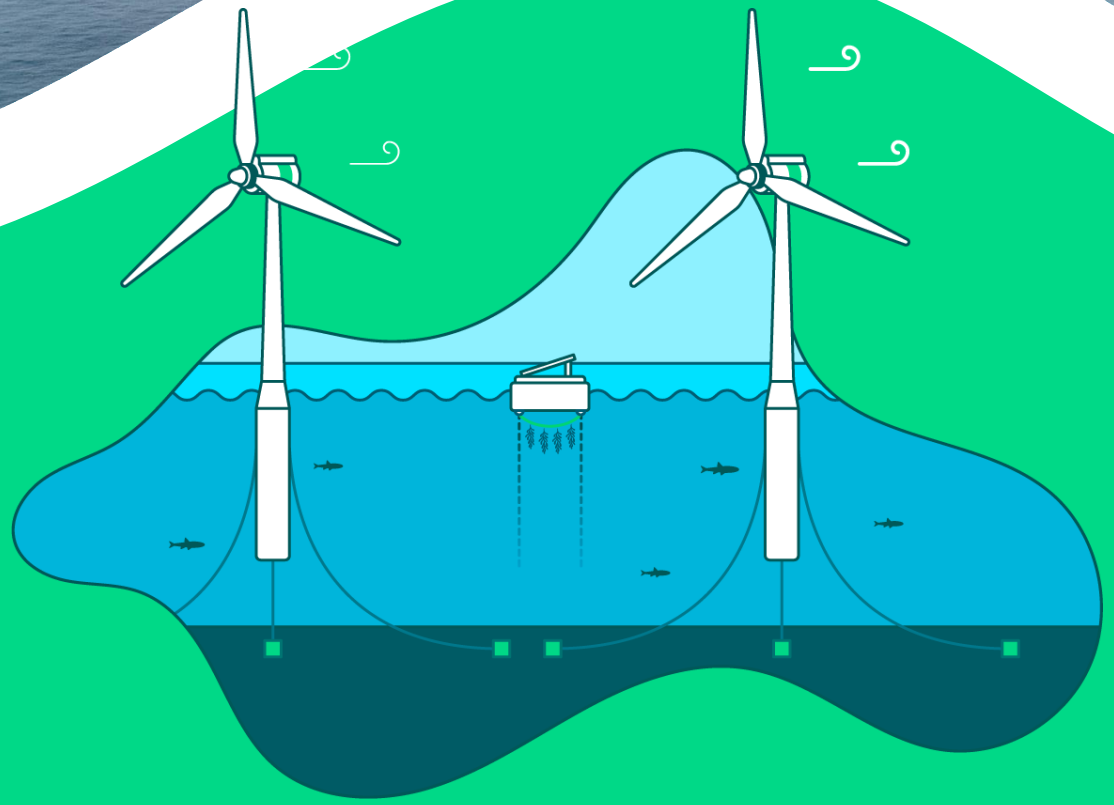
NiD4 OCEAN

Innovators Making Waves:

Nature-Inclusive Concepts for Floating Offshore Wind

21 April, Madrid



Funded by the European Union

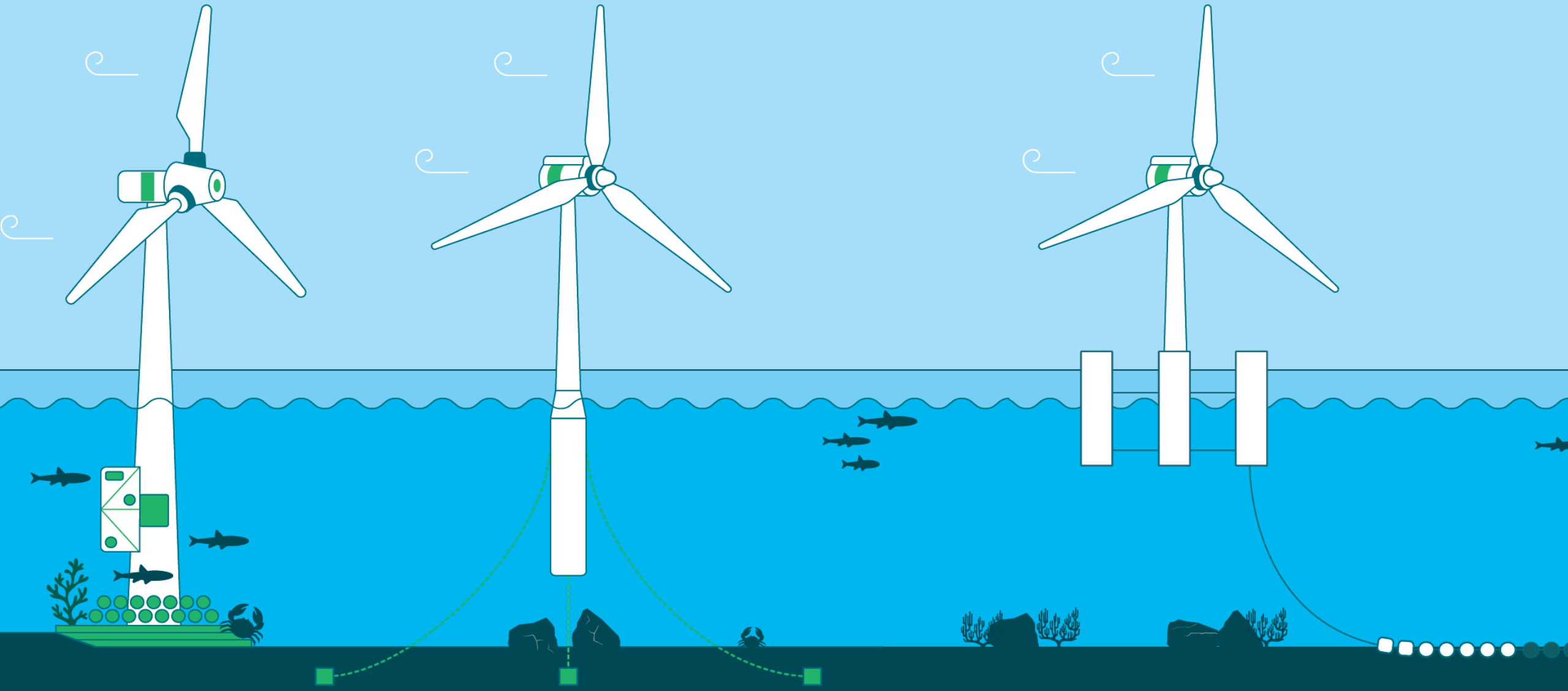
Agenda

Innovators Making Waves: Nature-Inclusive Concepts for Floating Offshore Wind
1. Setting the Scene
2. Innovation Challenge for SMEs: Lightning Talks
3. Panel Discussion: Opportunities and Challenges of NID in Floating Offshore Wind Infrastructure
4. Innovation Challenge for Universities: Lightning Talks
5. Next steps for the NiD4OCEAN project and closing remarks
6. Networking and Poster Presentations

