# North Sea Transition Workstream

*Offshore Europe 4th September 2025*

*Steve Travers, Baker Hughes*
*Mhairi Begg, North Sea Transition Authority*

technology leadership board

# North Sea Transition workstream members

Steve Travers — Baker Hughes

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Alex Argyros — JERA NEX BP

Paul Slorach — imenco FUTURE TECHNOLOGIES

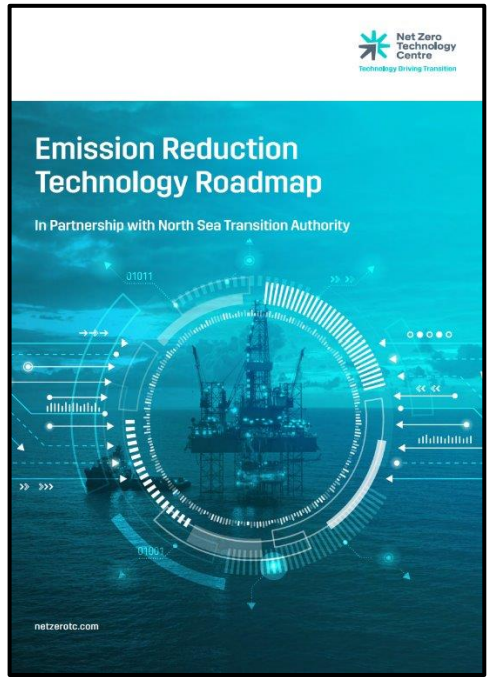
Chetan Laddha — TRANSFORMATIONAL ENERGY REIMAGINE NET ZERO

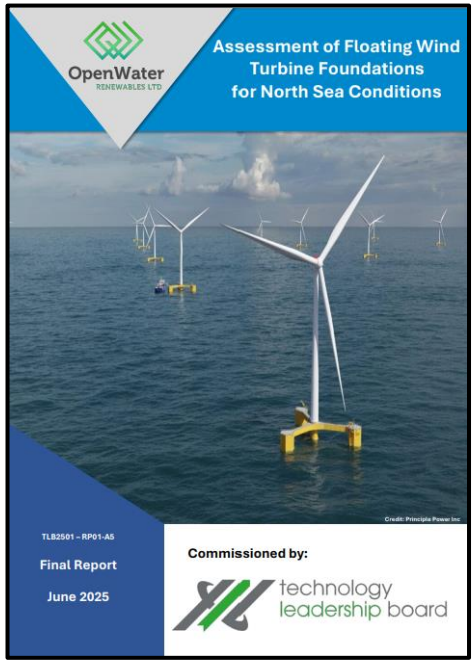
# North Sea Transition workstream topics

1. **Emission Reduction**
   - Emission Reduction Technology Roadmap (February 2025)
   - Emission Reduction Technology Showcase (February 2025)

2. **Carbon Storage**
   - Carbon Storage MMV Technology Showcase (October 2024)

3. **Floating Offshore Wind**
   - Assessment of Floating Offshore Wind Turbine Foundations for North Sea Conditions (June 2025)



# Assessment of Floating Wind Turbine Foundations for North Sea Conditions

# *Floating offshore wind foundation technologies*

*4th September 2025*

*Mhairi Begg, Senior Technology Advisor*
*North Sea Transition Authority*

technology leadership board

North Sea Transition Workstream

RECHARGE

Technology

# Hull ranking for UK floating offshore wind comes up with surprising result

Investments suitable for concrete-based foundations are taking place at ports such as Ardersier and Kishorn

ENERGY VOICE
The first word.

