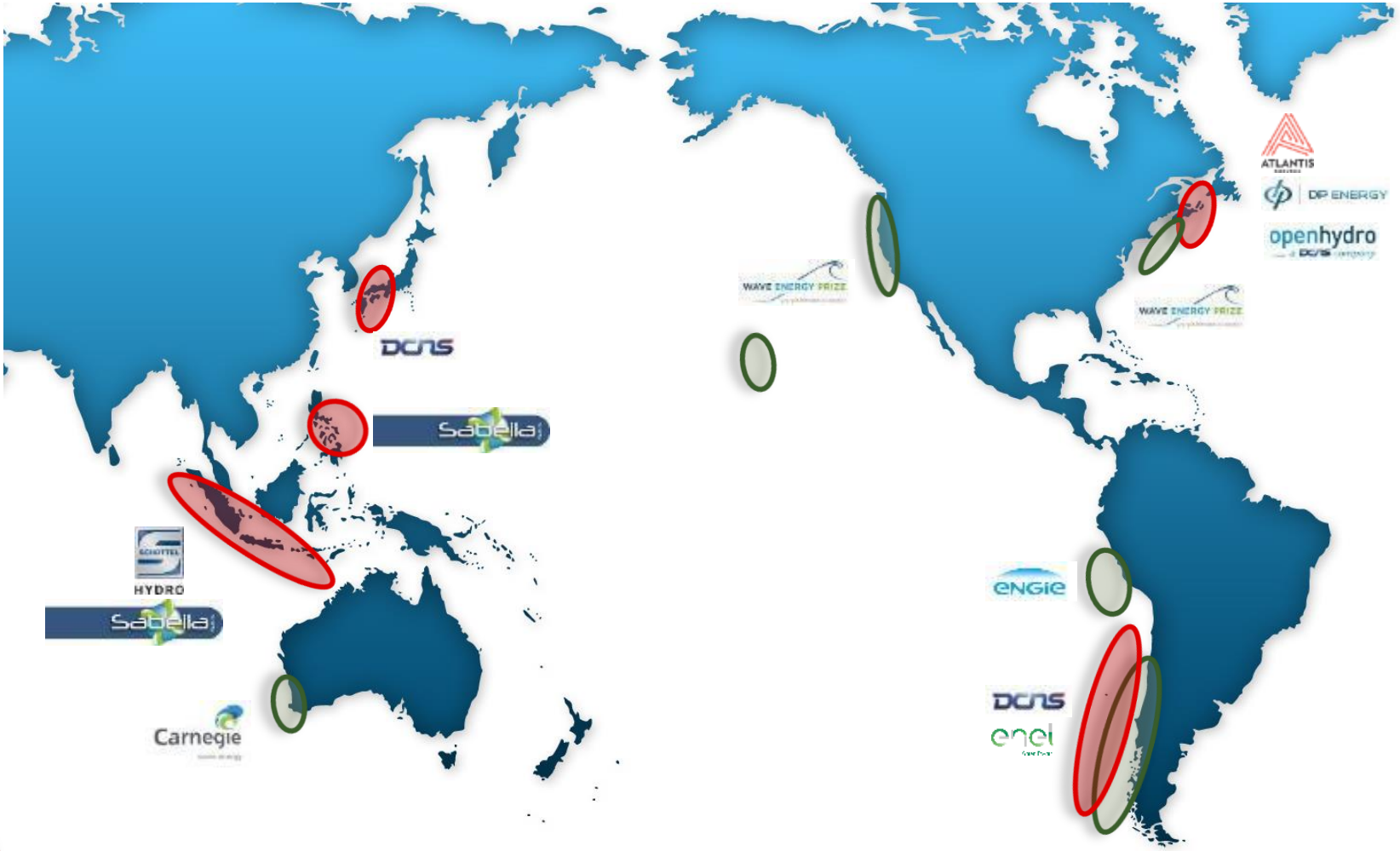

Tidal

Wave

Ocean Energy Forum
Before the Roadmap…

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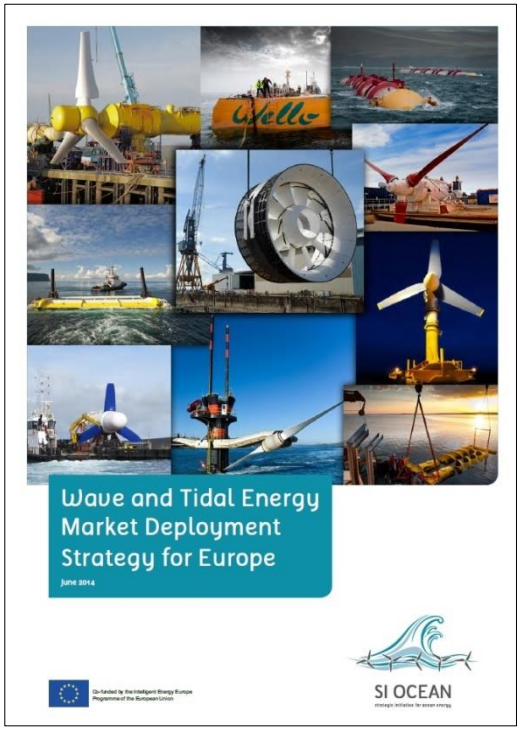