Antonios Emmanouil

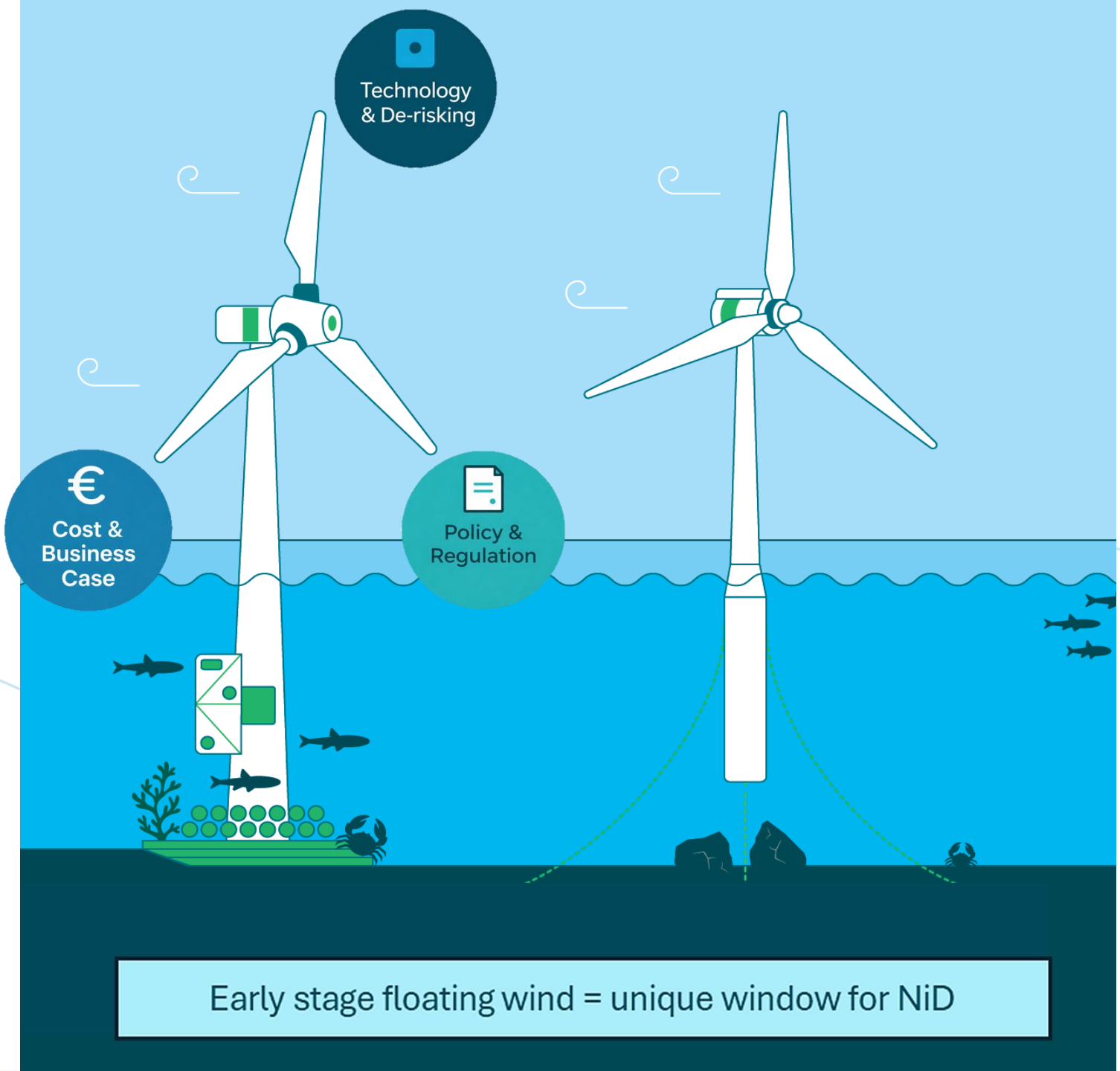
Advisor and Researcher Hydrodynamics and Offshore, Deltares

Nature-Inclusive Concepts in a Changing Ocean



Different seas → Different ecologies → Different NiD

Why innovation matters and why it matters now?



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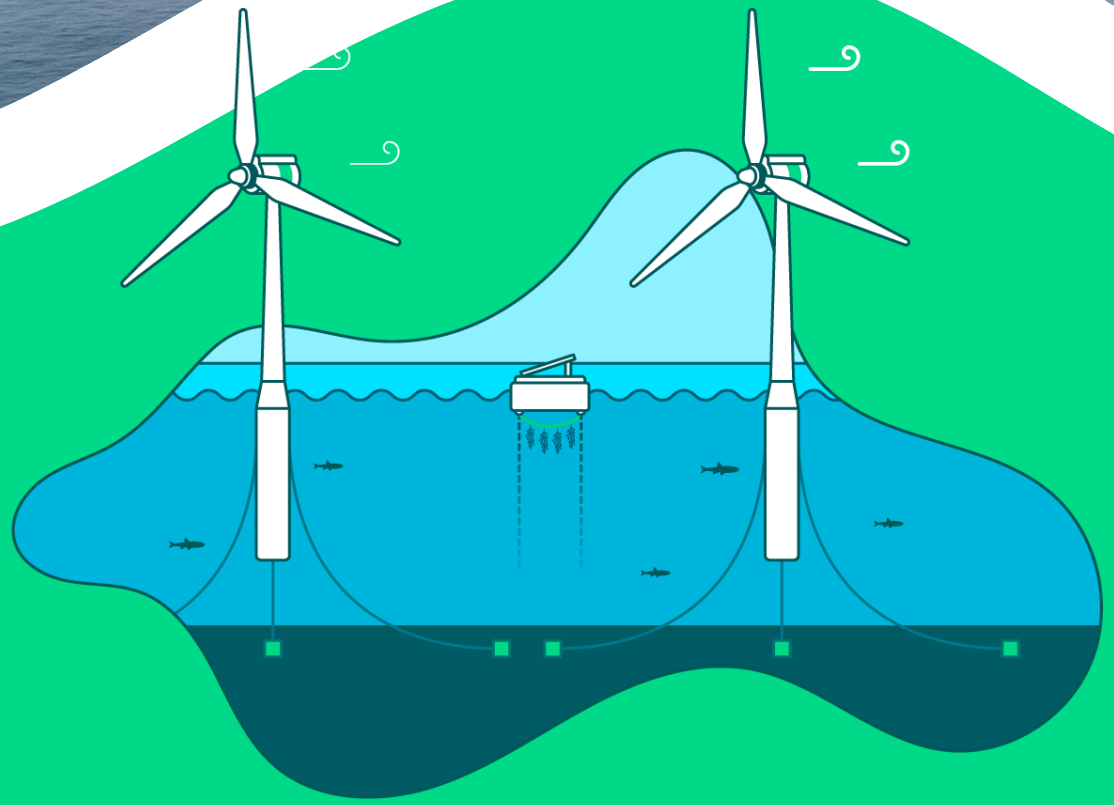


Funded by the European Union

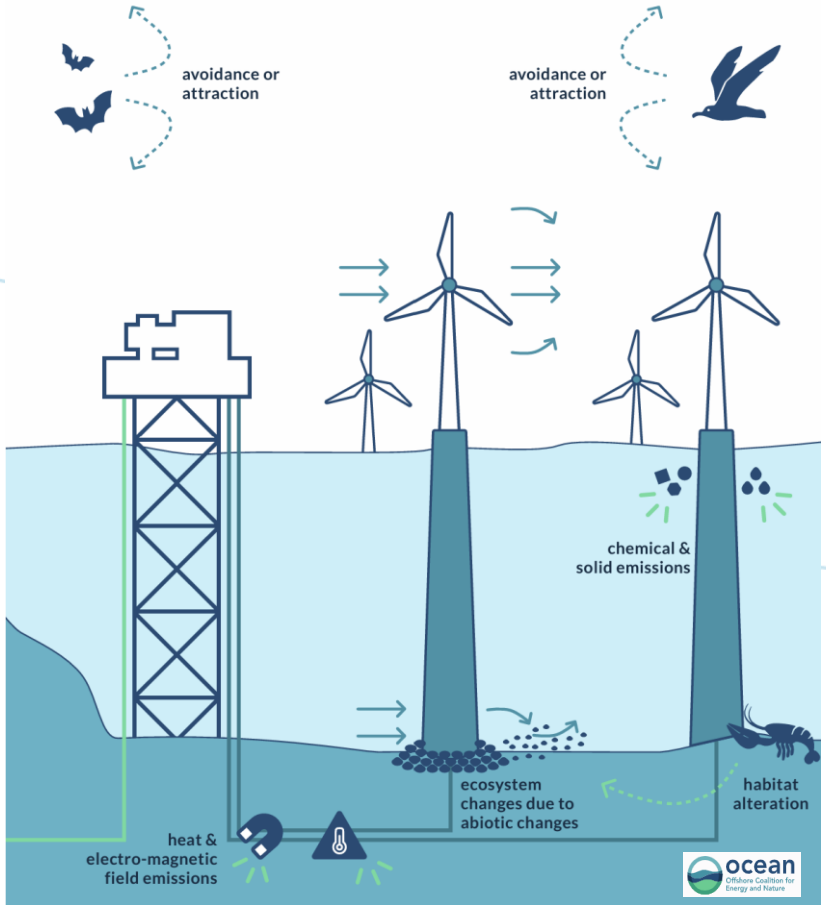
Marta Moyano

Senior Researcher, Norwegian Institute for Water Research (NIVA)

What are NiDs?

