OPIN CIG Scoping Meeting
Mooring Lines and Anchoring Solutions

June 17th 2020

Interreg North-West Europe OPIN

EUROPEAN UNION

European Regional Development Fund

Welcome to the CIG scoping meeting

- Attendees microphones will be muted during the presentation. 
- After the presentation there will be time for interaction during the Q&A/Discussion Session.
- Questions can be formulated in the chat at any time and they will be addressed during the Q&A/Discussion session. The chat is visible to all attendees. 
- If you would like to make a comment or ask a question directly during the Q&A/Discussion session, please type “Speak” in the chat. We will then let you know when you can unmute your microphone.
- The meeting will be recorded and the slides will be shared on the OPIN website.

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Agenda

10:00 – 10:10 **OPIN Introduction** *(Lesley Doyle – Scottish Enterprise)*

10:10 – 10:15 **Introduction to topic and speakers** *(Simon Cheeseman – ORE Catapult)*

10:15 – 10:25 **Setting the scene** *(Tony Laing - UK National Subsea Research Institute)*

10:25 – 10:35 **Floating wind scene set** *(Roberts Proskovics - ORE Catapult)*

10:35 – 10:45 **Practical case study - Floating Solar** *(Grigory Troshchenko - Heliorec)*

10:45 – 10:55 **Innovation, risk and cost drivers - Floating wind, wave & tidal** *(Danny Golden - Dublin Offshore Consultants)*

10:55 – 11:30 **Q&A and closing remarks**

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OPIN Introduction

Lesley Doyle – Scottish Enterprise

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What is OPIN ?

Ocean Power Innovation Network (OPIN) is a **European collaborative network**

OPIN Aim:

- Develop both cross-regional and cross-sectoral **collaboration**

OPIN Targets:

- Support over 100 companies
- Develop a self-sustaining network (>200 members)

3 years from 2019 to 2021

2.6M€ total project budget

1.5M€ in financial support from Interreg North West Europe

Join the network (free)

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Who are OPIN ?

7 partners from Ireland, UK, Belgium, France, the Netherlands and Germany

Project Partners	Countries/Regions
Sustainable Energy Authority of Ireland (SEAI)	Ireland
Scottish Enterprise (SE)	Scotland
Offshore Renewable Energy Catapult (OREC)	United Kingdom
Sirris, het collectief centrum van de technologische industrie (SIRRIS)	Belgium
West Atlantic Marine Energy Community, École Centrale de Nantes (WEAMEC)	France Pays de la Loire
Dutch Marine Energy Centre (DMEC)	Netherlands
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. (Fraunhofer IEE)	Germany

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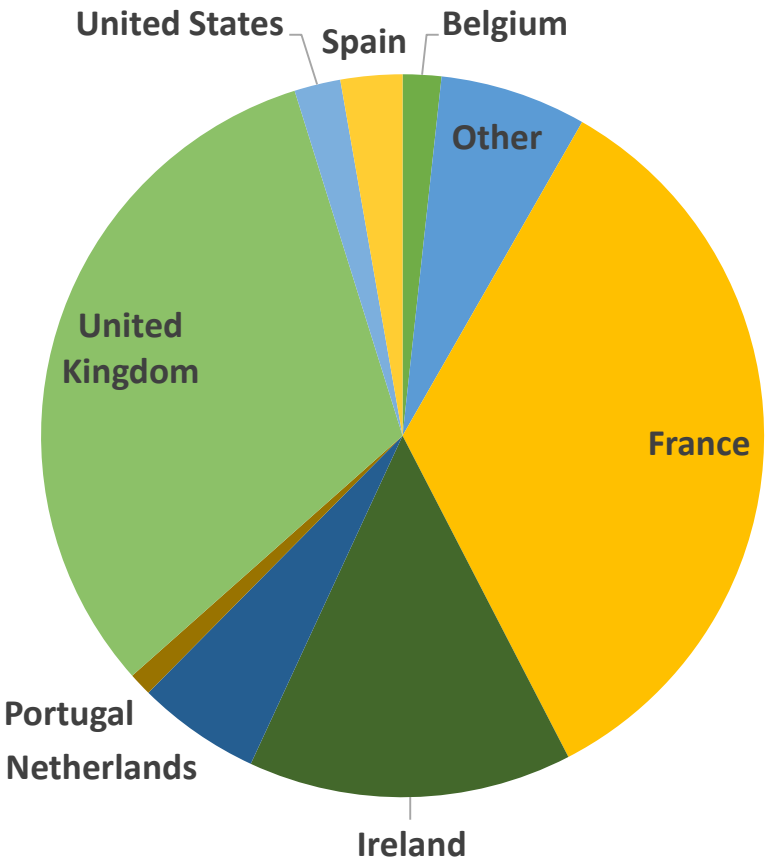
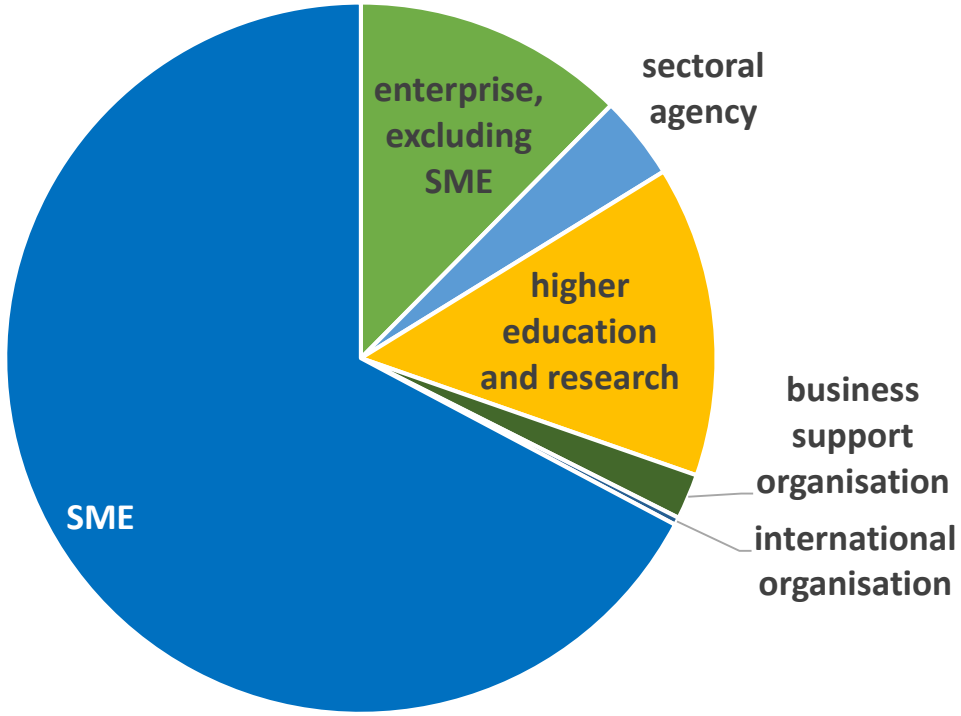
OPIN Members

290 members from
24 countries





Other countries (2 members or less):
Australia, Canada, Denmark, Finland, Germany, Hong Kong, India, Indonesia, Italy, Malaysia, Monaco, Norway, Russia, Sweden, Switzerland, Vietnam

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What can OPIN do for you (1/2)

Access **free events**: learning and networking opportunities

- **OPIN Webinar: Funding Opportunities for the Offshore Renewable Energy Sector**
  24/06/2020, online

- **OPIN/TIGER Webinar: Tidal Supply Chain Opportunities**
  09/07/20, online

- **OPIN Workshop: Challenges and Solutions for Improved Durability of Materials**
  22/10/20, Antwerp, Belgium

Have a look at our Events page and register today !

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What can OPIN do for you (2/2)

Access **expert advice** on your technology (TAPs)

- ✓ Independent expert opinion – e.g. on the route to market, on reducing development risks and costs, etc.
- ✓ Advice on next steps, funding and collaboration opportunities

Support **collaborative projects** (CIGs)

- ✓ Preparatory step to National and EU research calls
- ✓ Find ways to solve technical or financial problems you are facing
- ✓ Expand your network nationally and internationally
- ✓ Benefit from the experience of those in other industries

Receive **travel support**

- ✓ Enabling Irish and Scottish Enterprise SMEs to travel abroad for OPIN events

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OPIN Resources

OPIN Members list

OPIN Library:

- Workshops/masterclasses presentations
- Value chain study - summary report
- Ocean energy challenges and recommendations: Desktop analysis of studies and reports

OPIN Twitter and Linkedin groups. Join us for the latest updates!

Email us at: OPIN@seai.ie

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Collaborative Innovation Groups (CIGs)

Lesley Doyle - Scottish Enterprise

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What is a CIG?

CIG: Collaborative Innovation Group

CIG Format:

- Clusters of SMEs with research / large companies
- Project objectives and outputs

CIG Aim:

- Solve specific problems which are barriers to deployment of ocean energy
- Work up an idea, product, process, funding application

Benefits of CIGs

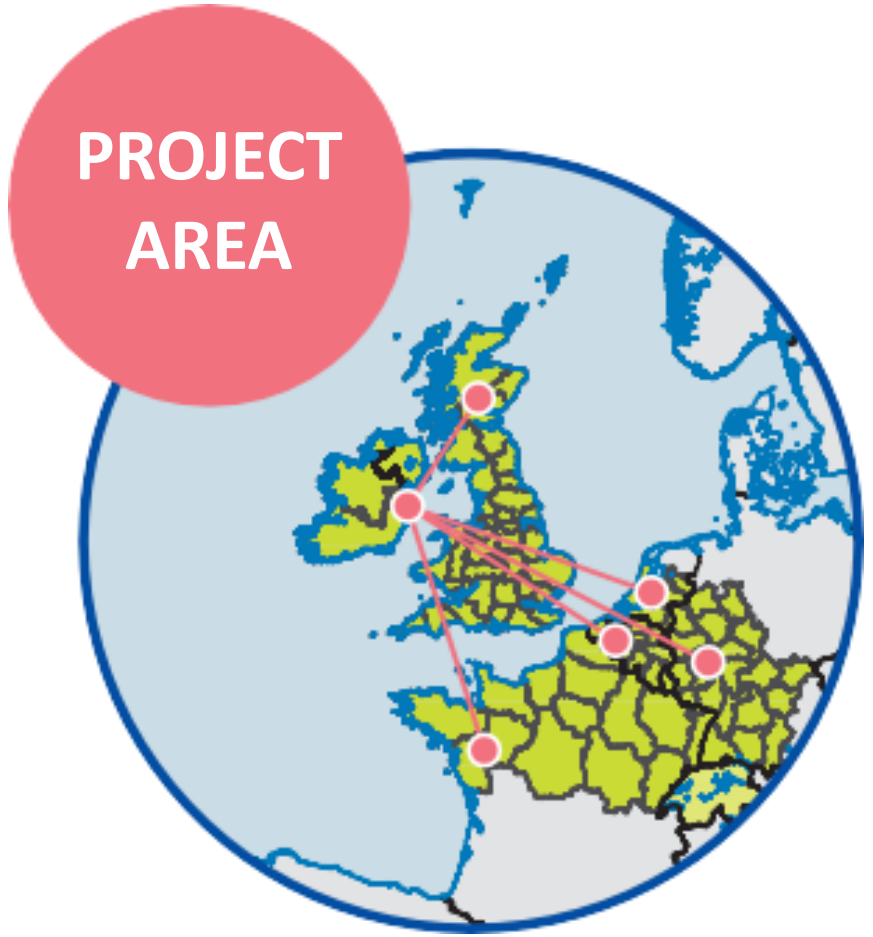
- Solve specific problems/challenges you could not solve alone
- Explore opportunities for new products, services, markets
- Expand your network nationally and internationally
- Gain complementary skills and expertise
- Gateway to other support / Preparatory step to National and EU research calls

OPIN CIG Support

- OPIN partner facilitation of the CIG
- Technical / Business Support: value up to €20,000 per CIG
- Travel support
- No financial contribution required from companies but ensure company staff / resources are available for tasks