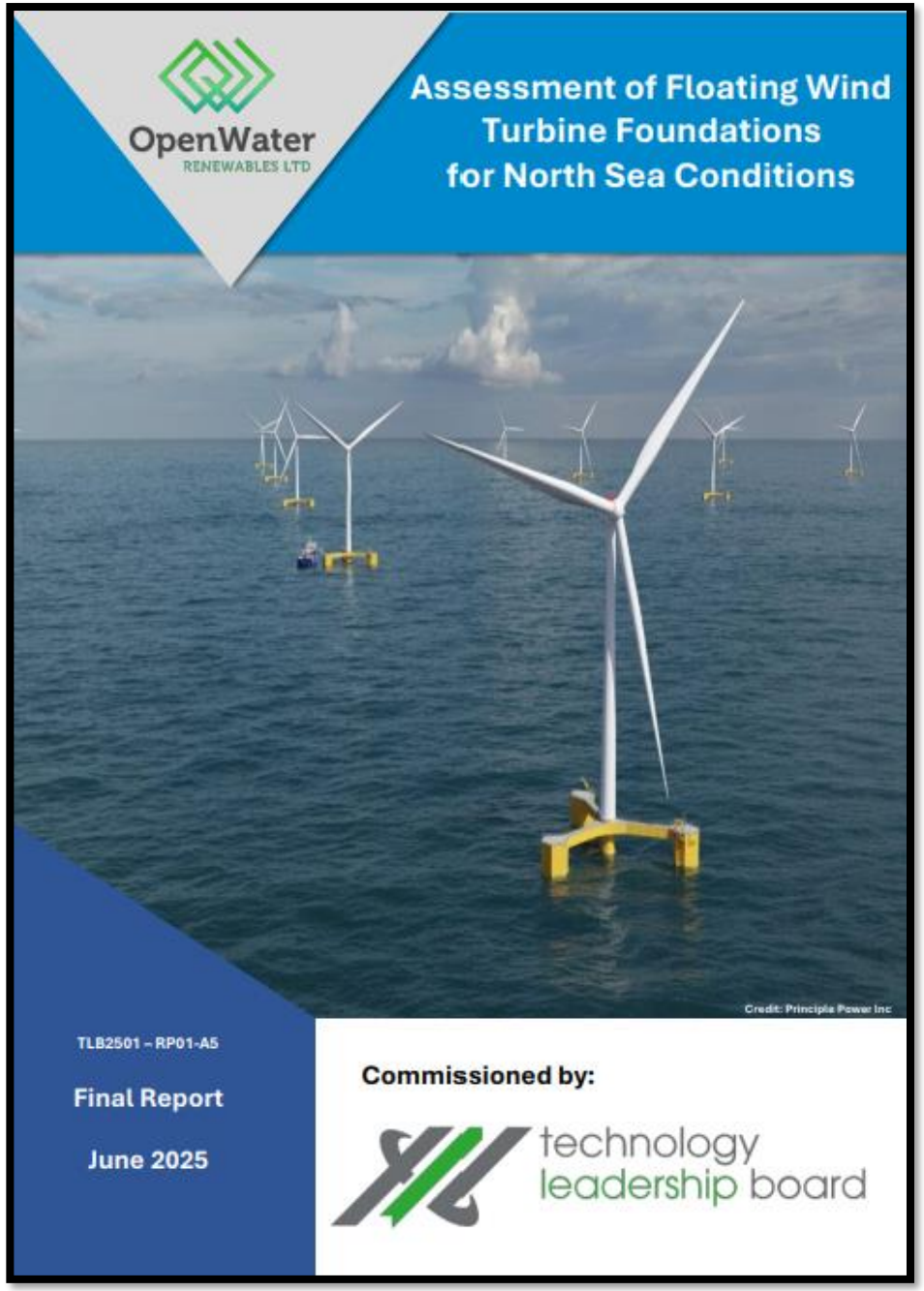
ENERGY TRANSITION

# Concrete foundations better suited for North Sea floating wind than steel

A new report found the materials durability and low maintenance made it better suited for hulls.

RECHARGE

The UK Technology Leadership Board (TLB), a strategic industry body for the offshore energy sector, attempted to address this problem by commissioning an independent study considering a variety of designs, using steel, concrete and hybrid materials.

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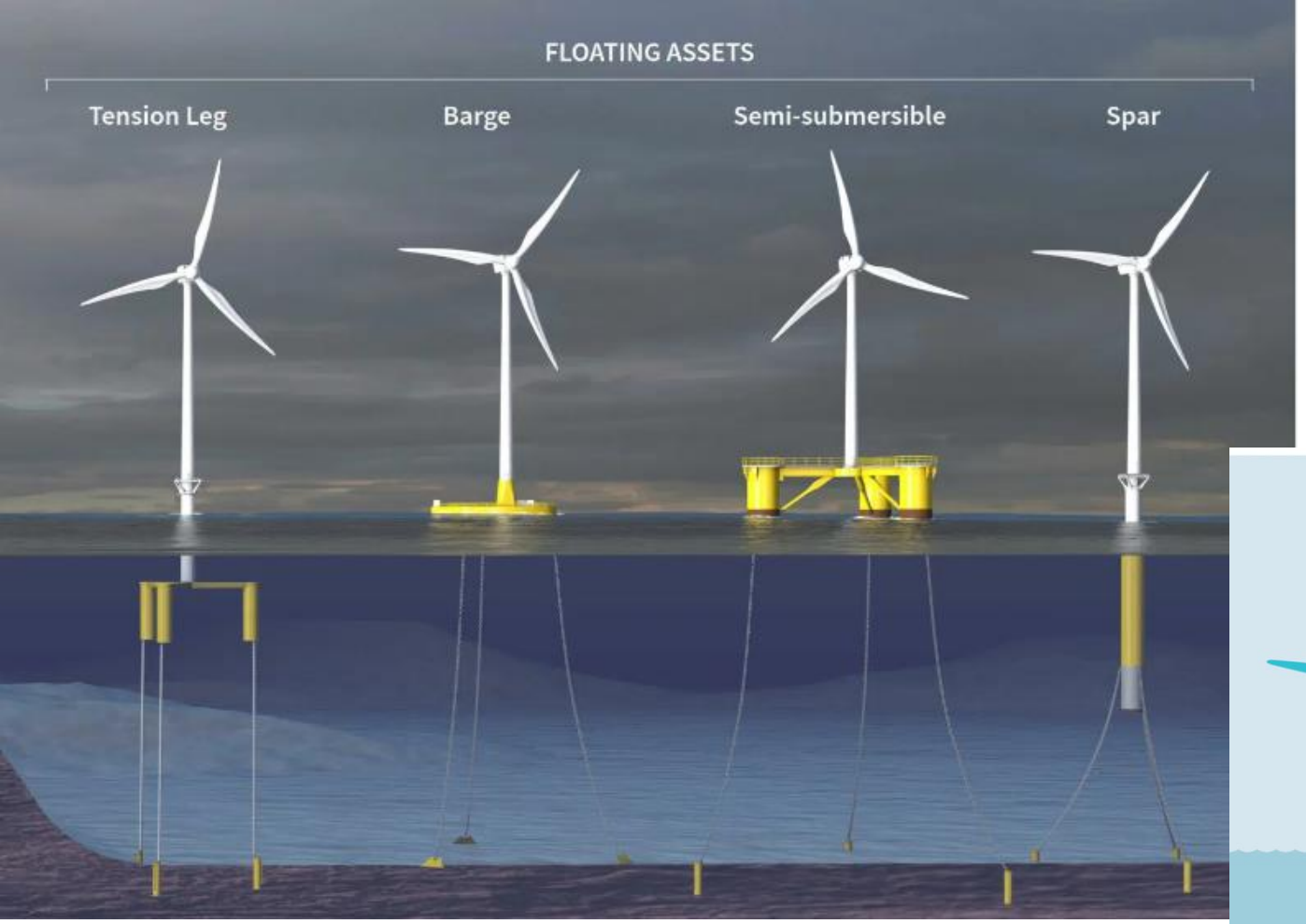
# Floating Offshore Wind (FOW) Foundations for North Sea Conditions