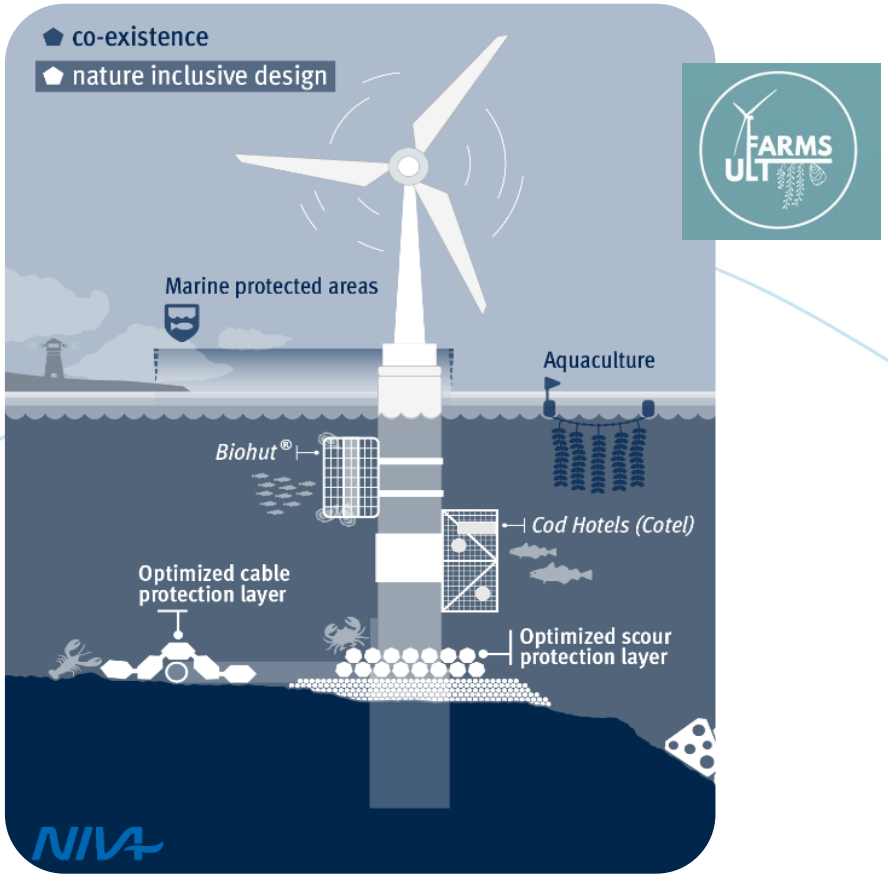
Mitigation measures vs Nature-inclusive designs (NiDs)

Measures to reduce, minimize negative effects (e.g. noise, EMF, collisions)



Nature-inclusive concepts

Measures that create optimized artificial habitat to enhance selected biodiversity assets (e.g. species, functions)



NiD4OCEAN - Nature-inclusive Designs for Reconciling Offshore Renewables with Ocean Protection

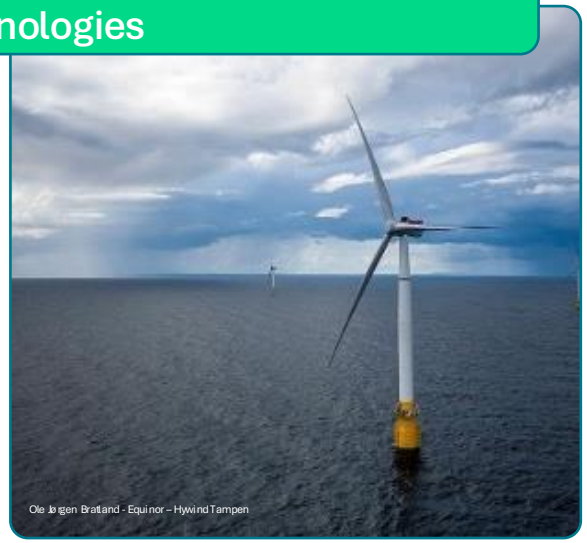
Horizon Europe Program Grant Agreement: 101156861
October 2024 – September 2027 (3 yrs)

Overall goal: to advance the emerging field of NiDs for offshore renewables, and provide effective, context-dependent solutions to industry, managers, and policymakers, towards achieving the global and EU targets for carbon neutrality, biodiversity restoration and sustainable blue economy.

From existing solutions...

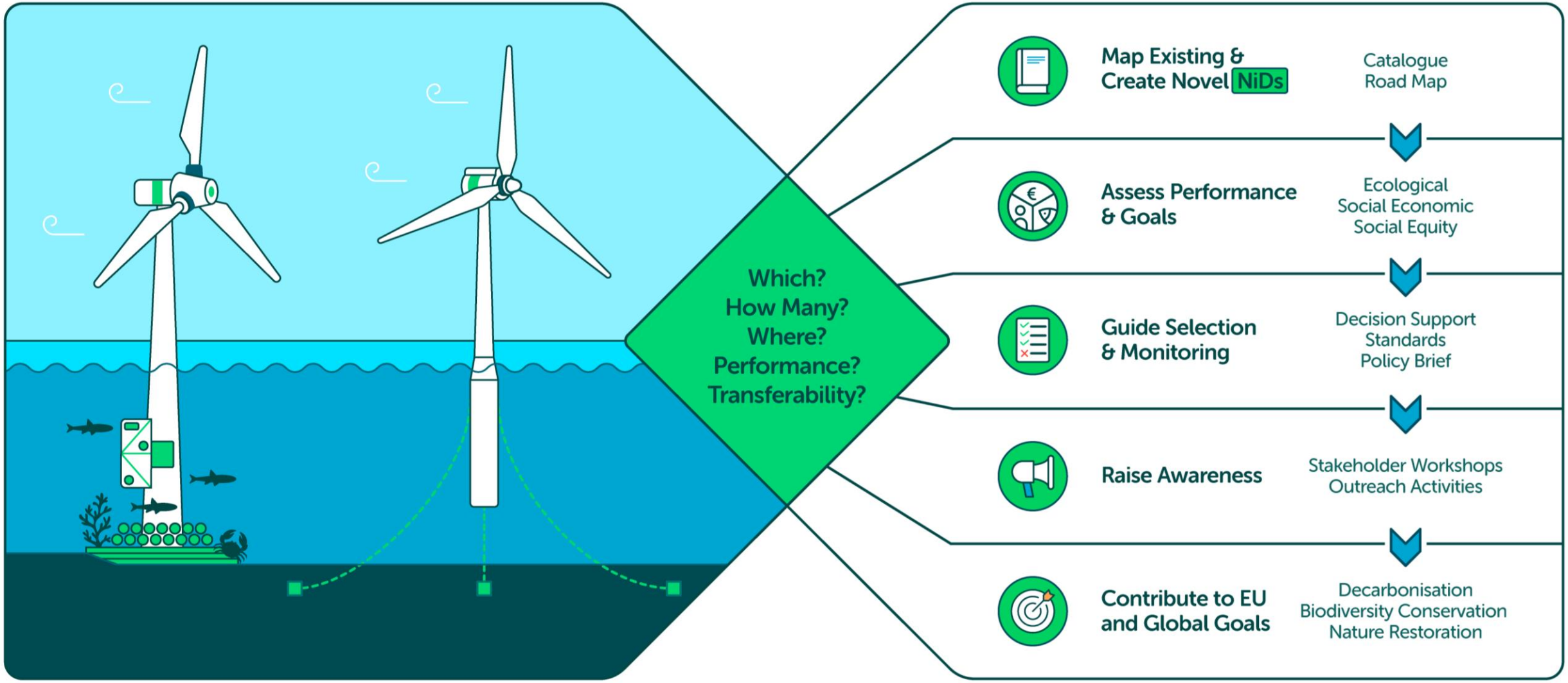
https://toolbox.therichnorthsea.com

...to context-dependent solutions to new ecoregions & technologies



Nature-inclusive designs for offshore renewables: an emerging field

NiD4 OCEAN



Funded by the European Union

NiD4OCEAN, Nature-inclusive Designs for Reconciling Offshore Renewables with Ocean Protection (Grant Agreement no. 101156861) project is funded by the European Union under the Horizon Europe programme.