CIG Eligibility

- Minimum of 2 SMEs
- Large companies and research organisations may participate
- Cross border – members from minimum of 2 OPIN regions
- Cross sector - recommended



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Introduction to topic and speakers

Simon Cheeseman (ORE Catapult)

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ORE Catapult

The Catapult Network

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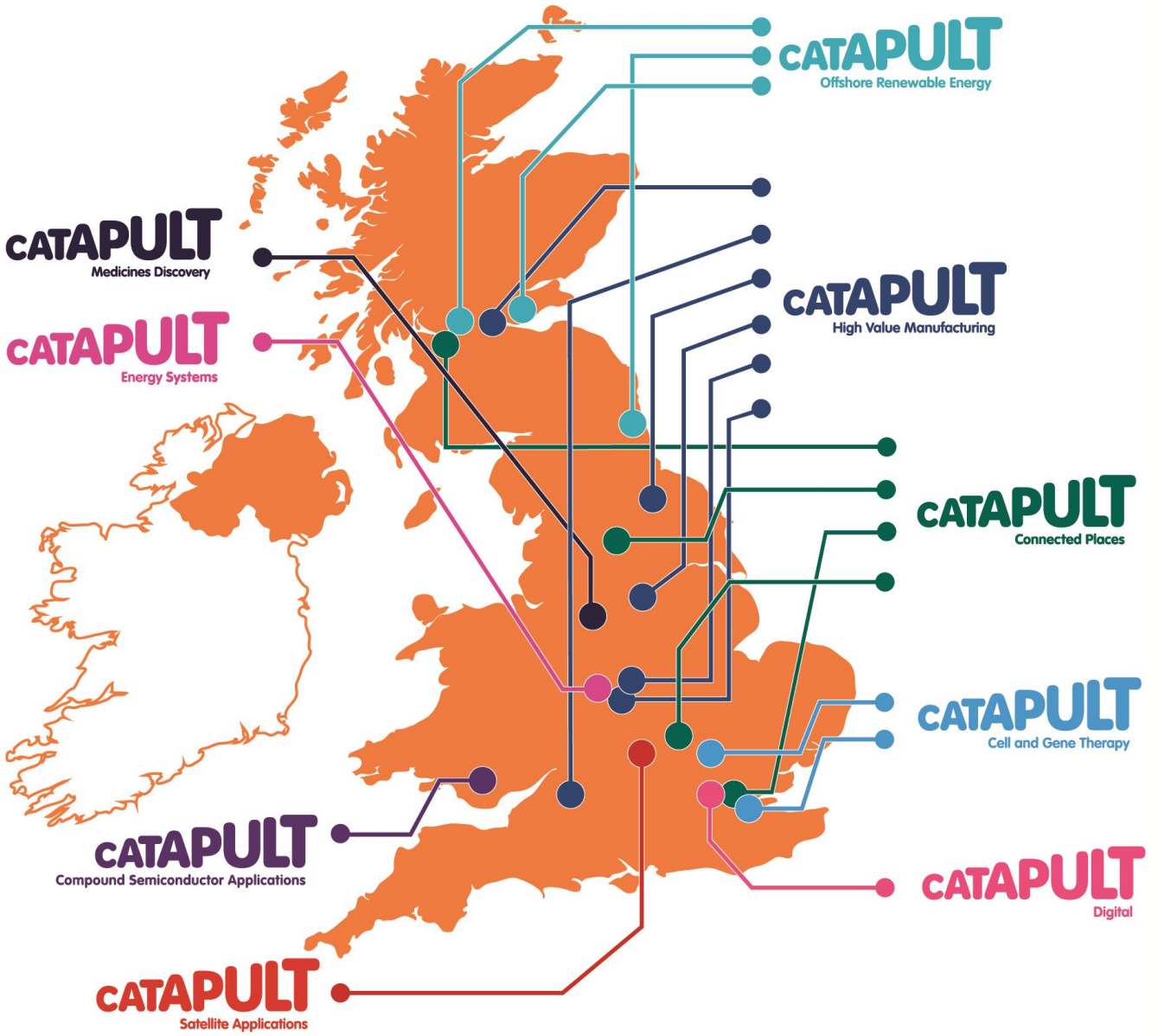
Innovate UK

- Designed to transform the UK's capability for innovation
- Core grant leveraged with industry and other public funding



Our Mission and Vision

Our mission

To accelerate the creation and growth of UK companies in the ORE sector

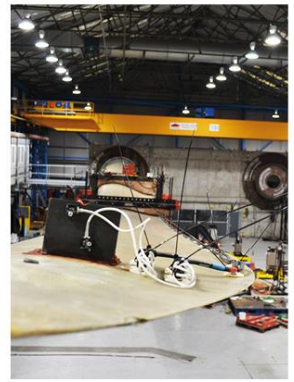
Our vision

By 2023, ORE Catapult will be the world's leading offshore renewables technology centre

- **Centres of Excellence**
- **Academic Research Hubs**
  in partnership with leading universities
- **Expanding our assets in Blyth and Levenmouth**
  the world's foremost open-access facilities

Our Business Structure

CATAPULT Offshore Renewable Energy



PROGRAMMES
Convening our stakeholders to create knowledge and know-how

RESEARCH
Delivering applied research projects

ADVISORY
Relevant actionable advice and insight on key industry issues

TESTING
Managing and operating testing and R&D infrastructure

CIG – Moorings & Anchoring Scoping Workshop

What's your problem?

Then talk to OPIN Partners and members for advice, guidance and solutions.

Agenda

- Oil & Gas perspective - National Subsea Research Initiative – Tony Laing
- Floating Wind – Offshore Renewable Energy Catapult – Roberts Proskovics
- Practical case study HelioRec, Floating Solar – HelioRec - Grigory Troshchenko
- Innovation, risk, cost drivers - floating wind, wave & tidal –Dublin Offshore Consultants - Danny Golden
- Questions and Answers - Identify collaboration opportunities - Facilitated by Simon Cheeseman
- Wash up
- Close

Setting the scene

Tony Laing (UK National Subsea Research Institute)

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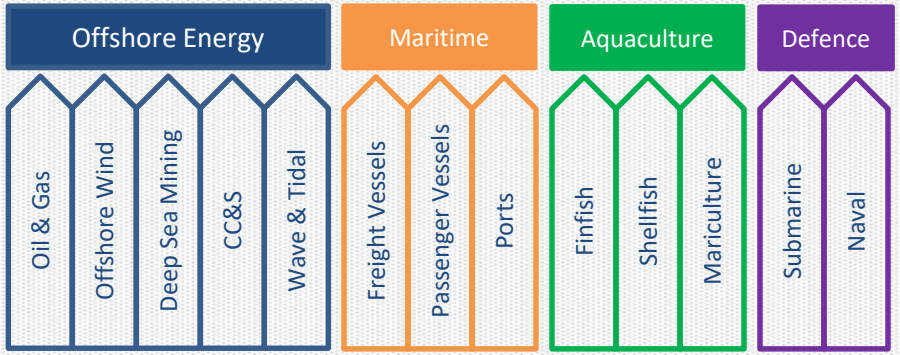
The Blue Economy Opportunity

The Blue Economy

Annual global spend in the blue economy is forecast to increase to c.£100 bn by 2035 from c.£20 bn today

The UK currently leads the world with around 40% global market share = £7.5bn



NSRI focus areas

Vision

Vision Statement

NSRI is dedicated to advancing underwater technology and sharing cross industry knowledge within the subsea domain, to accelerate economic growth within the Blue Economy.

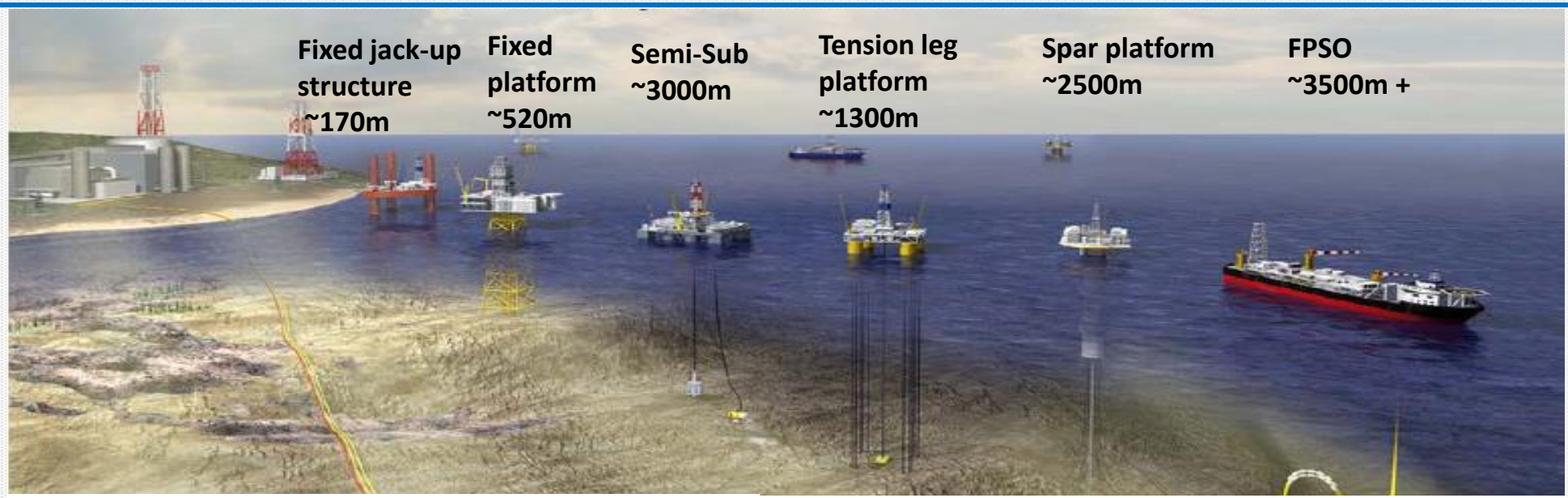
How we do this

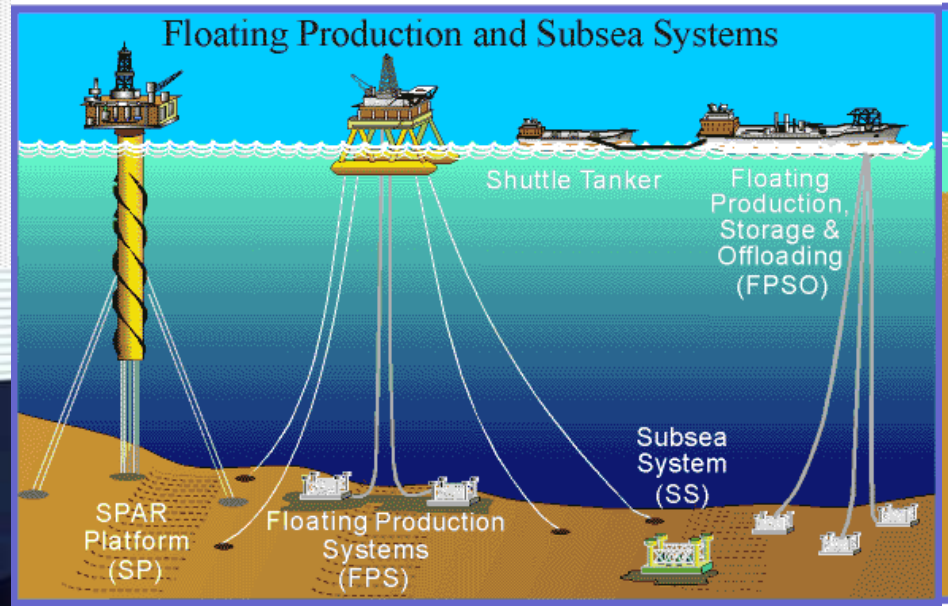
- Clarify industrial challenges and identify technology opportunities
- Promote cross sectoral technological advancement and user adoption
- Identify and engage the SME and industrial developer communities
- Independent & impartial; NSRI is not a funding organisation, however promotes & brokers funding opportunities