EUROPEAN
COMMISSION

Brussels, 20.1.2014
COM(2014) 8 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Blue Energy

Action needed to deliver on the potential of ocean energy in European seas and oceans by 2020 and beyond
{SWD(2014) 12 final}
{SWD(2014) 13 final}



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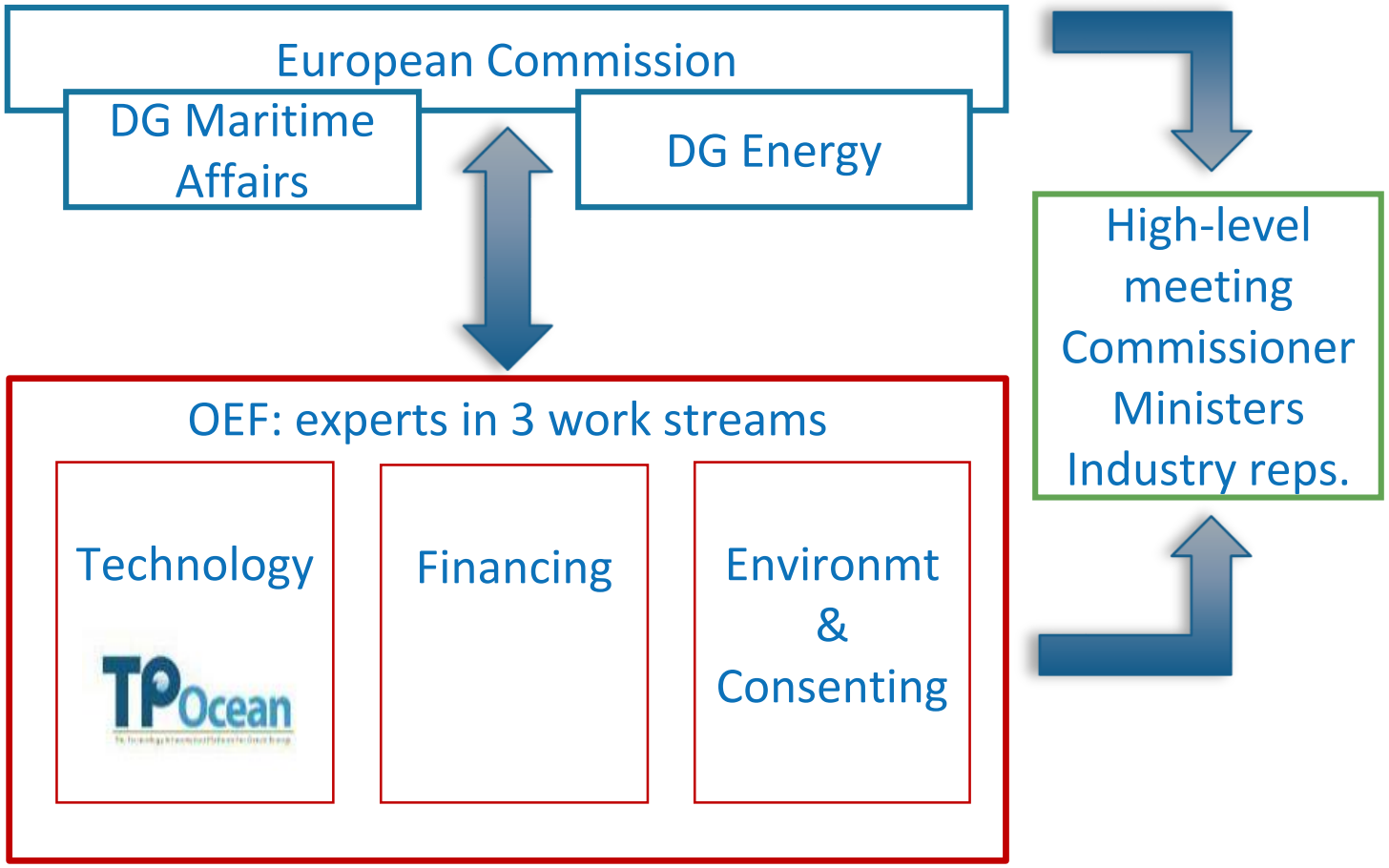
Ocean Energy Forum Roadmap