NiD4 OCEAN

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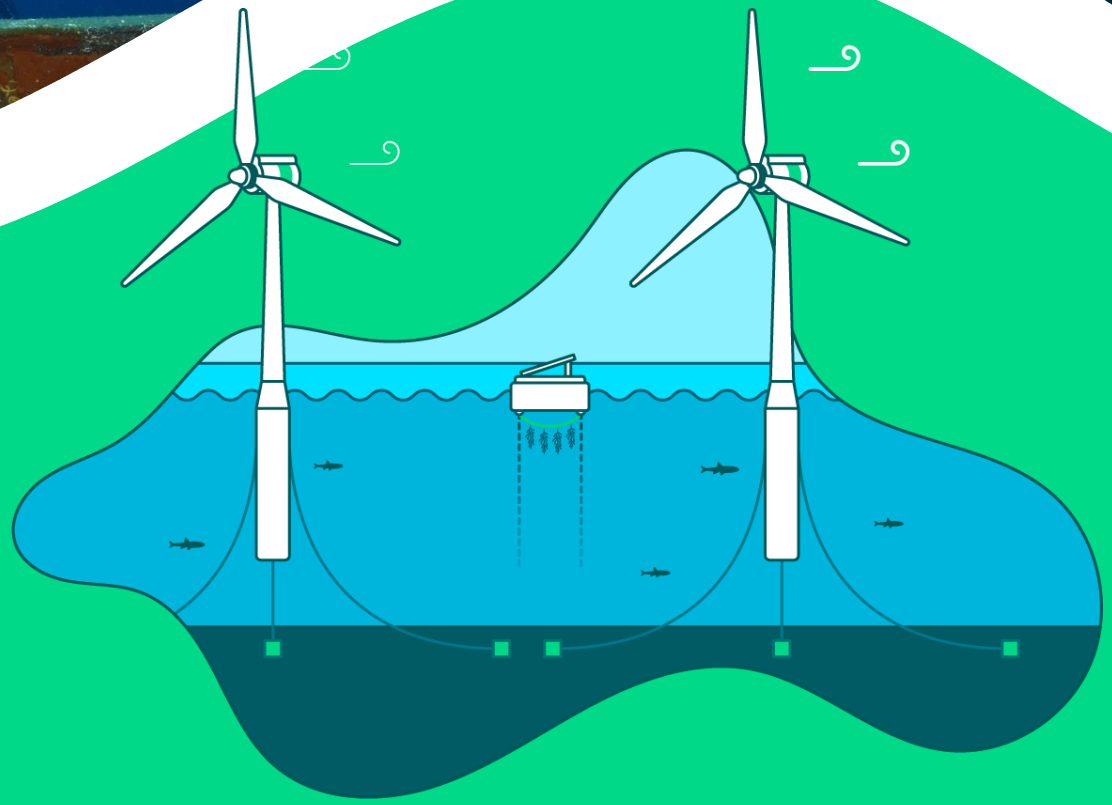
Innovation Challenge for SMEs

Lightning Talks



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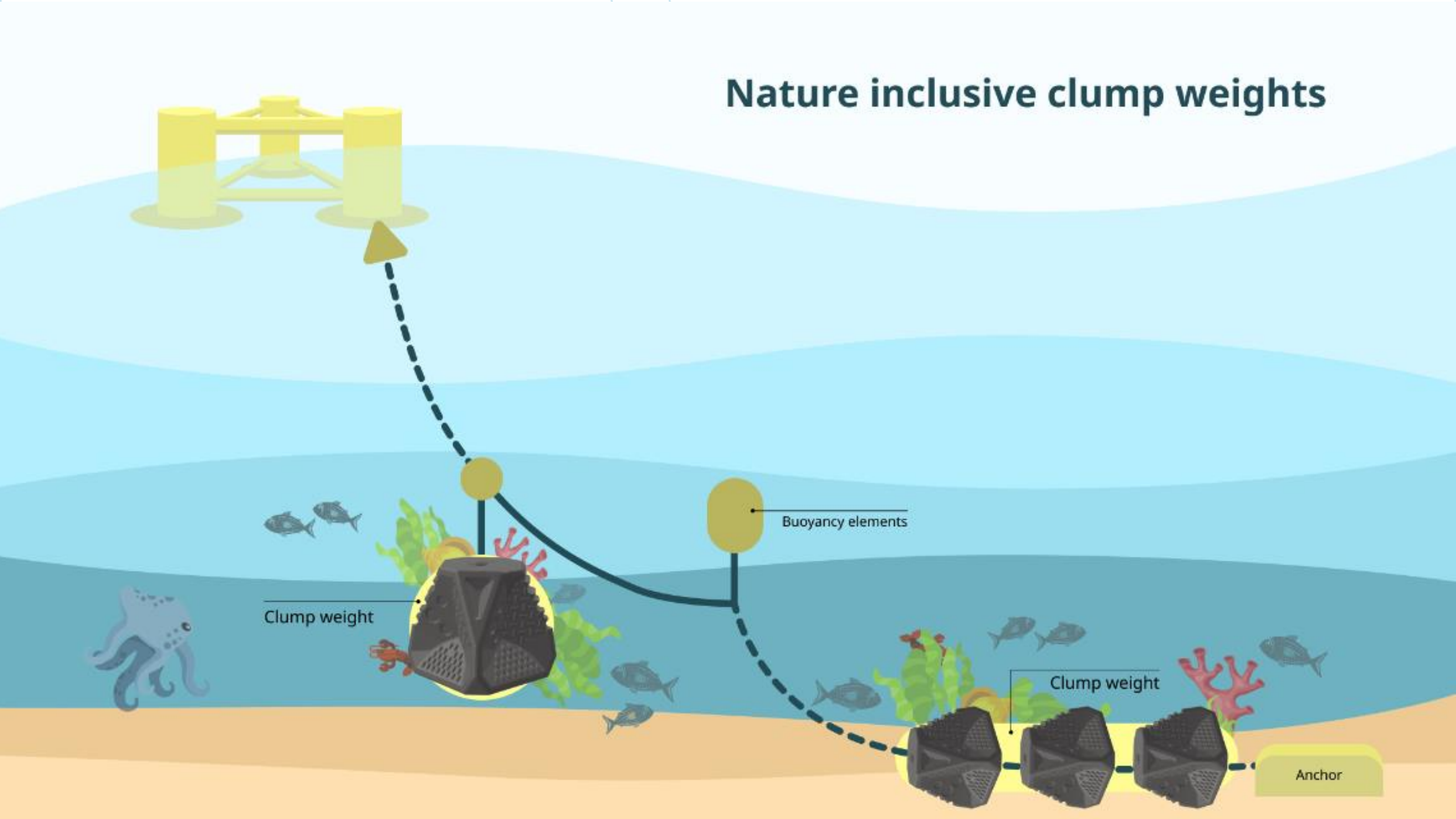
Anne Raspoort, MECAL

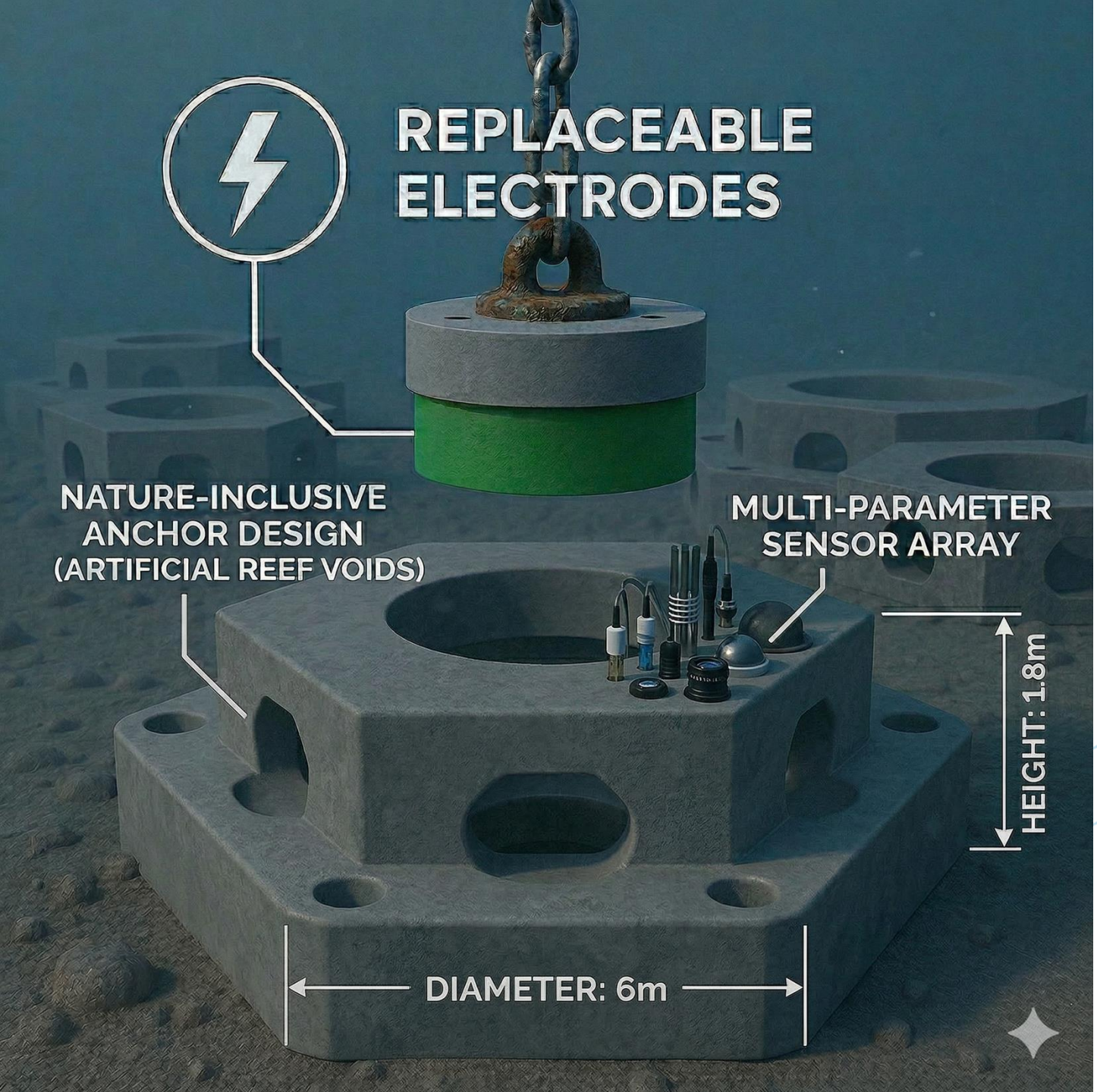
Nature-inclusive clump weights for mooring systems of floating wind turbines

Nature inclusive clump weights



Pablo Besquin, Oceanus International

ELECTROREEF



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ELECTROREEF

A sensor-enabled, nature-inclusive subsea platform for floating offshore wind, anti-scour protection, and green hydrogen production at depth.