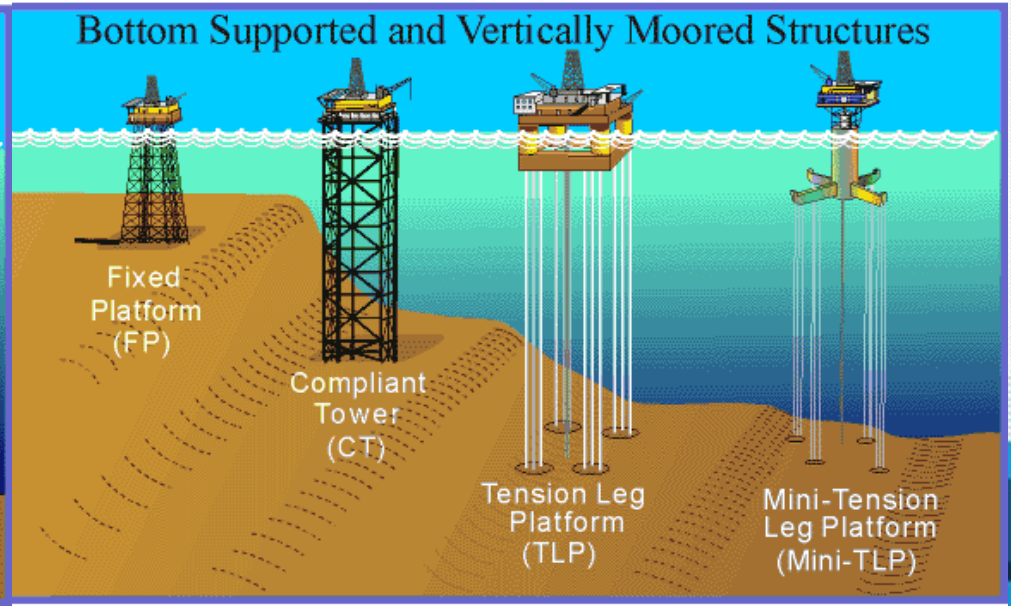
Who we support

- Industry, government, academia, users, developers and entrepreneurs

Foundation & Mooring in Oil & Gas

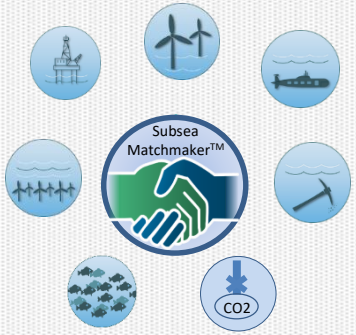






Shared Opportunities = Cost Reduction

Automation & Robotics | Digitisation | Advanced Manufacturing | Safety & Environmental | Circular Economy | Simulation & Reliability | Standardise / Modularise



Foundations & Moorings

High pressure Systems

Comms & Controls Systems

Process performance

Metals, Coatings & Composites

Power & Storage Systems

Sensors & Monitoring

Autonomous Operations

Re-use & Re-purpose

Identify needs - framing research & facilitating testing

Knowledge sharing

Increase Efficiency

Unlocking global opportunities

Economic Growth

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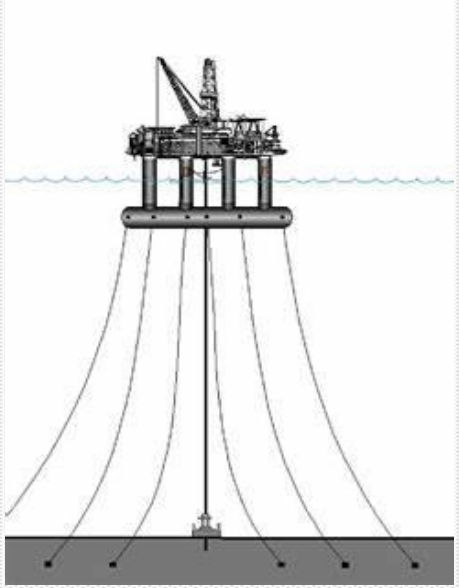
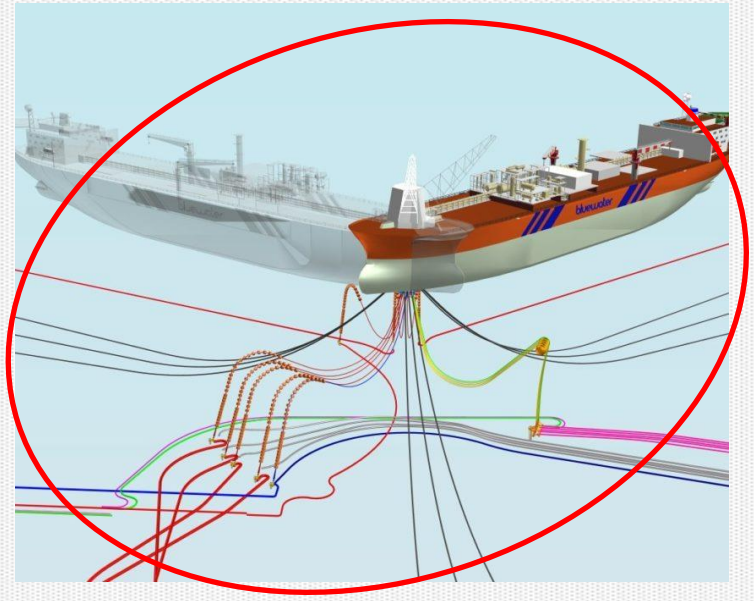
Foundation & Mooring in Oil & Gas

Broad, well understood engineering principles apply, however complexity arises from type of service being undertaken.



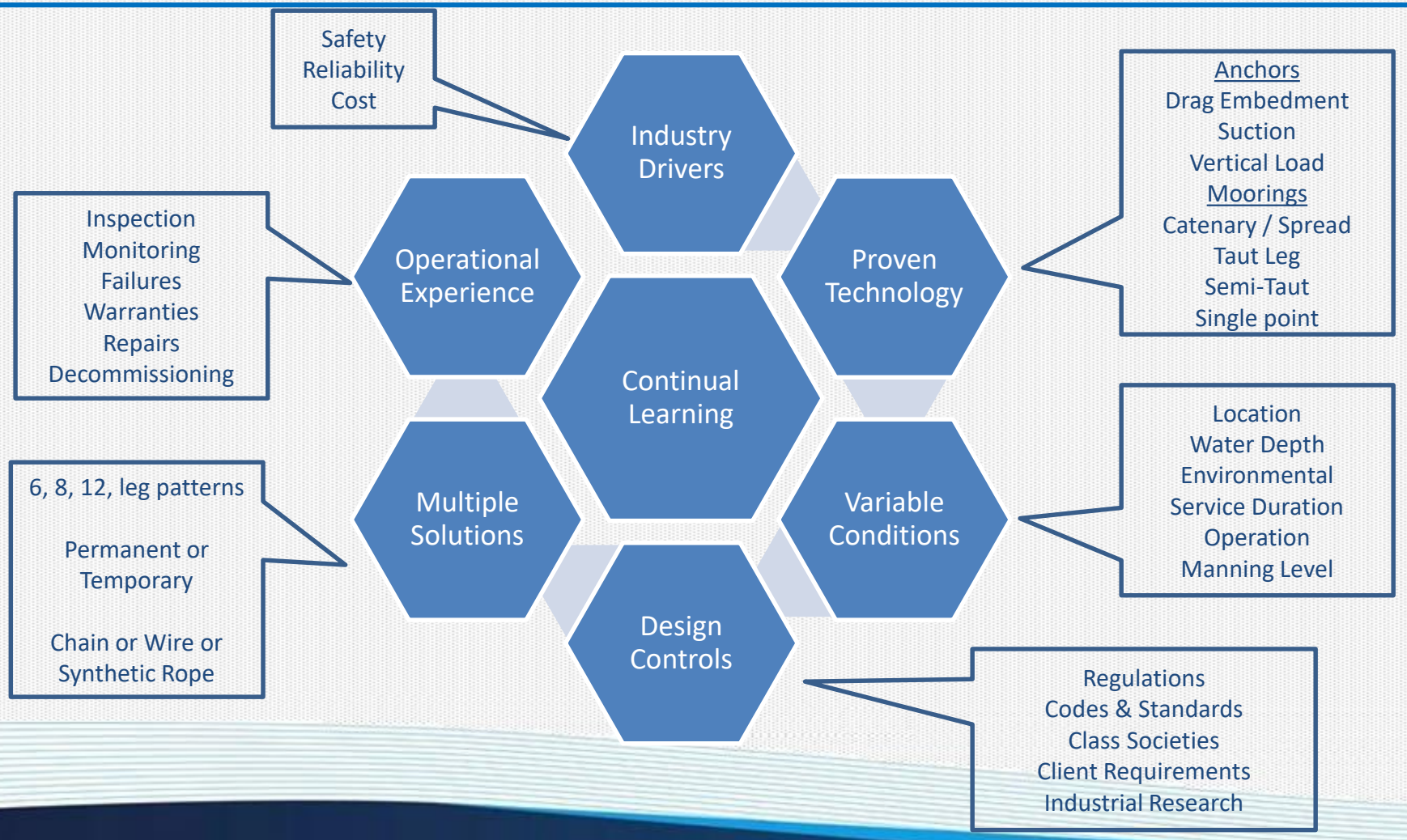
- Production Service (e.g. Drill Rig)
- Temporary moored (3months – 2 yrs)
- Simple functions (mooring for station keeping)



- Production Service (e.g.FPSO)
- Permanently moored (20-30yr design life)
- Multiple different functions (e.g.moorings, risers, multiple hydrocarbons, ship to ship offloading)
- Fortified 500m zone

OPT Wave Power Generator
- Providing local power during decommissioning.

Reducing costs by learning across the Blue Economy industries



Foundation & Mooring in Oil & Gas

Oil & Gas sector has significant knowledge/experience to offer but be aware it's continually evolving

- Insurers & Warranty Surveyors
- Class Societies
- Client Requirements
- Rig / FPSO Owners Requirements
- Anchoring & Mooring Supply/Service Companies

Recognised Industry Forums

- International Marine Contractors Association (IMCA)
- Oil Company International Marine Forum (OCIMF)

Case Study : Reducing OPEX costs Adopting - Walk To Work Systems

Developed early 2000s but slow response from oil and gas community

- Perception of safety risk perceptions
- Minimal drivers for change
- On location stabilisation

Pioneered by Offshore Wind

- No helicopter access, inherently safer than RIB vessel
- Planned inspection & maintenance campaigns
- Safe procedures, proper equipment, suitable vessels
- Significant increase in offshore wind farm development

Increased uptake from O&G community

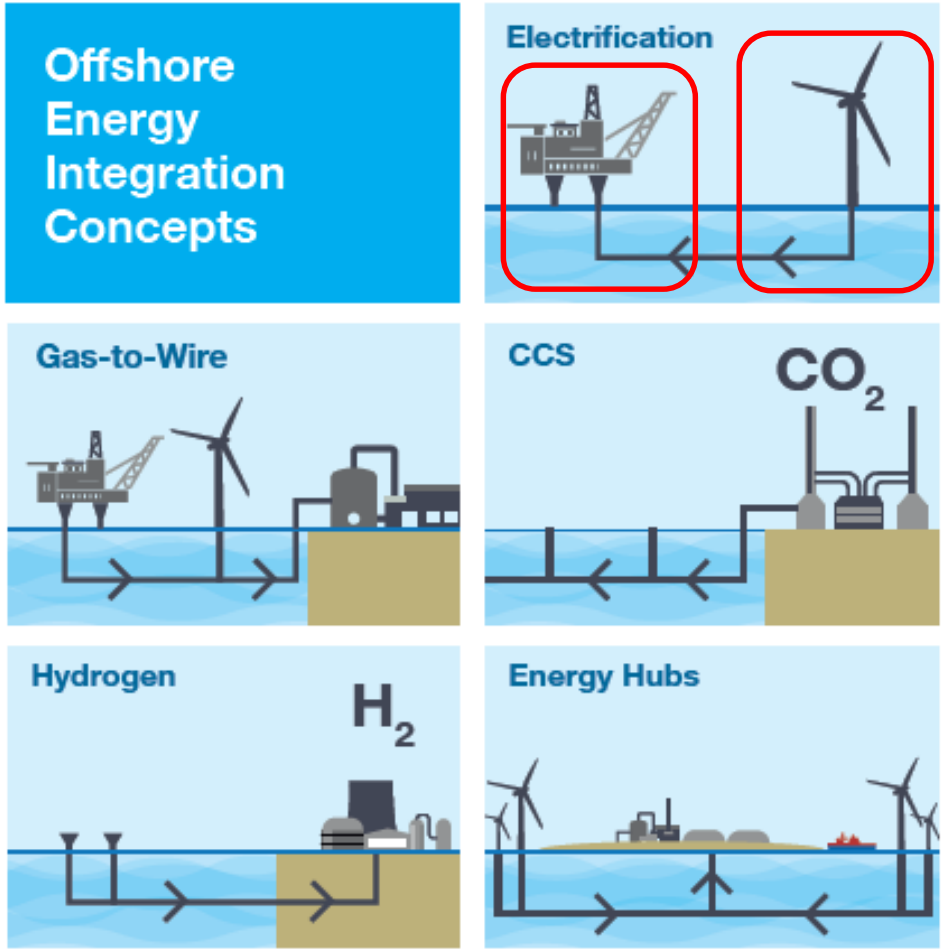
- Authorities approval
- Proven equipment & processes
- Cost efficient & reduces 'higher risk' helicopter ops
- Adopted across Southern North Sea assets