- Objective: industrial roll-out
- Informing decision-makers
- Industry consensus on challenges and solutions
- In depth look at targeted financing

Ocean Energy Forum structure



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Ocean Energy Forum

- 2.5 years of work
- 150+ experts
- Cross-sectoral consultations to reach consensus

- Per development phase
  - Identify challenges
  - Tackle barriers
  - Propose solutions

4 Phases to industrial roll-out

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R&D

- Small-scale or component testing

TRL 1-4

Prototype

- Single full-scale devices with full-scale components
- Deployed at sea
- Producing power
- Not necessarily grid connected

TRL 3-6

Demonstration

- Series (3 or more) of full-scale devices
- Deployed in real sea condition
- Grid-connected
- For OTEC and salinity gradient: full-functionality down-scaled power plant

TRL 5-7

Pre-Commercial

- Series (4 or more) of full-scale devices experiencing wake interactions
- Connected to a hub or substation (array)
- Deployed in real sea condition
- Feeding power to the grid
- For OTEC and salinity gradient: scalable

TRL 6-8

Industrial Roll-Out

- Full-scale commercial ocean energy power plant or farms
- Deployed in real sea condition
- Mass production of off-the-shelves components and devices

TRL 7-9

4 solutions across 4 phases

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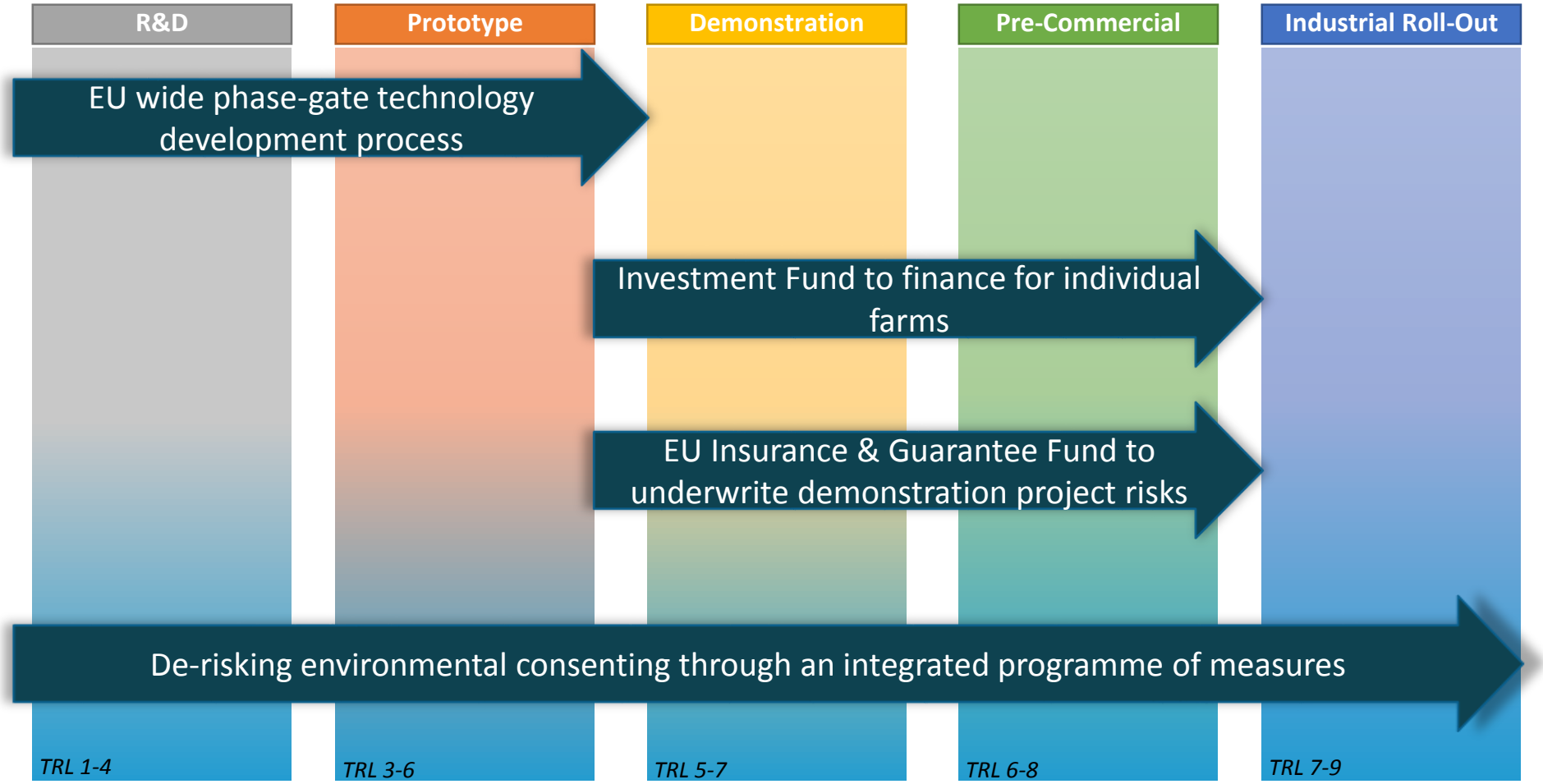