Gael Verao Fernández, Technishe Universität Branschweig

INF4INiTY Project

INTEGRATED DESIGNS FOR FUTURE FLOATING OFFSHORE WIND FARM TECHNOLOGY

Nature inclusive designs for floating offshore wind farms

Gael Verao Fernández, Christian Windt, Nils Goseberg

Introduction

The INF4INiTY project aims at:

- Leveraging future offshore structures for **increased biodiversity via nature inclusive designs (NIDs)**.
- Understanding the consequences of **NIDs** for **engineering design.**
- Providing **Front End Engineering Design (FEED)** for the floating substructure, gravity anchor and associated scour protection.

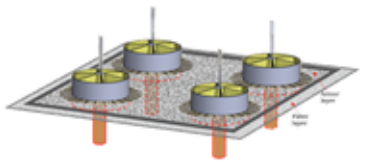
INF4INiTY at a glance

- **Programme** HORIZON-CL5-2023-D3-01
- **Type of Action** HORIZON-RIA
- **Duration** January 2024 – December 2027
- **Consortium** 13 partners from 8 countries
- **Coordinator** TUB
- **Total Budget** 5,994,964.00 €
- **EU Grant** 100%

Gravity Anchor Scour Protection

Suction buckets with ballast chambers:

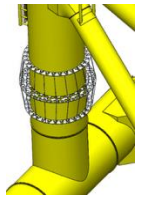
- **Tailored ballast material** to meet local ecosystem requirements.
- Allows for accommodate **artificial reefs** and **tailored scour protection**.
- **Reduced footprint** at installation and decommissioning.



Floating Substructure

Multiplatform artificial reef structure:

- Does **not compromise structural integrity** of the floating substructure.
- **Modularity**, small impact of platform dynamic behavior, suitability for target species, maintainability.



Landscape species biodiversity.

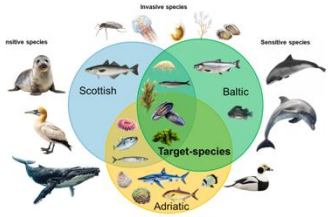
Biodiversity in three sea basins was characterized to understand each species' **ecosystem role** and its **NID requirements**. Species were grouped as:

(1) **Habitat forming species:** kelp, mussels, oysters, anemone barnacles, corals, hydroids…

(2) **Mobile fauna:** mackerel, saith, cod, tuna…

(3) **Protected species:** whales, dolphins, seabirds…

(4) **Invasive species:** carpet sea-squirt, wireweed, Japanese kelp…



Future work

(1) **Finalising** the FEED of the different **NID solutions**.

(2) **Publication** of the **design guidelines**.

(3) **Medium-scale experimental test campaign** of the floating substructure with integrated NIDs.

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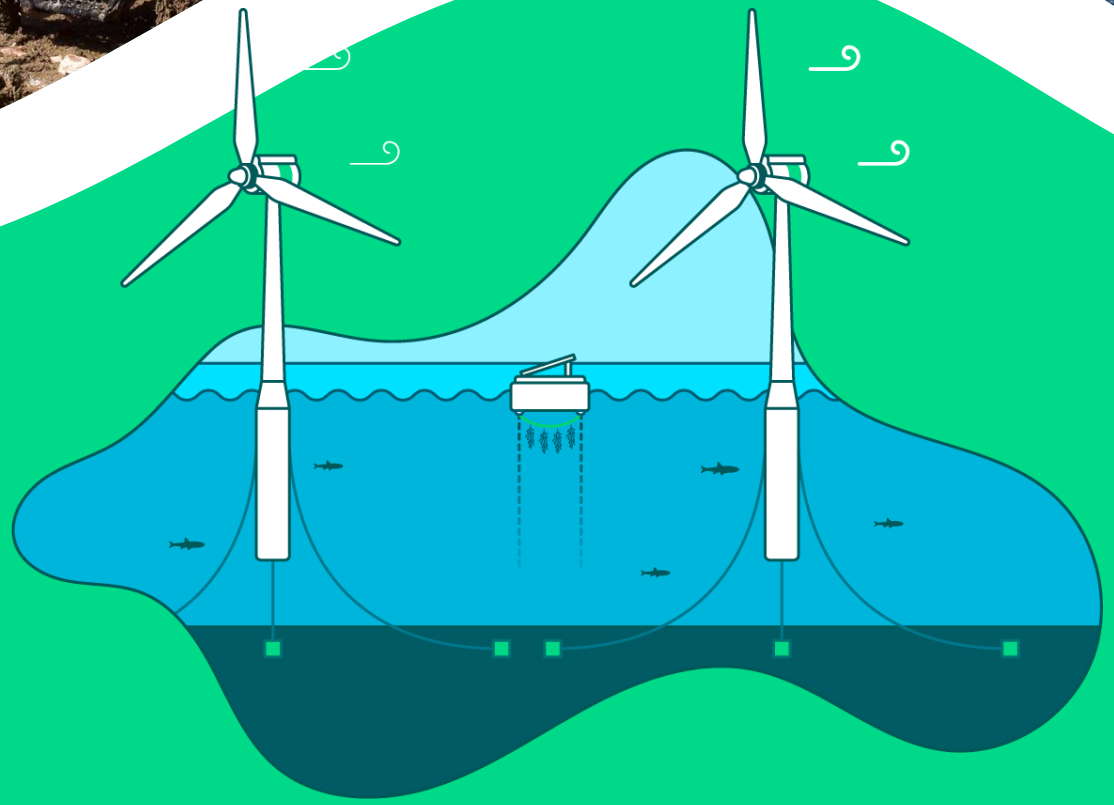
Opportunities and Challenges of NID in Floating Offshore Wind Infrastructure

Panel Discussion



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Opportunities and Challenges of Nature-Inclusive Design in Floating Offshore Wind Infrastructure