Cross Sector Knowledge/Experience Transfer

Building Opportunities by the Transition to Net Zero

Phase 1 delivered with Lloyd's Register

- Five offshore energy integration concepts assessed (Lloyd's Register)
  - Platform Electrification
  - Gas-to-Wire (GTW)
  - Carbon Capture and Storage (CCS)
  - Hydrogen (H_2) – both 'Blue' (methane reforming, with capture and storage of resulting CO_2) and 'Green' (water electrolysis, using power from renewable sources)
  - Energy Hubs
- Development options
  - Stand-alone
  - Reuse
  - Synergies
- Technical feasibility (with current and future technologies)
- Costing and sensitivities
- Build-up scenarios
- The purpose of this document is to communicate interim project findings and engage industry on the project Phase 2



https://www.ogauthority.co.uk/news-publications/publications/2019/ukcs-energy-integration-interim-findings/

NSRI
National Subsea Research Initiative

Working together across industries 'accelerating opportunities' - Questions

Thanks to our sponsors:

bp

Shell

TOTAL

SUBSEA UK

Scottish Enterprise

Contact details: tony.laing@nsri.co.uk

www.nsri.co.uk
@NSRI_Subsea

Floating wind scene set

Roberts Proskovics (ORE Catapult)

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OPIN CIG Mooring and Anchoring

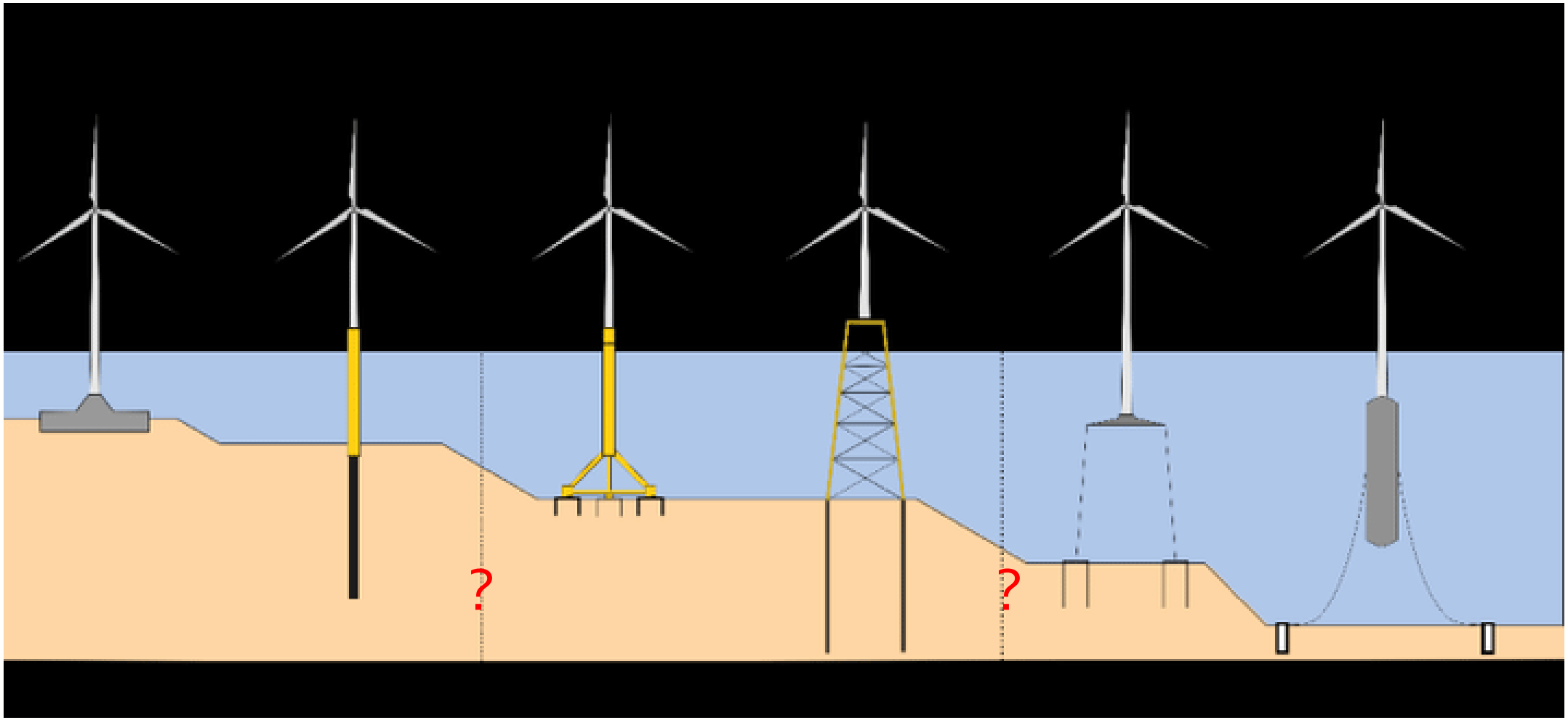
17/06/2020 | Roberts Proskovics

CATAPULT Offshore Renewable Energy

Agenda

- Introduction to Floating Offshore Wind (FOW)
- FOW Substructures
- Mooring systems in FOW
- Industry challenges

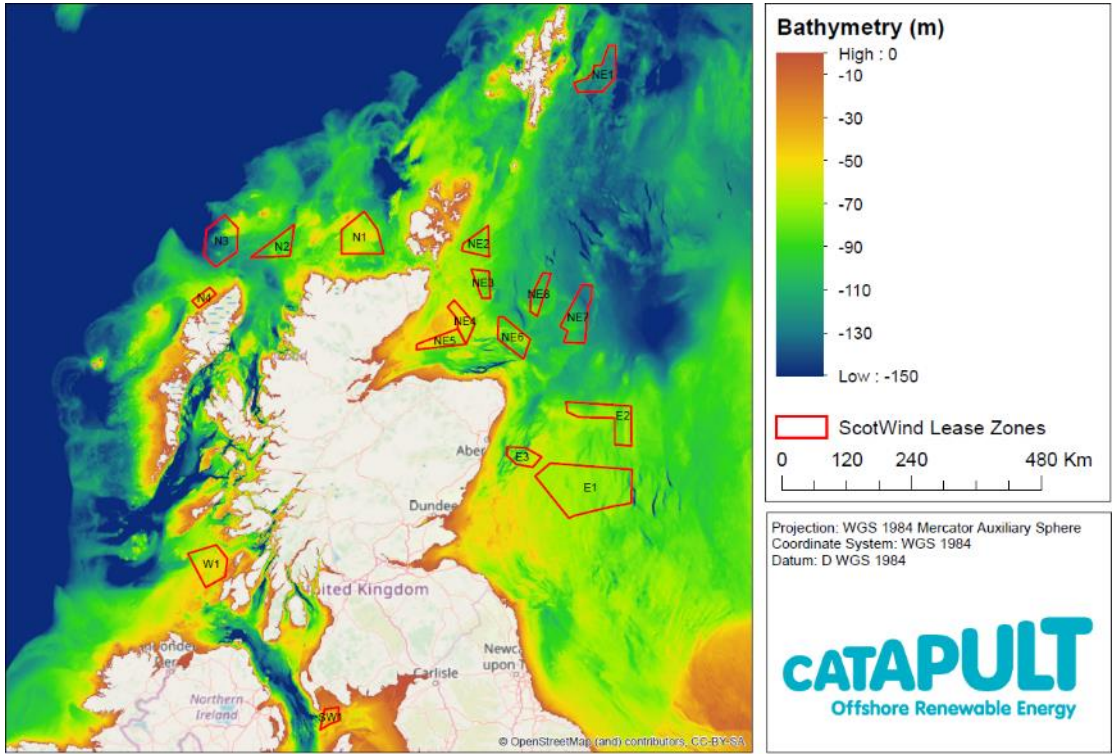
Introduction to FOW



Bhattacharya, Subhamoy & Nikitas, George & Jalbi, Saleh. (2018). On the Use of Scaled Model Tests for Analysis and Design of Offshore Wind Turbines. 10.1007/978-981-10-7721-0_6.

Introduction to FOW

- Why bother with FOW?
  - Water depth limitation
  - Ambitious global renewable energy targets
  - Opportunity for supply chain



ScotWind Lease Zones

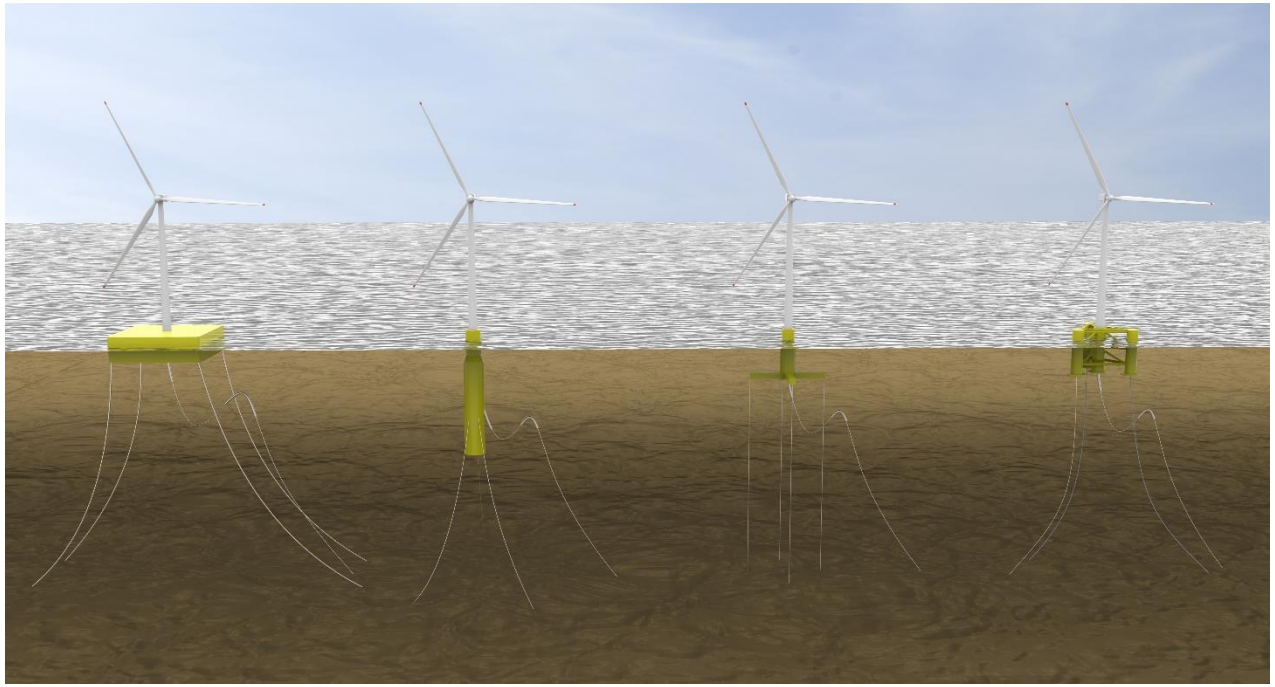
COUNTRY / REGION	SHARE OF OFFSHORE WIND RESOURCE IN +60m DEPTH	POTENTIAL FOR FLOATING WIND CAPACITY
Europe	80%	4,000 GW
USA	60%	2,450 GW
Japan	80%	500 GW
Taiwan	-	90 GW

