SBT Energy

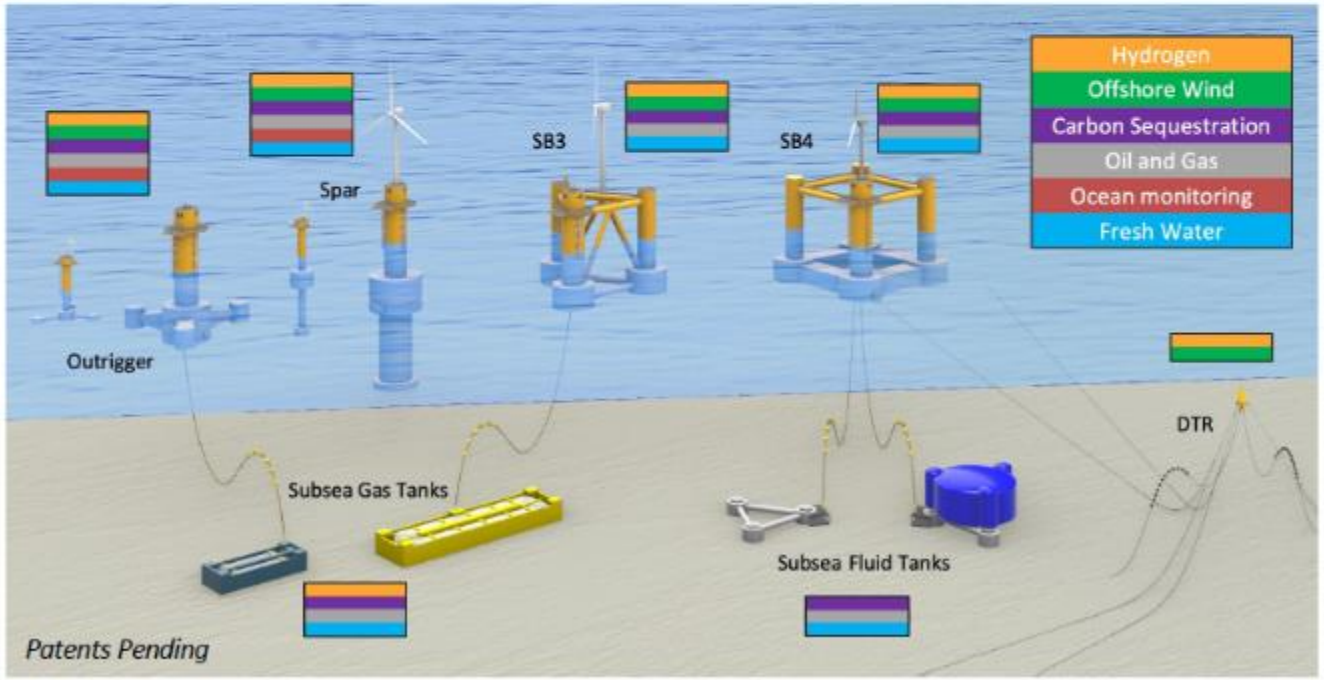
SBT Energy – DeepWind

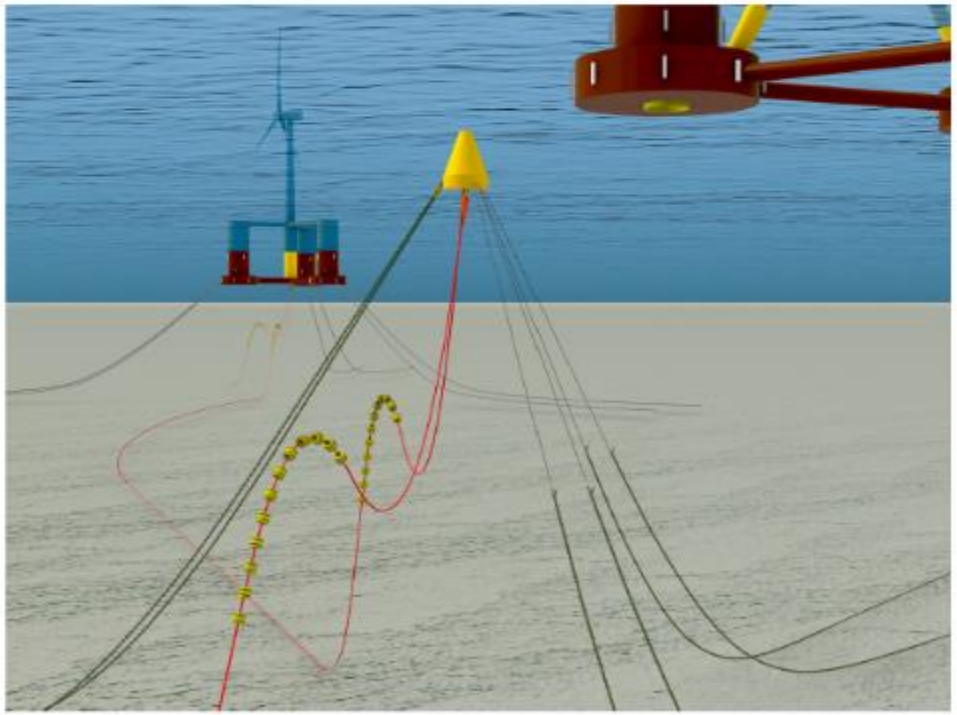
Disconnectable Turret for Renewables (DTR)

Scotland-Norway Joint Cluster Workshop - 4th May 2021

Who are SBT Energy?