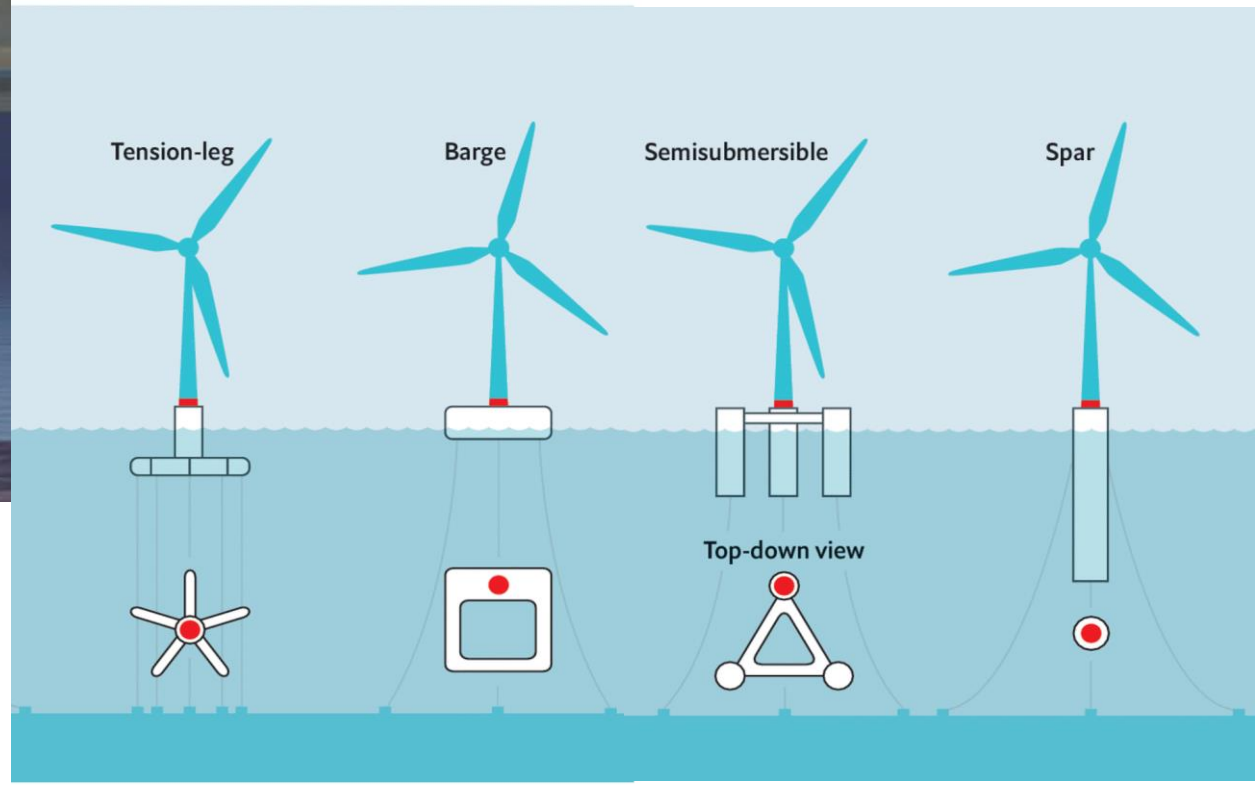
OpenWater Renewables Ltd (OWRL) worked with the Technology Leadership Board's (TLB's) North Sea Transition workstream to analyse FOW foundations.