FOW Potential (Source: WindEurope)

FOW Substructures

- Large number of substructures in development
  - 50+ designs
  - Dominated by semi-sub and steel
  - Some heritage from O&G designs

Source: GICON-SOF, Equinor and SBM Offshore



Left to right: barge, spar, TLP and semi-sub

Mooring System in FOW

Wind turbine	mostly wind turbine agnostic					
Transition piece	separate		Integrated (bolted connection)			
Substructure (steel/concrete)	barge (e.g. IDEOL)	semi-sub (e.g. PrinciplePower)	spar (e.g. Hywind)	TLP (e.g. TLPWIND)	hybrid (e.g. ACS Cobra)	
Mooring (redundancy and material: steel chain/wire, synthetic rope (nylon, polyester))	catenary*: conventional, lumped mass, buoyancy units			semi-taut*	taut	
Anchor/pile	drag-embedded*	suction	driven pile	drilled	gravity	torpedo

* TLPs are not compatible with catenary or semi-taut mooring and drag-embedded anchors

Industry Challenges

Key challenges

- Cost
- Shallow waters
- Seabed conditions (including extreme events)
- Global supply capability

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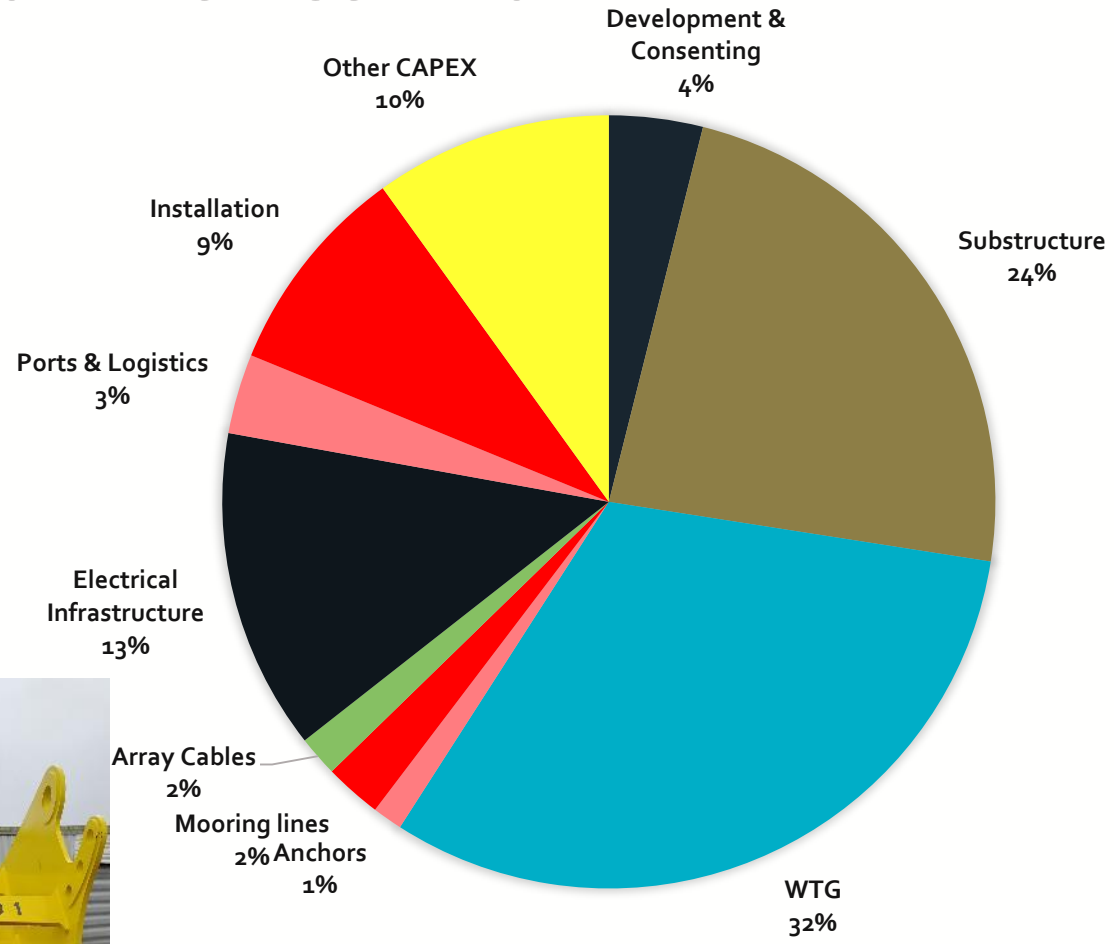
Innovation Hub & ETIP Roadmaps

- Intelligent mooring systems
- New materials
- Shared anchors
- Standards (O&G experience)

COMMERCIAL SCALE FOWF



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Practical case study - Floating Solar

Grigory Troshchenko (Heliorec)

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Technology overview

3 Principle types of Mooring:

- Passive mooring
- Reactive mooring
- Active mooring

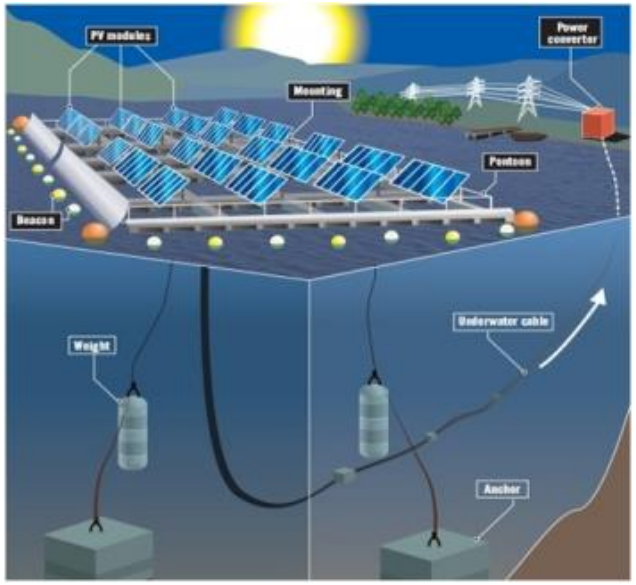


Fig 1: Passive mooring system

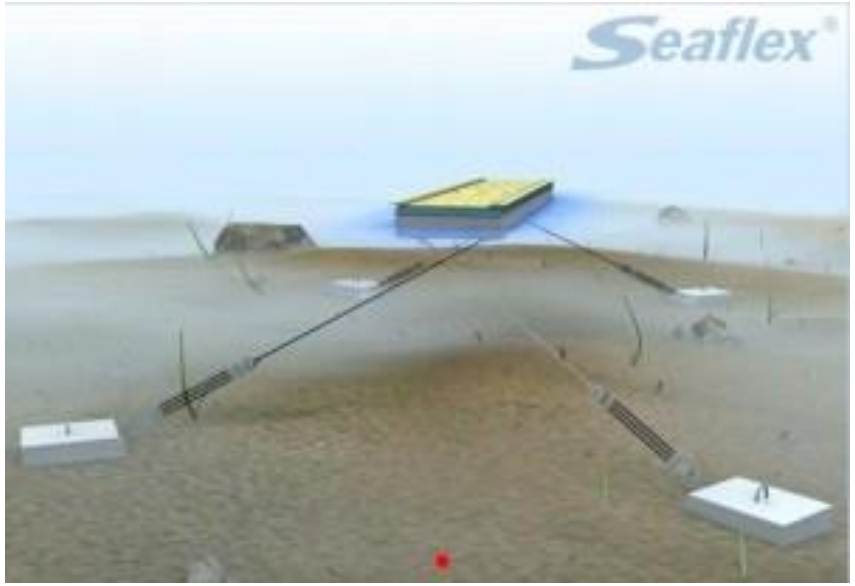


Fig 2: Reactive mooring system

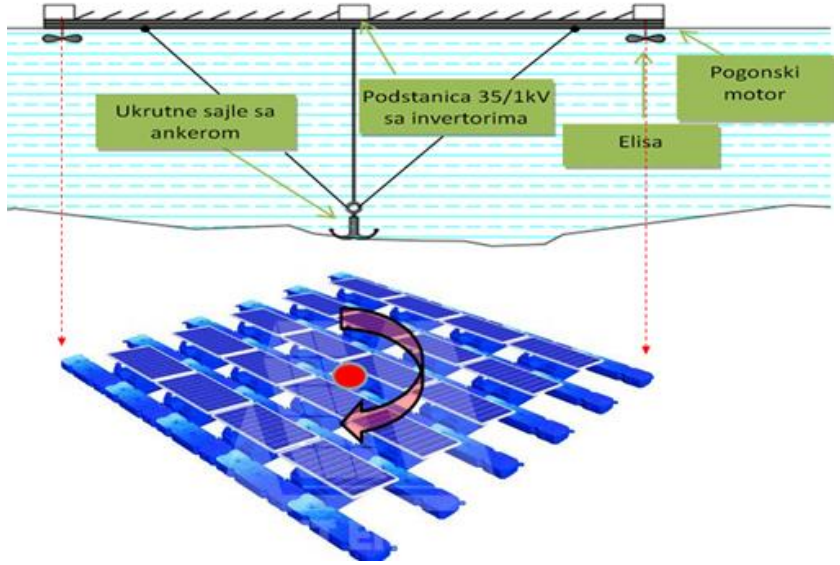


Fig 3: Active mooring system

Design Considerations

- Design Approach
- Numerical Simulation
- Maintenance

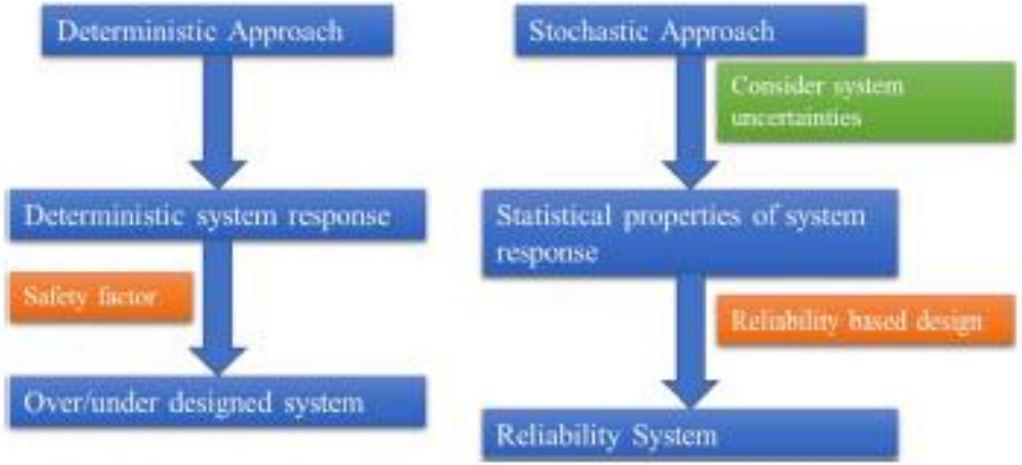
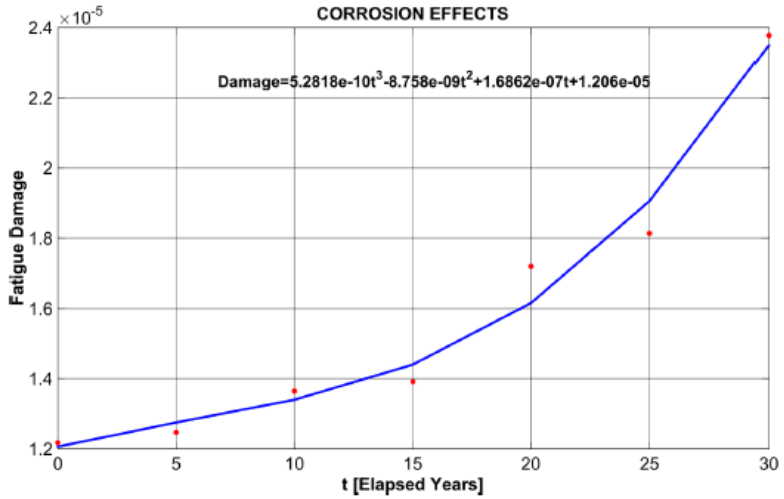
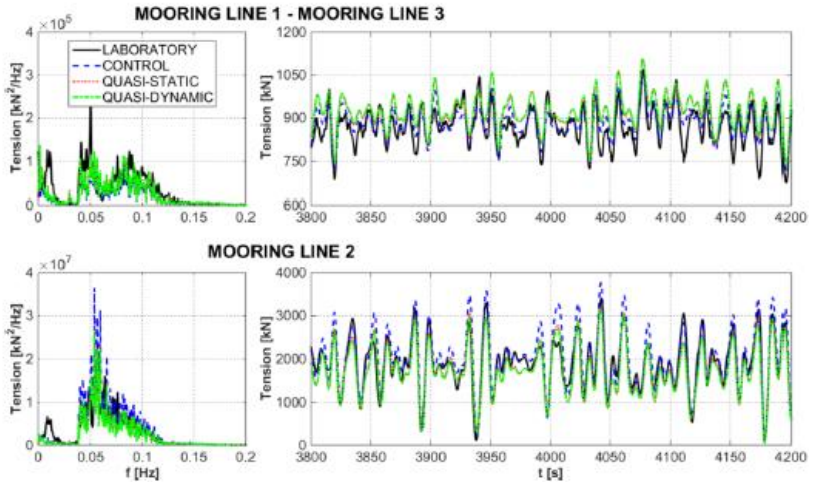