Marjolein Kelder

Senior Project Lead

The Rich North Sea

Oscar Bos

Marine ecologist

Wageningen Marine Research

Arne Myhrvold

Senior Advisor Sustainability

Equinor

Marija Nilova

Offshore Ecology Manager

ScottishPower Renewables

Caryl Benjamin

Senior Researcher

DNV

Dení Aguilar Bellamy, RGI

Moderator

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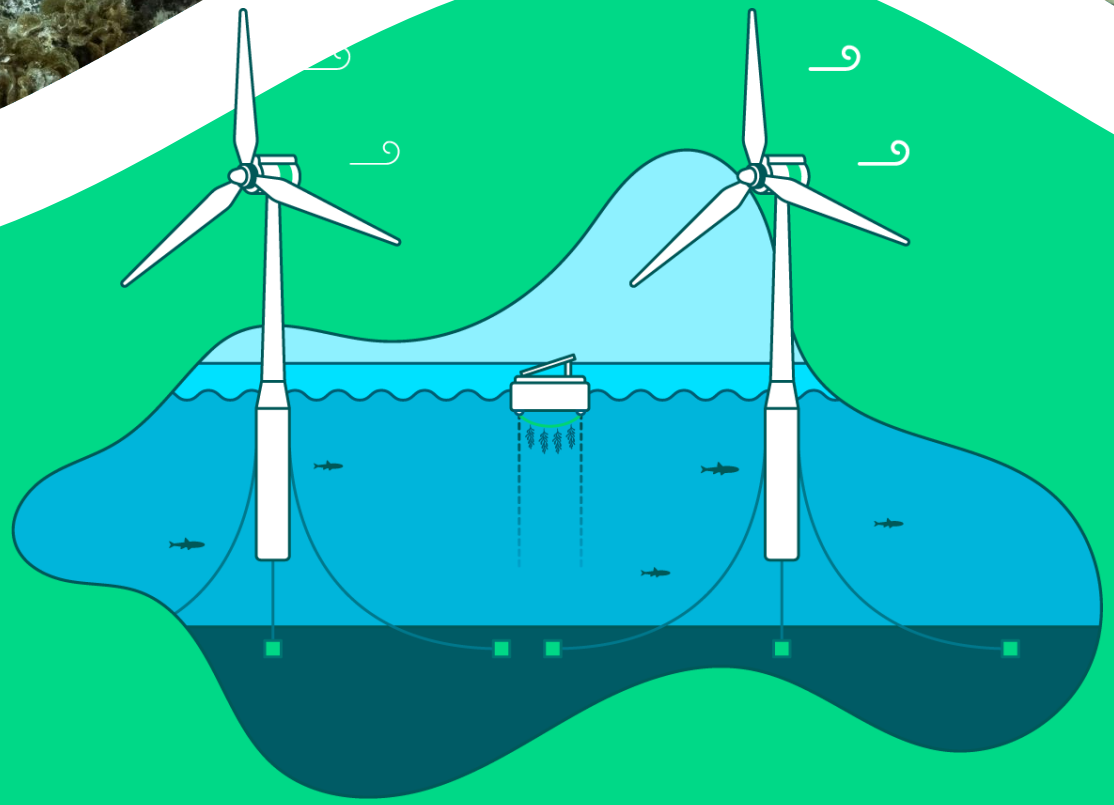
Innovation Challenge for Universities

Lightning Talks



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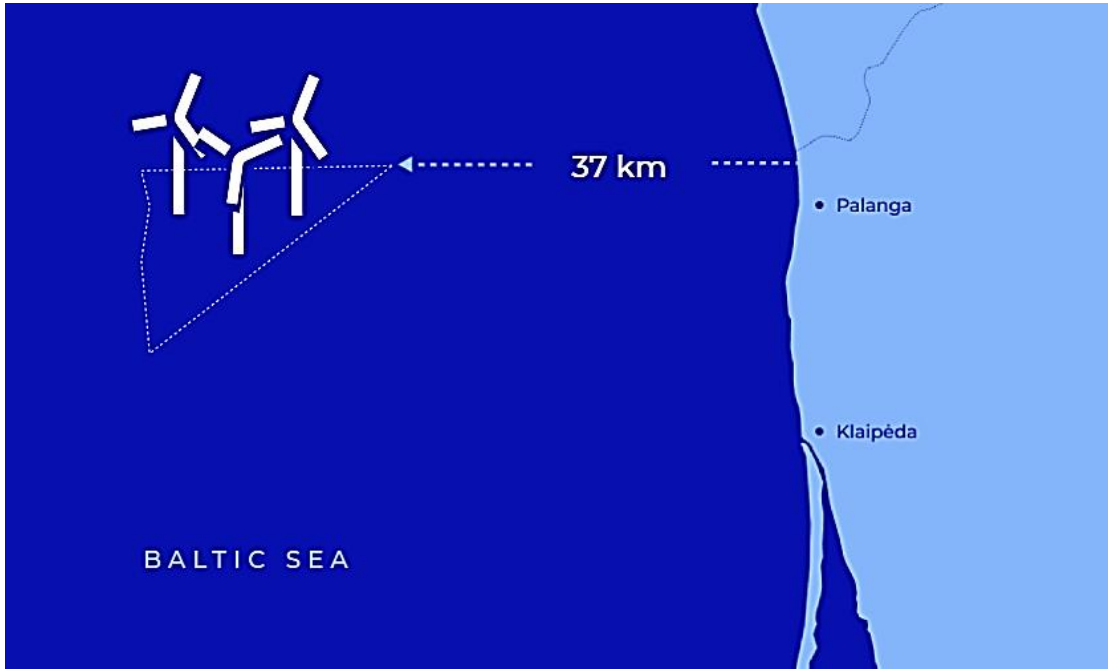
ACOUSTO-REEF HARMONY SYSTEM (ARHS)

Mario B. Egboye, Patricija Padleckyte, Orkhan Mirzayev
Klaipeda University (KU), Lithuania

Overview of Lithuania's OWF



Challenges of Lithuania's OWF

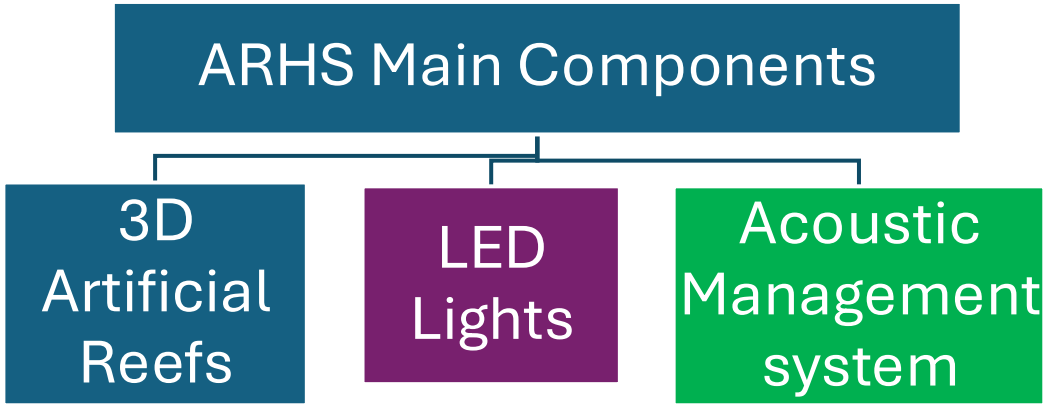
- Anthropogenic Noise



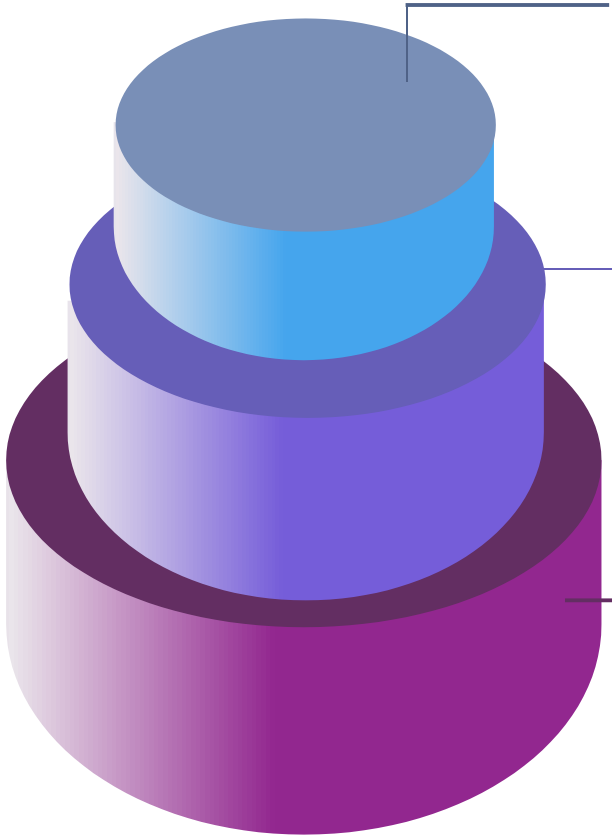
- Algae Decline – Low Light intensity


Innovative Idea (ARHS)

- ARHS is pioneering eco-engineering idea which draws from proven elements but assemble them uniquely.