**Why?**

- Over 100 FOW foundation designs
- Others have reviewed the different concepts, but the results have generally not been made public.
- The TLB's intent is to widely share the key factors relevant to FOW foundation selection.
- TLPs, Barges, Semi-submersibles, and Spars considered in steel, concrete or hybrid of both.




Source: Acteon




Source: Encyclopaedia MDPI

# FOW Foundations for North Sea Conditions

## Basis of Study:

- Hypothetical 750 MW wind farm in 100-150m Scottish North Sea water depth.
- Distance from shore 80km to 120 km.
- 50 x 15 MW Wind Turbine Generators to be deployed between 2030 and 2035.

| Criteria Group | Criteria | PWF Group | PWF |
|---|---|---|---|
| **CAPEX** | Draft after Turbine Integration | A | 2 |
| | Local Content Opportunity | A | 2 |
| **Installation** | Ease of Installation | C | 4 |
| | Use of Temporary Buoyancy | C | 4 |
| | Use of Temporary Winches | C | 4 |
| | Offshore Vessel Requirement | C | 4 |
| | Towing Costs | C | 4 |
| **OPEX** | Accessibility | A | 2 |
| **Performance** | Nacelle Motions | A | 2 |
| **Repair** | Ease of Disconnection | B | 3 |
| | Laydown area | A | 2 |
| **Risk** | TRL | B | 3 |
| | Financial Strength of Company | B | 3 |
| **EPCI** | Engineering Strength | B | 3 |
| | Project Execution Strength | B | 3 |

## Approach:

- 107 FOW concepts assessed using OWRL's ranking tool.
- Scored across a range of technical, commercial and project execution characteristics.
- North Sea Project Weighting Factors (PWF) applied - installation, accessibility, performance and risk.
- The short windows of calm weather in the North Sea means that ease of installation is a key differentiator between concepts.

# Technology Readiness Levels (TRL)

- Technical maturity was a key factor in assessing the risk of selecting a foundation concept.
- TRL scale of 1 to 9 used to estimate the maturity of concepts.
- Most of the tracked concepts are at TRL 3 or TRL 4.