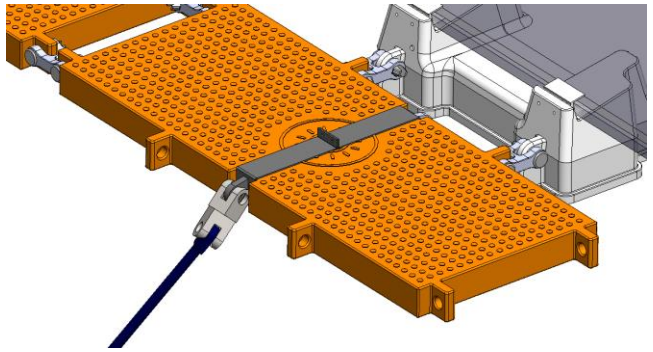
Fig. 11. Design approaches for structures.





HelioRec's mooring technology Case Study

- Static Installation



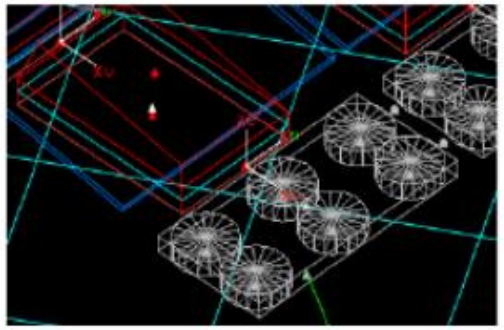
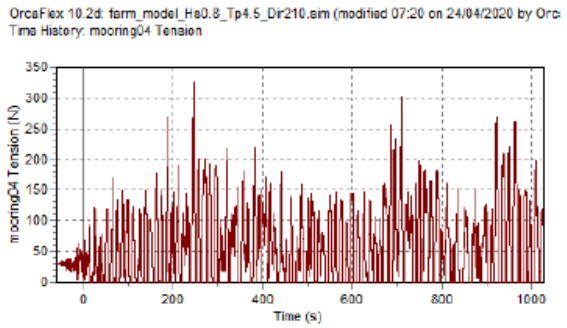
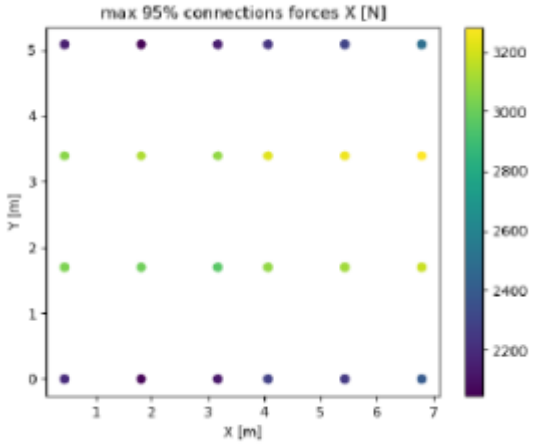


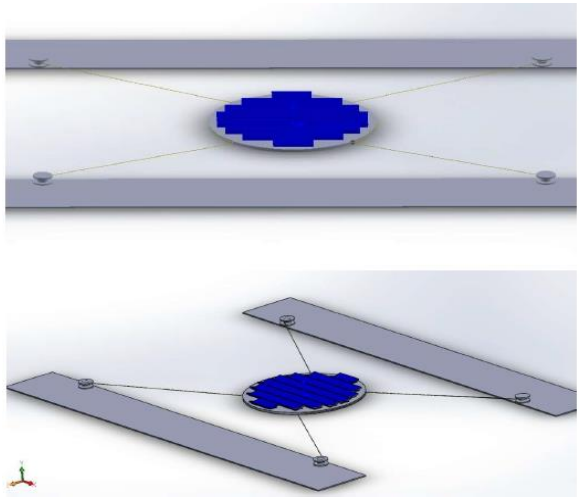
Figure 5: : footpath 6DBuoys representation

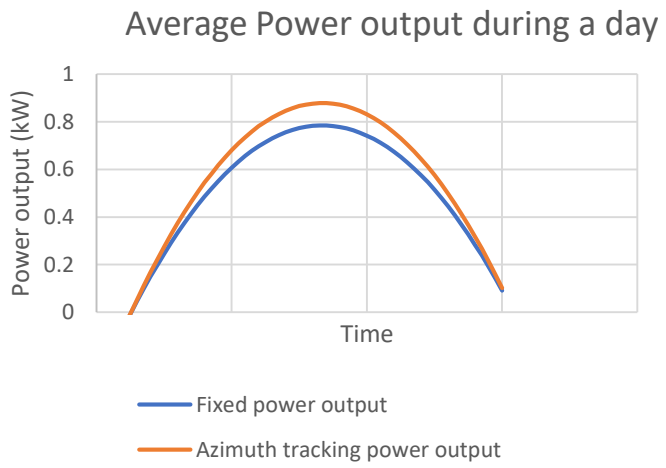




- Azimuth tracking using winch mooring

Smart tracking with data fusion to optimize energy balance





- A ≈ 10,000m^2 | W_{total} ≈ 120 Tons | P ≈ 1MW
- η_{gain} ≈ 11.34%
- V ≈ 10 deg/h
- Maintenance considerations
- CAPEX, OPEX, LCOE and ROI.

Innovation, risk and cost drivers - Floating wind, wave & tidal

Danny Golden (Dublin Offshore Consultants)

Interreg North-West Europe OPIN

EUROPEAN UNION

European Regional Development Fund

Innovation, risk and cost drivers.

Mooring and Anchoring for floating wind, wave & tidal

OPIN CIG Mooring & Anchoring Solutions
June 2020

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ENGINEERING OFFSHORE SOLUTIONS

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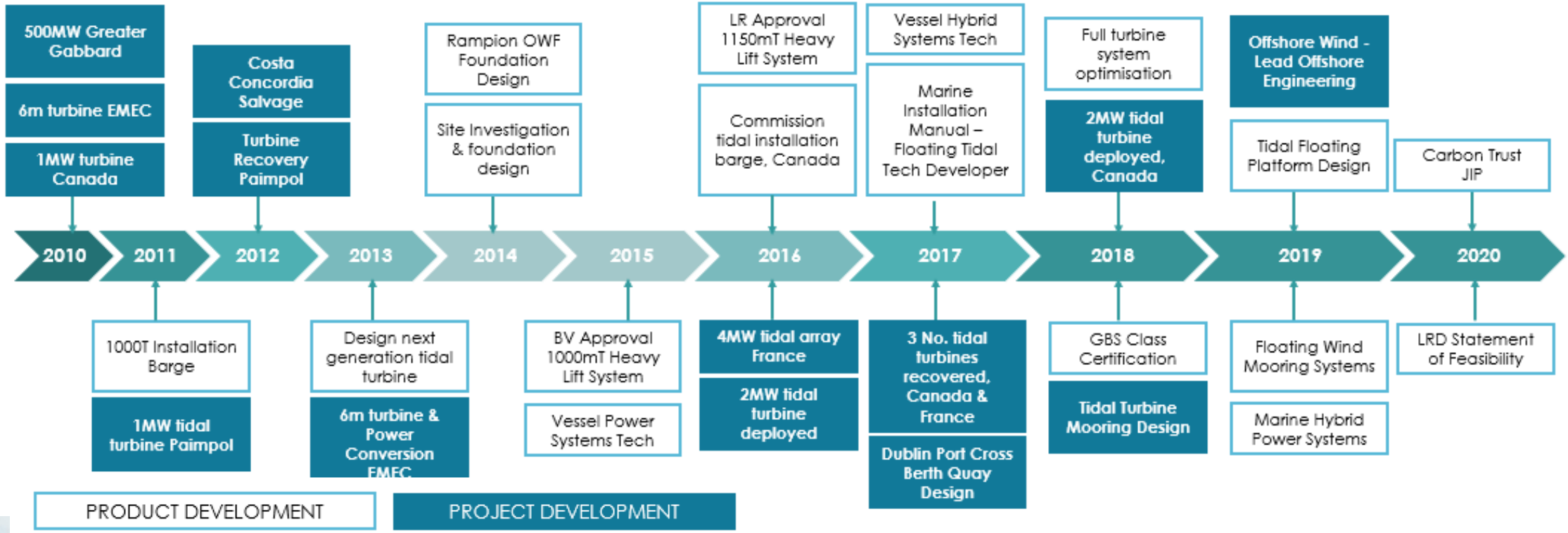

- Mission – develop innovative marine technology for offshore renewables

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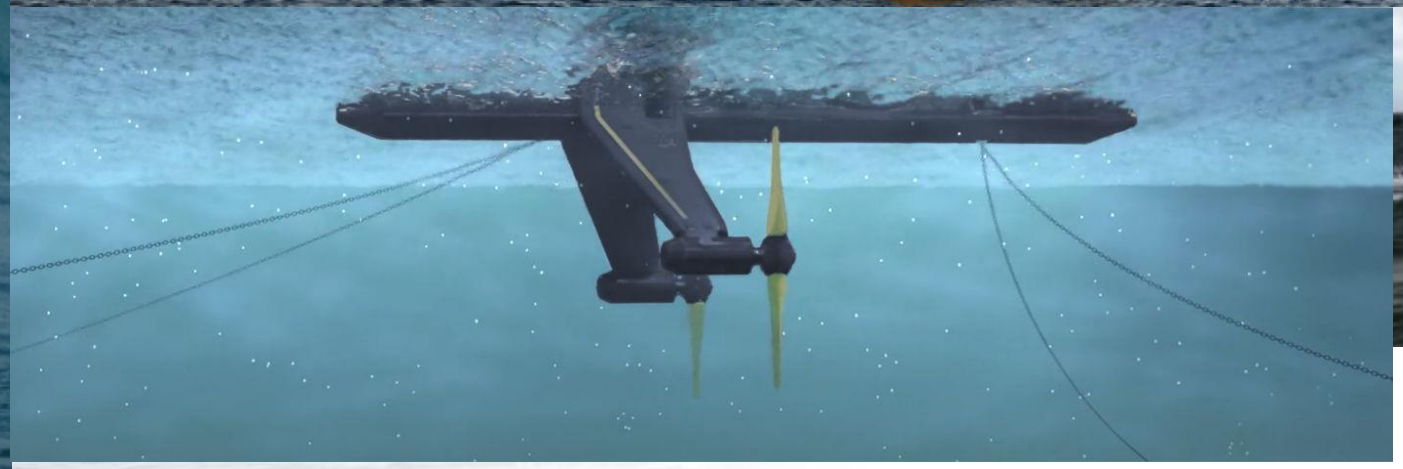
The Challenge