ARHS KEY BENEFITS



- Expect increase in Algae base
- Expect Increase of local biomass by 10-20%, supporting food web recovery

EU mandates (MFSD & Green Deal) Compliance

- ✓ Protecting and increasing biodiversity
- ✓ Reduced Noise for marine lives

Lower LCOE (45-55 €/MWh vs. 60-80 standard), 15% O&M savings from self-powering, and eco-certifications, revenue (€50K/ha aquaculture)

THANK YOU
FOR LISTENING

BioRing Roses: Nature-Inclusive Design for Offshore Wind Anchors

Paula Carreras Busom, Mariona Martínez Fusté,
Irene Gil Soriano, Adriana Cuevas Millà
Universitat Politècnica de Catalunya (UPC), Spain

Challenge

We must shift from disruption to regeneration

Destruction or displace of habitats, reduction of local biodiversity, and alteration of natural biogeochemical cycles

Alteration of seabed's mechanical properties and long-term stability

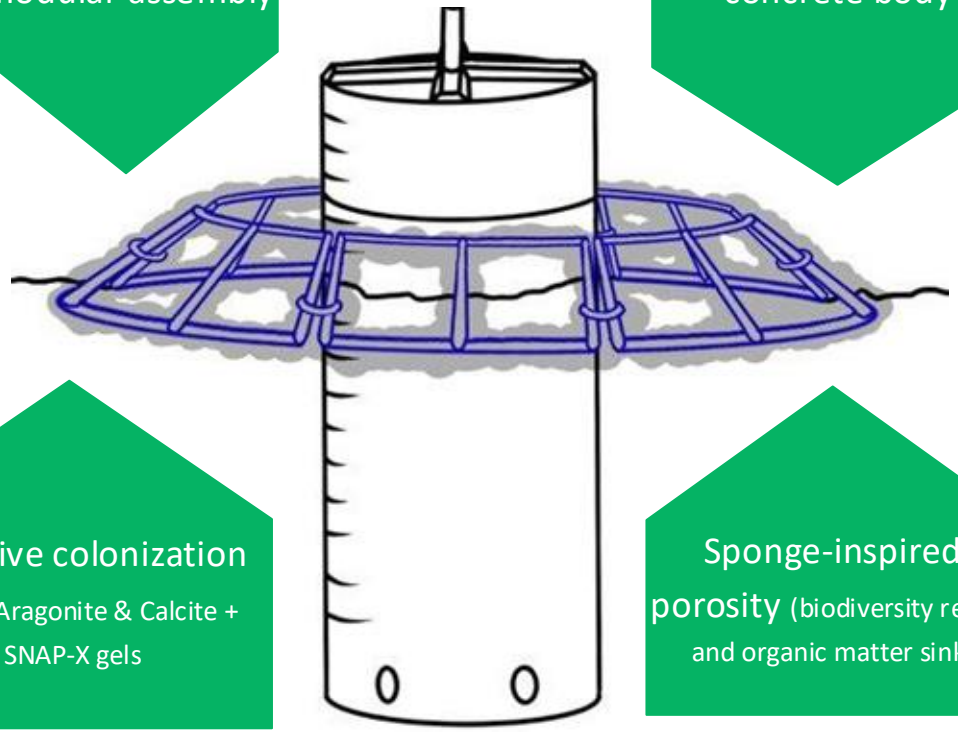
Suction anchors used in floating offshore wind platforms (spar buoys) can cause mechanical and ecological alterations

Slow recovery of local biodiversity

Proposed Solution

Non-intrusive modular assembly

Marine geopolymer and low-alkalinity concrete body



Bioactive colonization layer Aragonite & Calcite + SNAP-X gels

Sponge-inspired porosity (biodiversity refuge and organic matter sink)

Future Steps

1. Prototype development, material optimization and experimental testing.
2. Numerical modeling of hydrodynamic and ecological processes (scour vs deposition).
3. Pilot installation and ROV deployment to evaluate real-world performance
4. Permits and scalability for large-scale implementation in offshore wind projects.
5. Long-term biodiversity monitoring to assess ecological integration.

Nid4Buoy: A Carbon-Fixing Concrete BuoyNature-Inclusive Buoyancy Modules for Offshore Wind

Sreekumar Pookkudi, Doina Huso, Michael Geis, Jayachandra Malavatu

University of Agder (UiA), Norway

The Problem: Plastic in offshore Wind Technology

Key challenge

- Marine plastic pollution
- Carbon neutrality pressure

Plastic buoyancy modules limitations

- End-of-life challenges
- Low recyclability
- Limited ecological value

(image source: Ocean Cleanup)

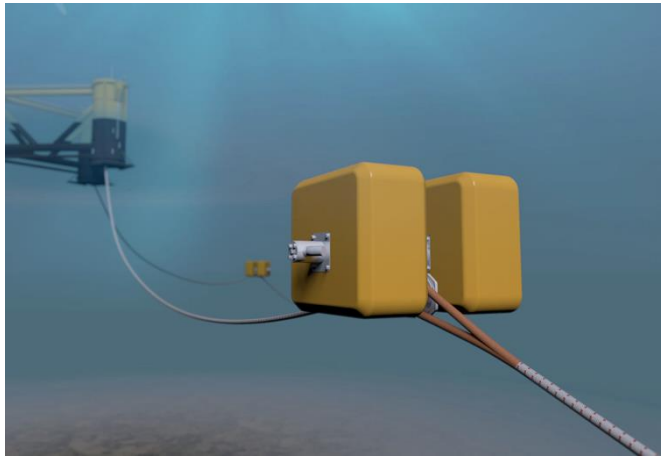


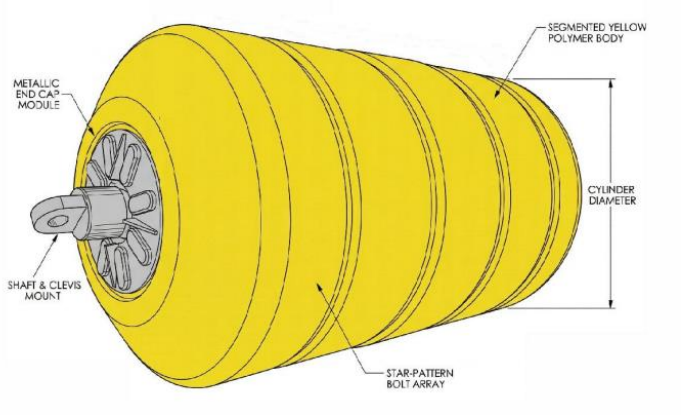
Image source: https://www.balmoraloffshore.com/

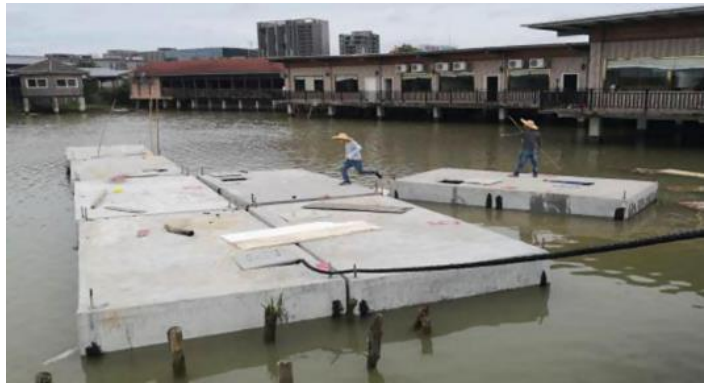
Image reference: CRP Subsea

Nid4Buoy: A Carbon-Fixing Concrete Buoy Modules for Offshore Wind

Key idea

- Plastic to low density floating concrete
- Use carbon capture technology to meet carbon neutrality
- End-of-life reef conversion
- Possibility of extending to additional component





Frame: Aluminum / ductile iron cage. These materials are designed for durability

Shell: Carbon-neutral concrete casing infused with **biochar**. Biochar improves carbon absorption during curing and enhances marine chemistry, promoting larval settlement for diverse marine life.

AQUA FLOAT

Aila Christ, Avamehr Vaghaiwalla, Lucas Perske, Sean Tom & Theodora Filippos

Technical University of Denmark (DTU)