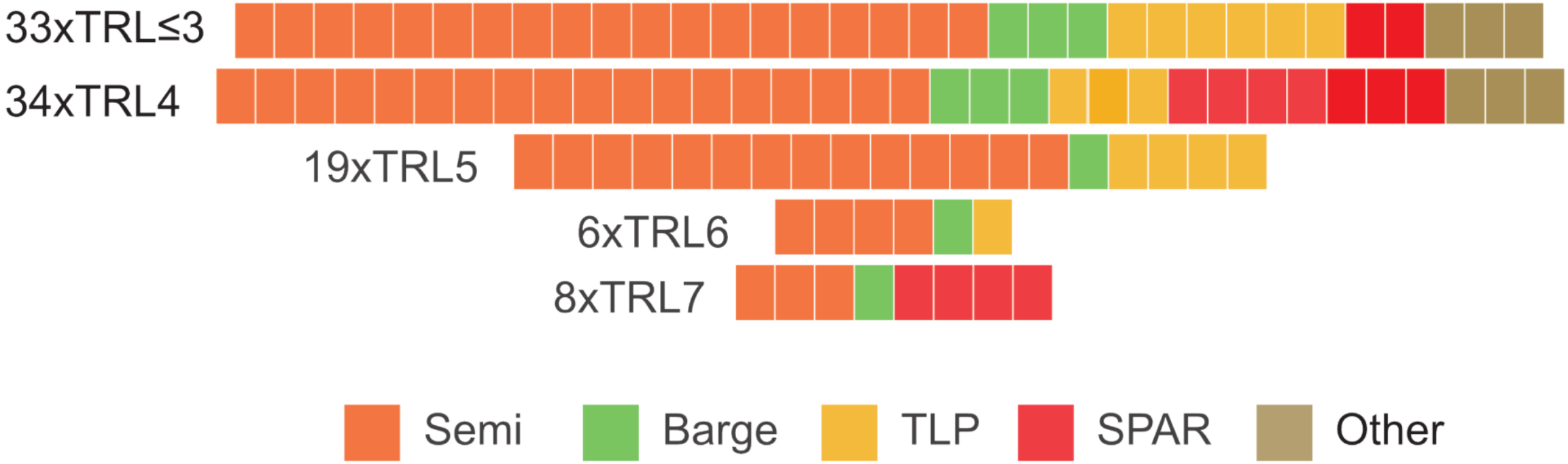
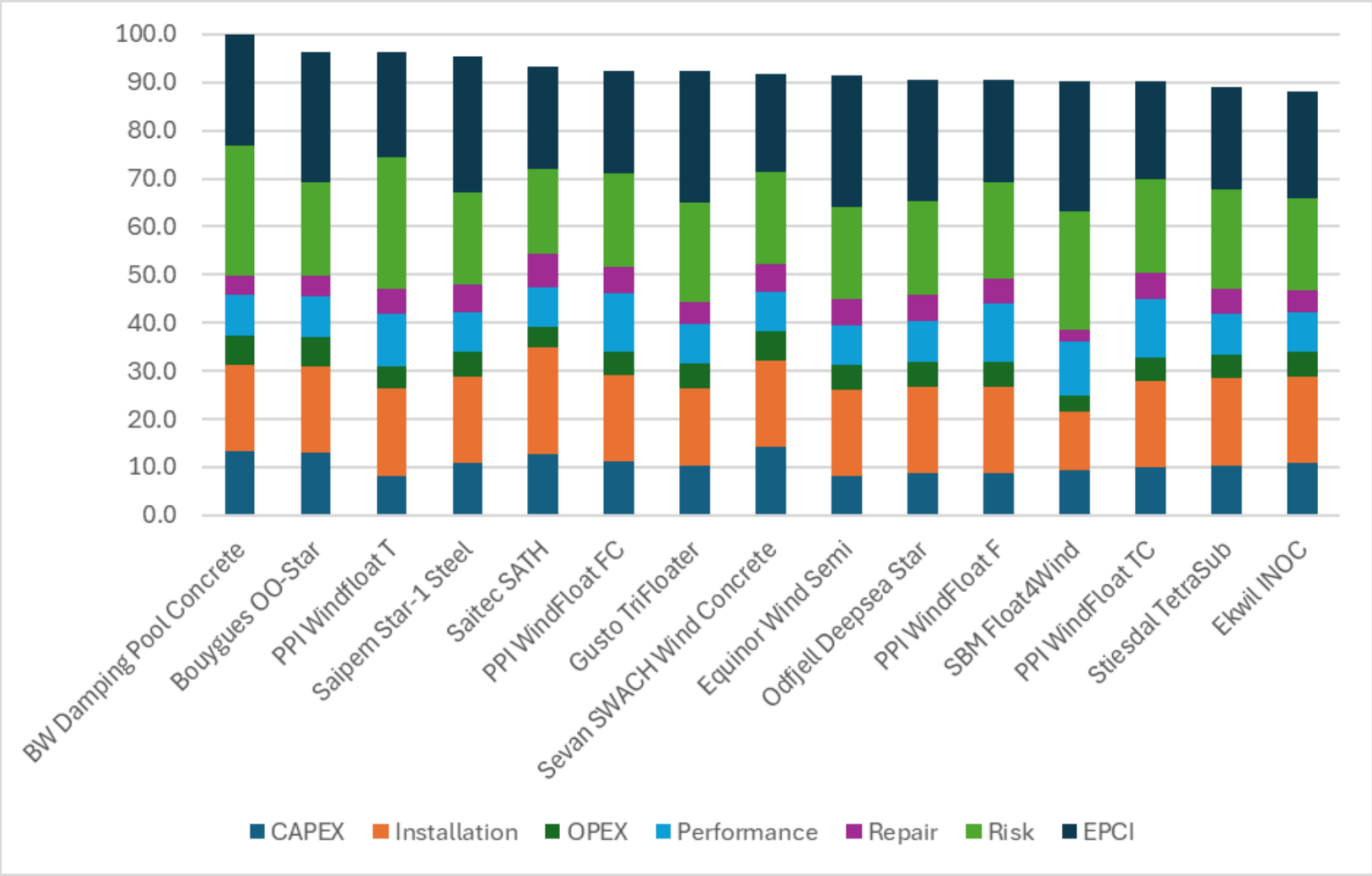