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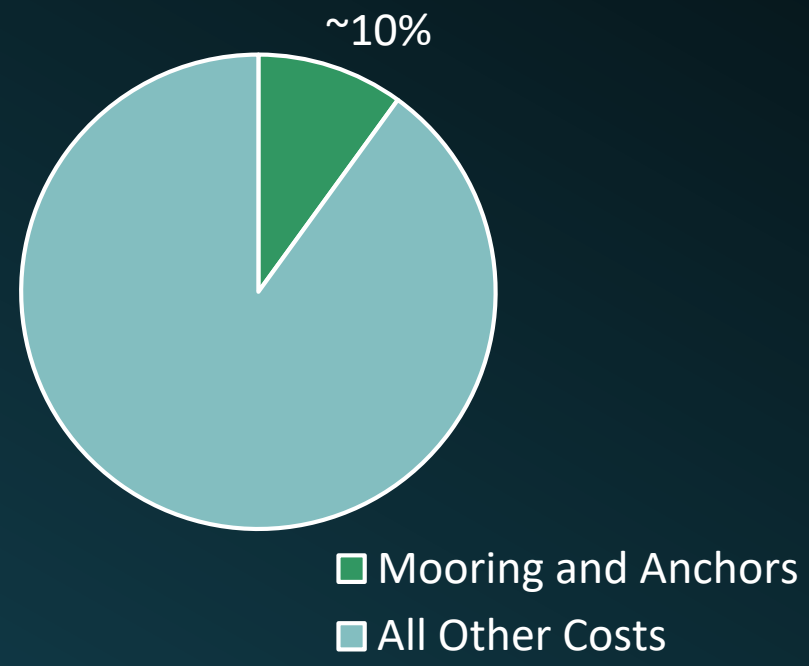
Market Context

Floating Offshore Wind LCOE



"The mooring system for a floating offshore wind turbine is based on the mooring systems … for offshore oil and gas operations. Such moorings have largely been optimised…"

– InnoEnnergy (BVG), 2019

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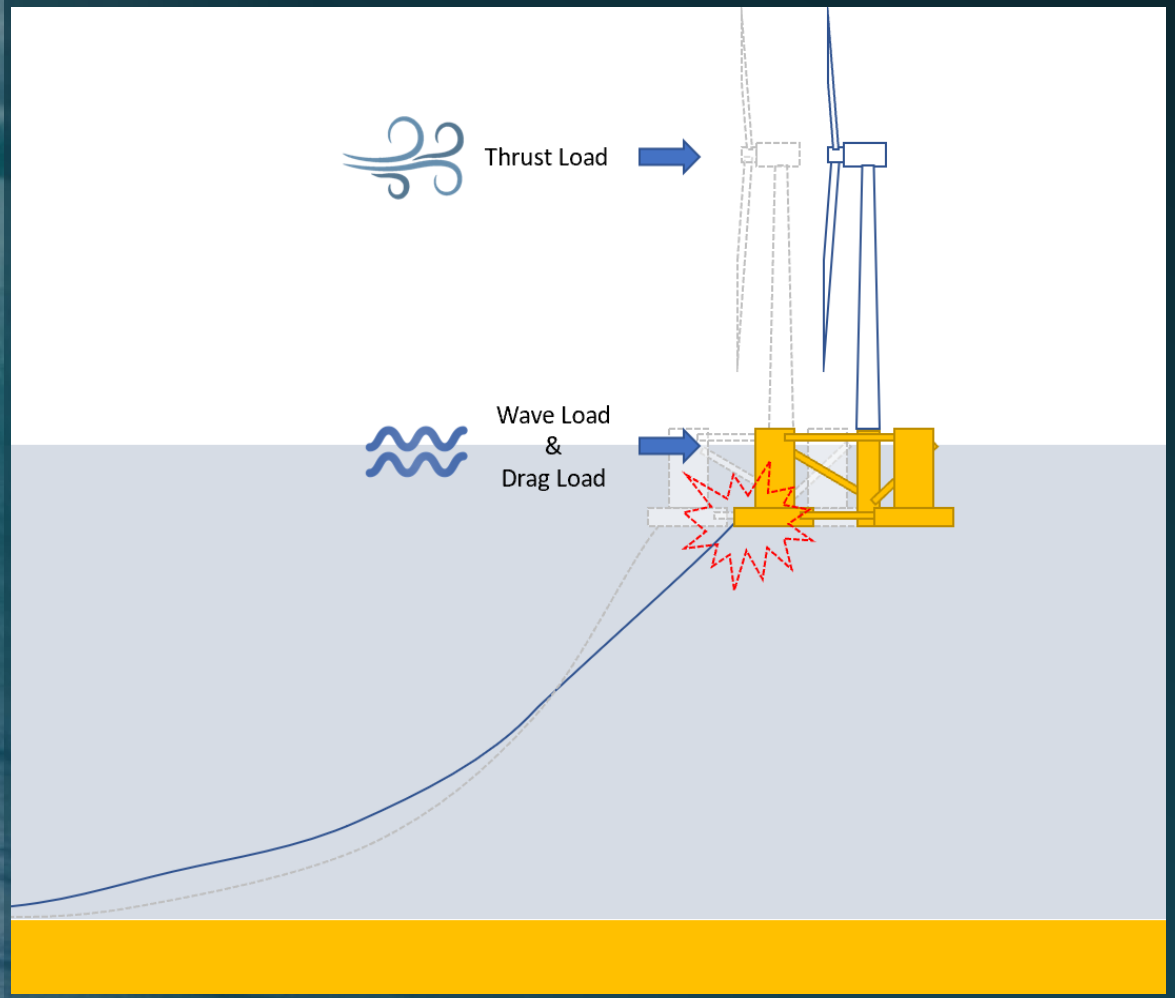
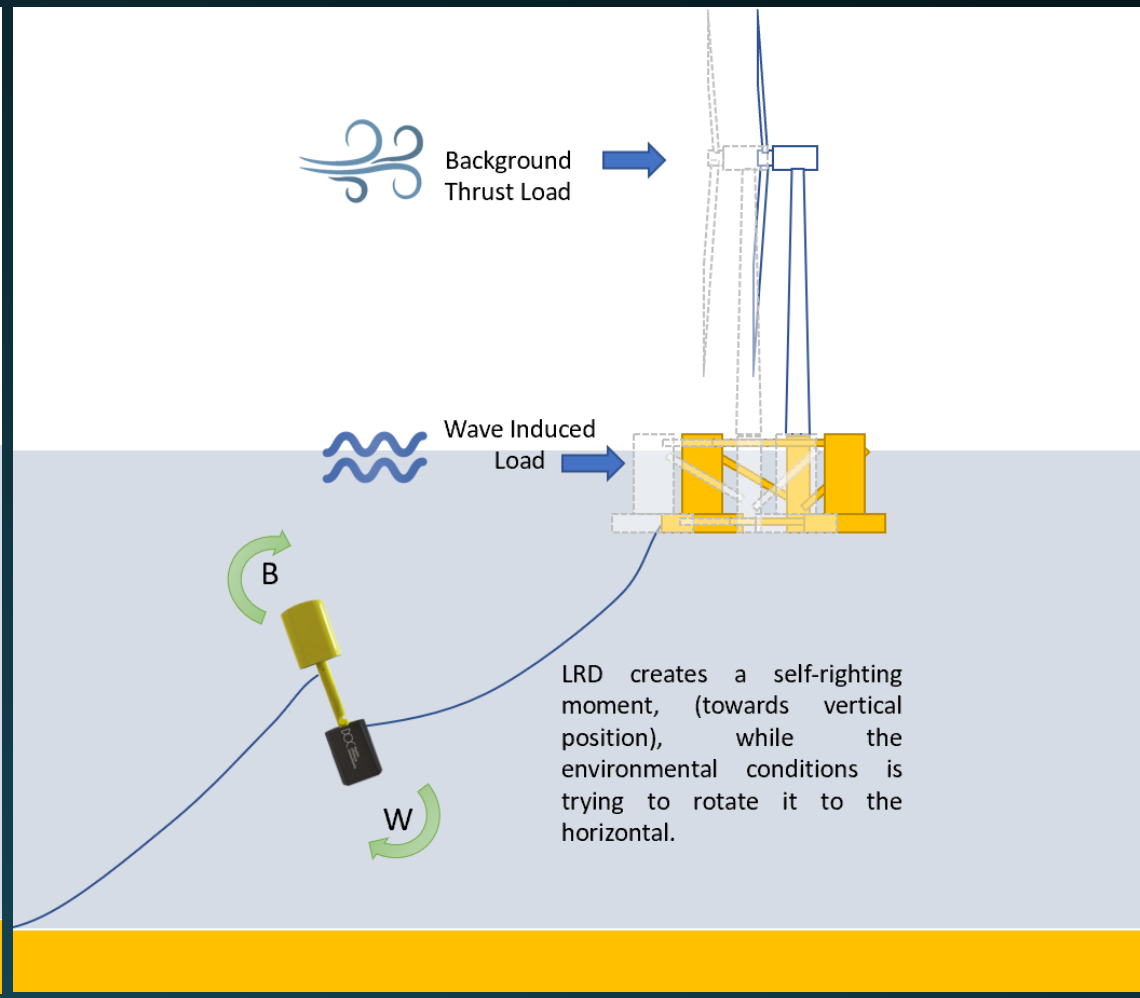
Problem





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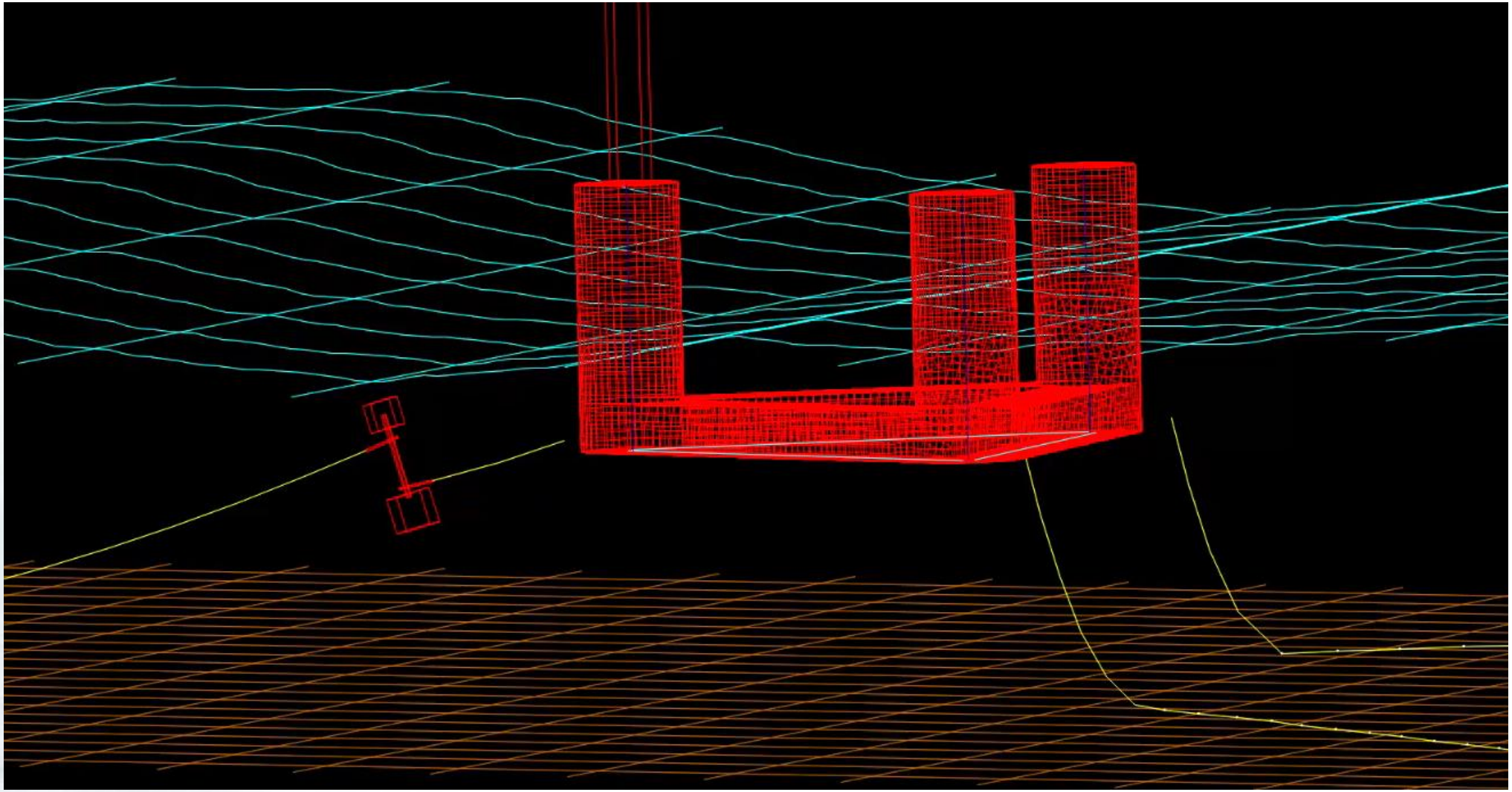
Technology