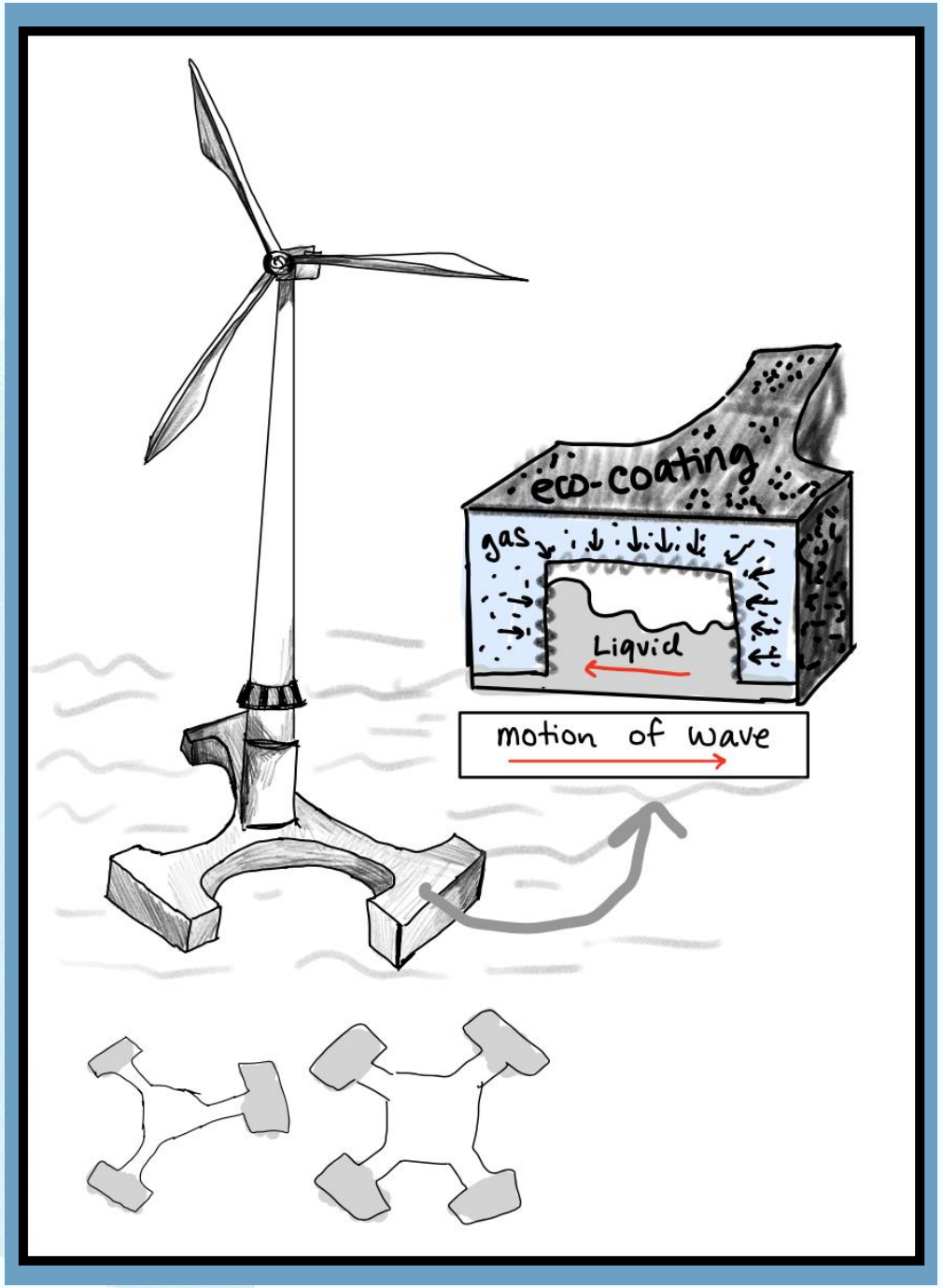
Aqua Float

Aqua Float - What is it?

- Floating offshore wind platform.
- Passive bio-dampening system.
- Hybrid gas-fluid chambers reduce motion.
- Stabilizes turbines in harsh ocean conditions.
- Reduces structural vibrations and fatigue.

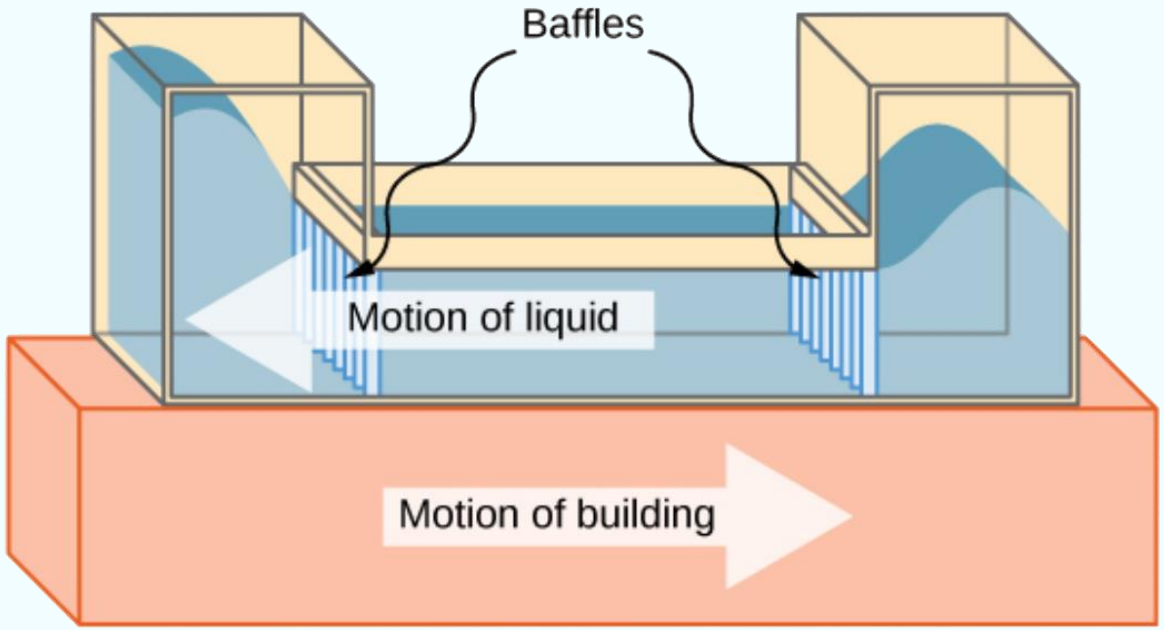
Value - Why it matters?

- Extends turbine lifespan.
- Reduces maintenance costs.
- Improves energy efficiency.
- Supports sustainable offshore wind expansion.



A project by: Aila Christ, Avamehr Vaghaiwalla, Lucas Perske, Sean Tom & Theodora Filippos

The Comcast Building in Philadelphia, Pennsylvania.



A tuned-mass damper is used to reduce the oscillations.

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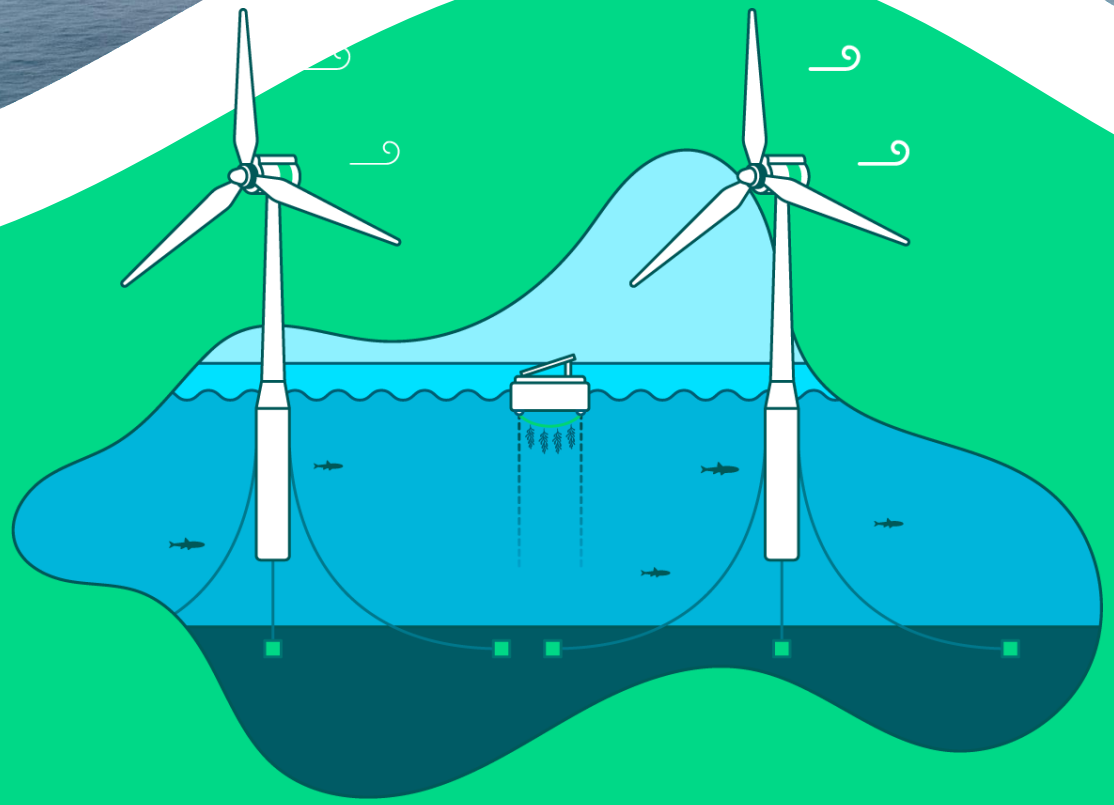

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NiD4OCEAN next steps

- Roadmap innovative designs for addressing the ecological, socio-economic, and sociopolitical challenges of the use of NiDs
- Region-specific decision support tool (DST) for deploying NiDs
- Recommendations towards standards for NiD selection and monitoring
- Co-design recommendations, requirements, and a toolkit to reconcile offshore wind development and restoration policies

Thank you!

Funded by
the European Union

Nature-inclusive designs for reconciling offshore renewables with ocean protection – NiD4OCEAN is co-funded by the European Union under the Horizon Europe programme Grant Agreement: 101156861