**Figure 4-2: Summary of TRL levels by hull type**

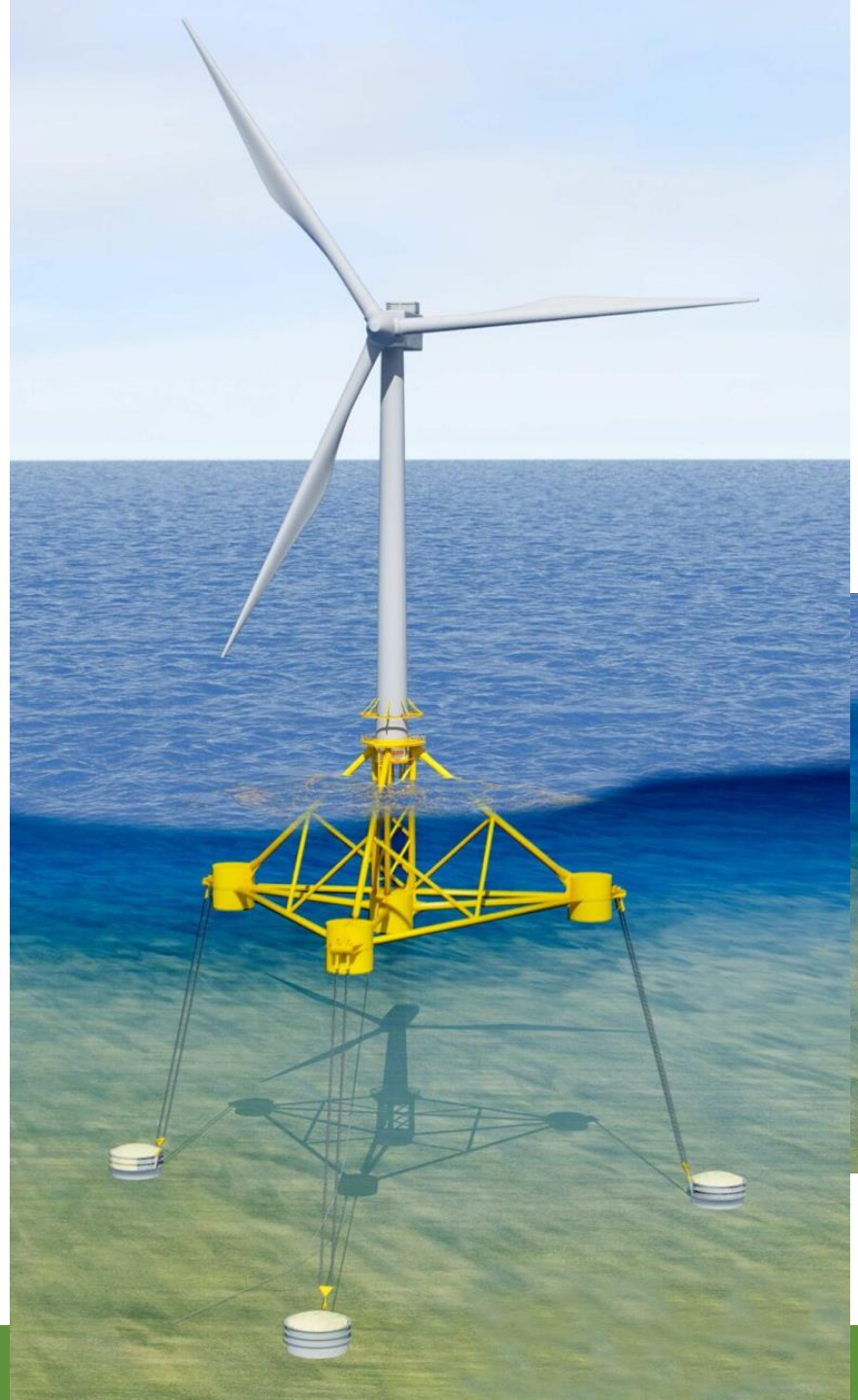
# Shortlist of 15 foundation concepts suitable for North Sea projects

- **15 most highly ranked** concepts for North Sea projects, of which:
  - 11 semi-subs
  - 3 barges
  - 1 TLP
- **4** are **TRL 6 or 7**
- **11** of the most promising **TRL 5** concepts were also considered, these will require development acceleration.



# Tension Leg Platform (TLP)

- TLPs are generally lightweight
- SBM Float4Wind TLP scores highest for performance
- TLPs have inherently low motions, results in minimal nacelle motions
- Reduced seabed footprint
- ….in the main TLPs have less favourable installation characteristics and not well suited for North Sea conditions.