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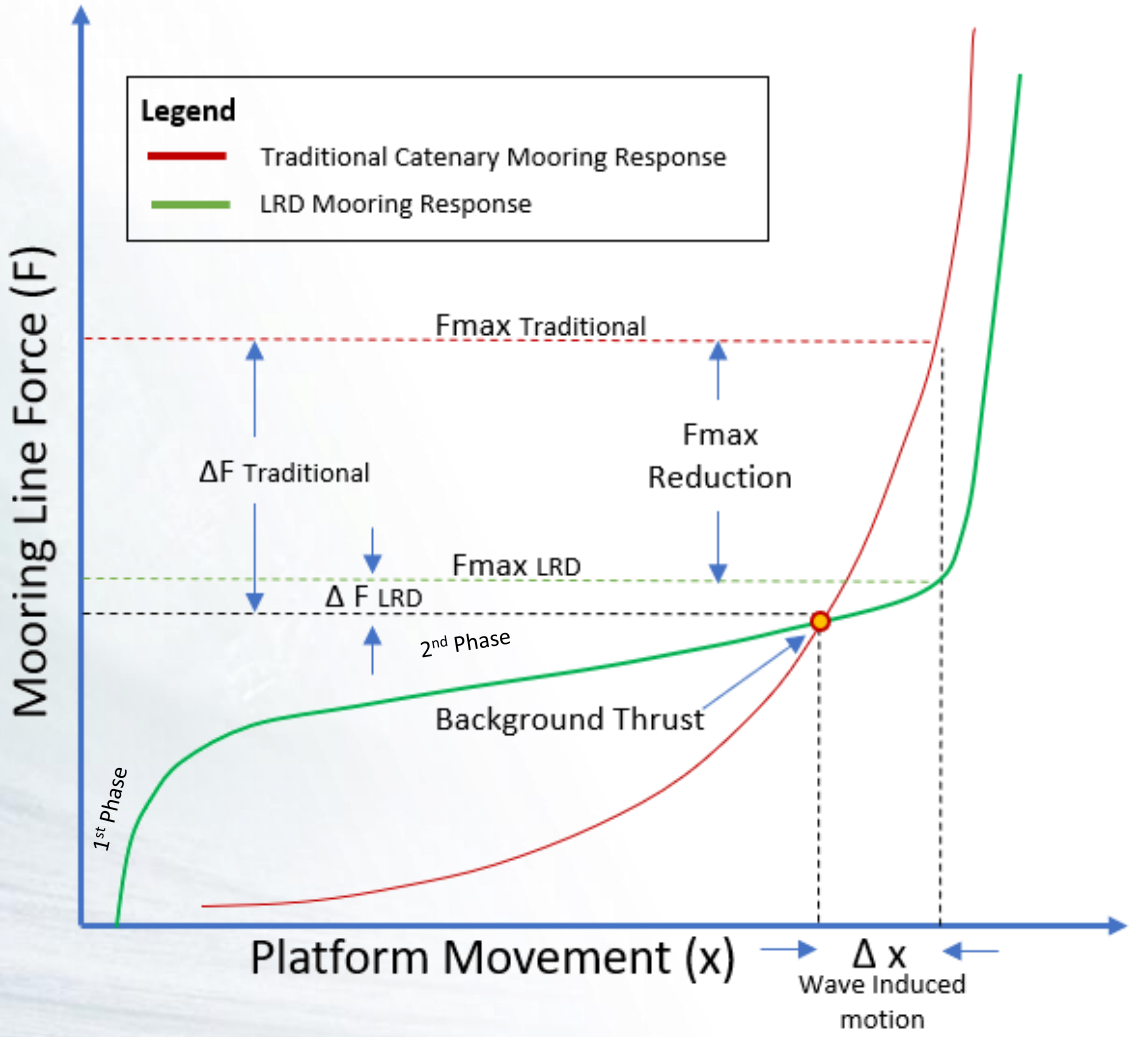
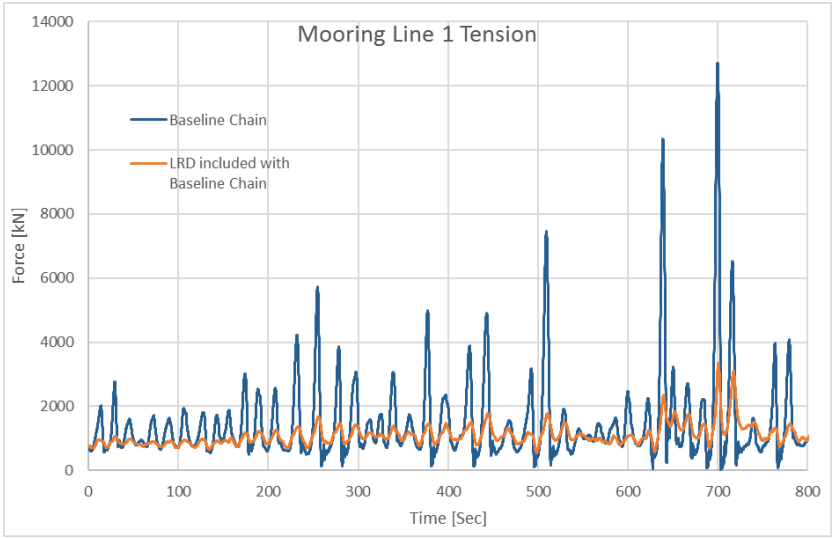
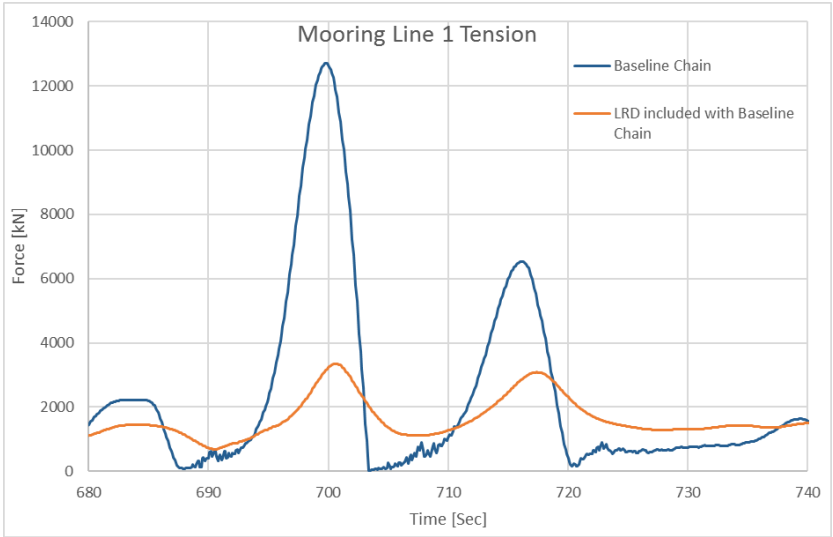
Technology







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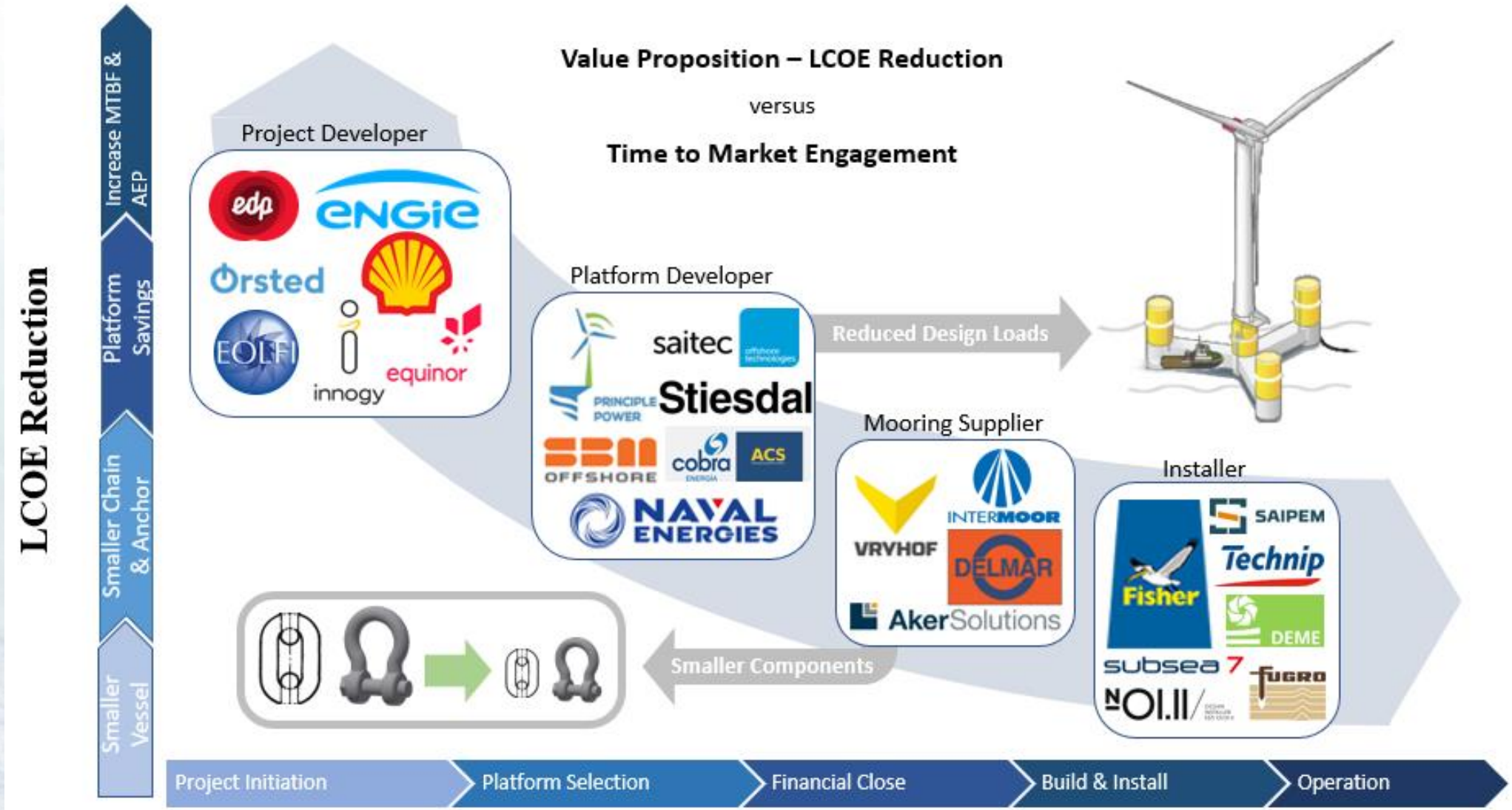
Value Proposition



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Thank you!