Demonstration & pre-commercial phases - challenges and solutions

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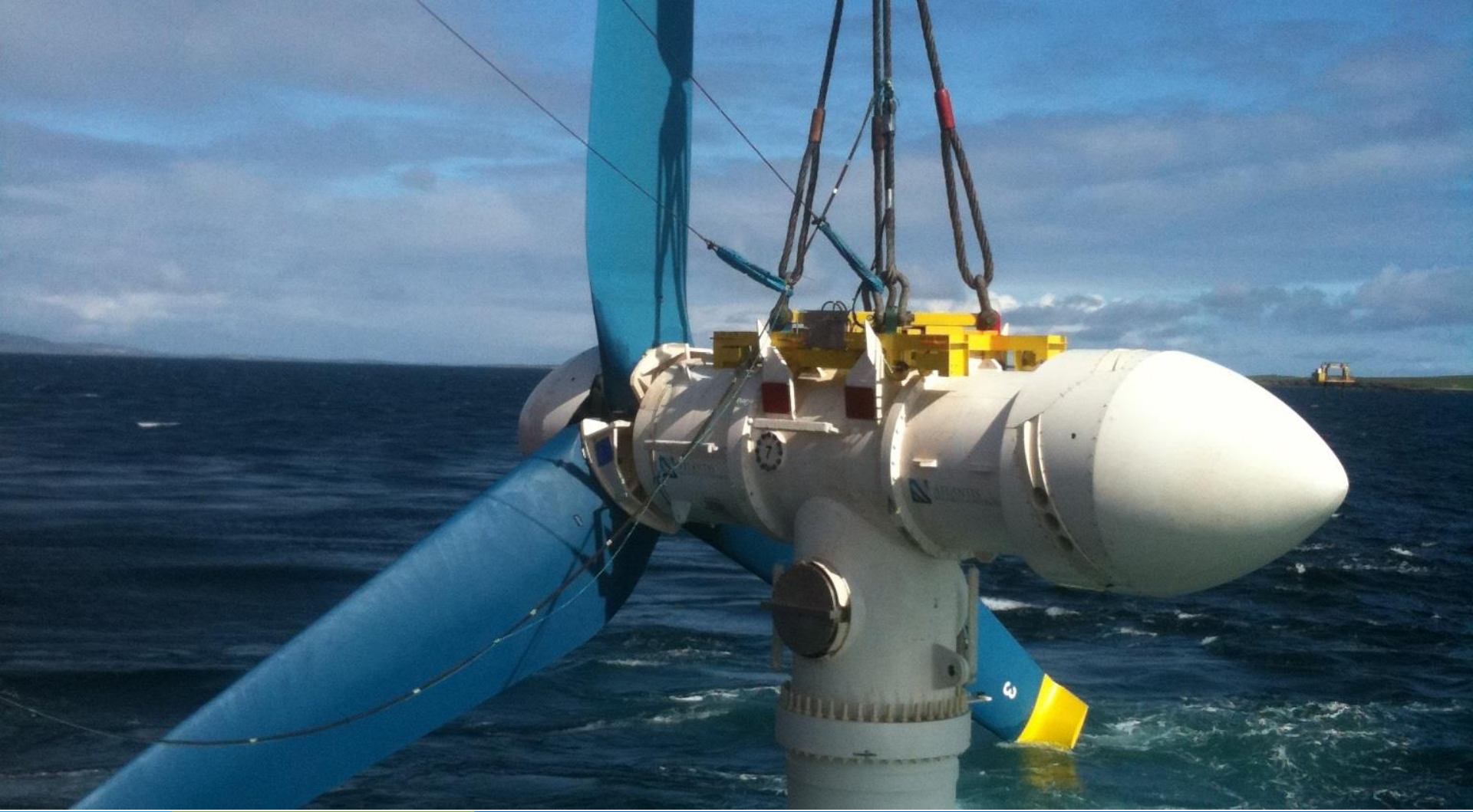
- Identified challenges
  - CAPEX-intensive – high upfront investments
  - Innovation => uncertainties => risk => cost
  - Limited pool of investors in today's market
  - Need to bring the grid to the resource
- Objective – financial instruments
  - De-risk projects
  - Give private investors a resonable risk/return
  - Gather data to improve knowledge and devices
- Solutions
  - Insurance and Guarantee Fund
  - Investment platform

Conclusions - Getting Ocean Energy to industrial roll-out

- 2016 is kick-off year for ocean energy
  - EU farms in the water, many in the pipeline
  - Global push for development
- EU is and has a chance to stay N°1 in Ocean Energy
- Research and Innovation needs to continue
  - Improve reliability, reduce costs
- Strong focus on demonstration/pilot farms needed
  - Emerging technologies have to be supported to deliver their economic and environmental benefits
  - Tailor made financial instruments required: NER300, innovation fund, InnovFin, investment platform



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