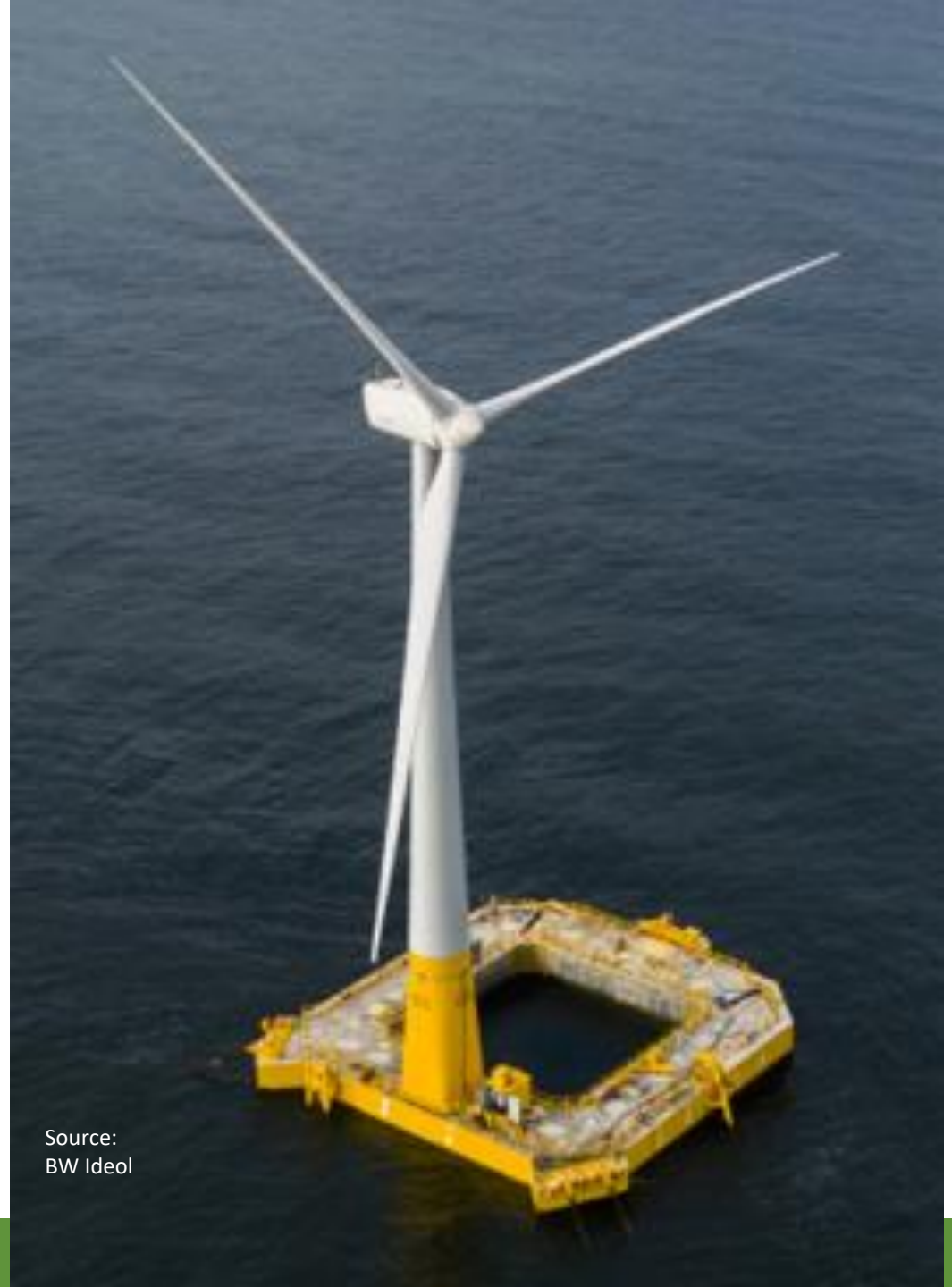


**SBM Float4Wind (now Ekwill JV with Technip): TRL 6**

Source: Empire Engineering SBM offshore wind floater scaled (main); Riviera.

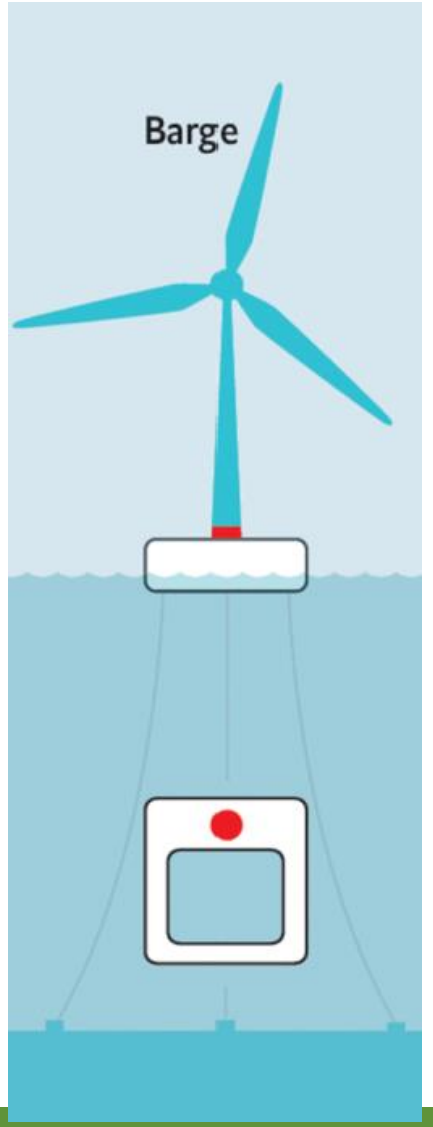
# Barge

- In concrete
- Ease of installation
- Significantly cheaper than steel
- Lends itself to UK content
- BW Ideol barge has a patented system of stabilisation relying on entrapped water in the central pool
- Less maintenance than steel
- Lower embedded carbon



Source:
BW Ideol

## BW Ideol Damping Pool Concrete: TRL 7



# Barge in concrete and steel hybrid

- Saitec SATH barge scores highest for both installation and repair
- High stability in tow-out with lowest drag
- Single Point Mooring, allows rapid installation and disconnection…..
- But introduces critical mechanical components which must be inspected and maintained throughout the unit's life.


**Saitec SATH (Swinging Around Twin Hull): TRL 6**

Source: Saitec

# Semi-subs

- The most numerous type in the FOW development pipeline
- 11 of 15 highest ranking are semi-subs
- Good motion characteristics
- Ease of installation
- Steel designs are likely to be more expensive and require more maintenance than concrete hulls as the structures age

Source: Principle Power

**Principle Power Windfloat T: TRL 7**

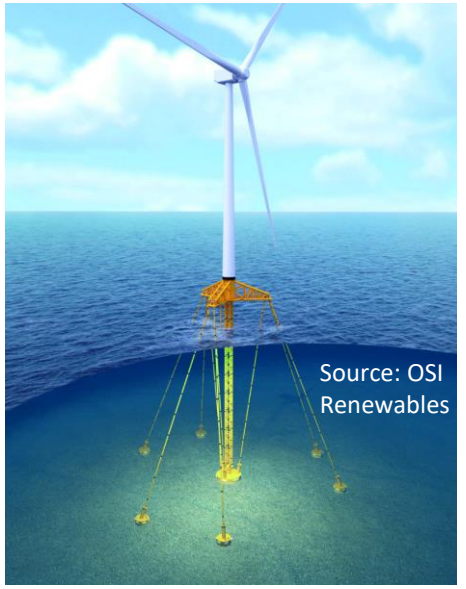
# 15 most highly ranked concepts

| | CAPEX * | OPEX | LCOE | Ease of WTG Integration | Ease of Installation | Ease of O&M | Reliability | Performance | Ease of Major Repair | TRL/Risk | Examples (TRL) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Barge in Concrete | 100% | | | | | | | | | | BW Ideol Damping Pool (7), Sevan SWATCH (5) |
| Barge in Hybrid Steel & Concrete | 110% | | | | | | | | | | Saitec SATH (6) |
| Semi-Sub in Steel | 105% to 115% | | | | | | | | | | PPI WindFloat-T (7), PPI WindFloat F/FC/TC (5), Saipem Star-1 (5), Gusto TriFloat (5), Equinor WindSemi (5), Odfjell Deepsea Star (5), Steisdal TetraSub (5), Ekwil INOC (5) |
| Semi-Sub in Concrete | 100% | | | | | | | | | | Bouygues OO-Star (5) |
| TLP in Steel | 115% | | | | | | | | | | SBM Float4Wind (6) |
| * Ball Park total project CAPEX compared to the Concrete Barge case. | | | | | | | Key: | Good | Intermediate | Poor | |

The shortlist encompasses a diverse range of available concept types

# Conclusions

- Semi-sub or barge concepts favoured for North Sea
- Spars screened out - no UK deep-water ports
- TLPs disadvantaged by installation complexity
- Concrete hulls good for robustness, and local content, but steel also acceptable
- The lowest CAPEX and OPEX, and hence LCOE, was found to be a concrete foundation – either a Barge or Semi-sub.
- Recommendations
  - Accelerate TRL progress for promising concepts.
  - Several less mature UK-based concepts could be candidates for accelerated development.




OSI Renewables F-TLP


Trivane hybrid steel/concrete barge

# Thank you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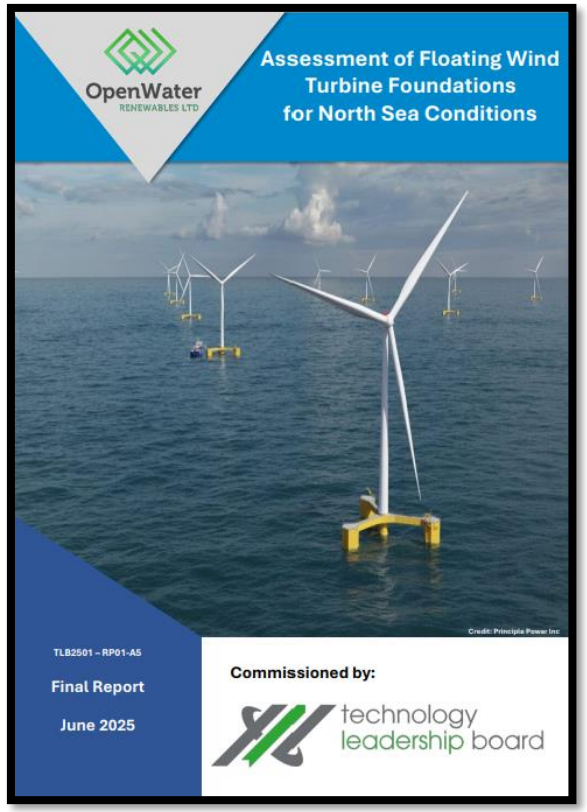


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# Concluding remarks

- Thank-you to Mhairi for her presentation
- North Sea Transition workstream is planning a strategy session to formulate a work-plan for the coming year
- NST workstream is open to new members
- Come speak to us or email info@the-tlb.com