- Concept and Product Development company based in Aberdeen.
- Team with extensive background in oil & gas, defence and offshore renewables
- Core objective is development of cost-effective and technically feasible solutions.





Floating Wind Challenge (Carbon Trust).

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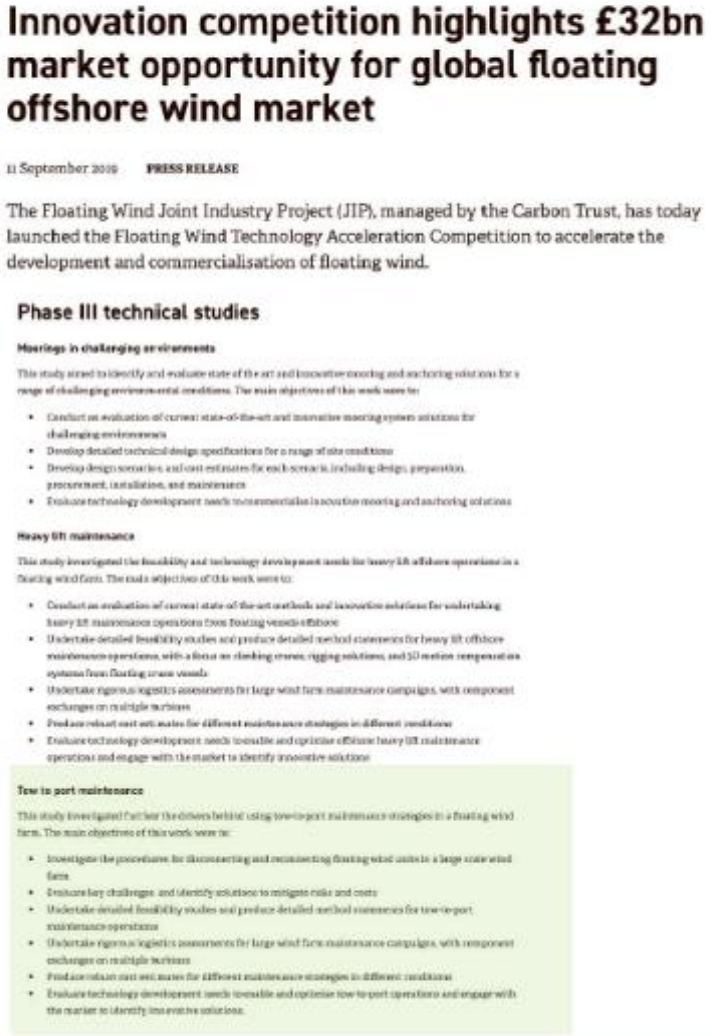
- The Carbon Trust set the Challenge in Phase III of their Floating Wind JIP.
- SBT Energy responded to the challenge by unveiling their DTR solution to the "Tow to Port Maintenance" which also offers an alternative to the "Heavy Lift Maintenance" offshore task.

Challenge 2: Disconnecting and re-connecting offshore foundation structures when they are removed from the wind farm and towed to port for major maintenance. Before towing a structure to port, mooring lines and electrical power cables need to be disconnected. This operation can take several hours and be limited by available weather windows. When leaving the disconnected power cables and mooring lines behind, they need to be secured so that a re-connection of the structure is easily achievable once it returns to the wind farm. This may be several months after it has been removed. The competition will welcome applications on technologies that will allow cost effective and safe disconnection and re-connection operations when turbines foundations are towed to port.



Innovation competition highlights £32bn market opportunity for global floating offshore wind market

11 September 2018 **PRESS RELEASE**

The Floating Wind Joint Industry Project (JIP), managed by the Carbon Trust, has today launched the Floating Wind Technology Acceleration Competition to accelerate the development and commercialisation of floating wind.

Phase III technical studies

Moorings in challenging environments

This study aimed to identify and evaluate state of the art and innovative mooring and anchoring solutions for a range of challenging environmental conditions. The main objectives of this work were to:

- Conduct an evaluation of current state-of-the-art and innovative mooring system solutions for challenging environments
- Develop detailed technical design specifications for a range of site conditions
- Develop design scenarios and cost estimates for each scenario, including design, preparation, procurement, installation, and maintenance
- Evaluate technology development needs to commercialise innovative mooring and anchoring solutions

Heavy lift maintenance

This study investigated the feasibility and technology development needs for heavy lift offshore operations in a floating wind farm. The main objectives of this work were to:

- Conduct an evaluation of current state-of-the-art methods and innovative solutions for undertaking heavy lift maintenance operations from floating vessels offshore
- Undertake detailed feasibility studies and produce detailed method statements for heavy lift offshore maintenance operations, with a focus on climbing cranes, rigging solutions, and 3D motion compensation systems from floating crane vessels
- Undertake rigorous logistics assessments for large wind farm maintenance campaigns, with component exchanges on multiple turbines
- Produce robust cost estimates for different maintenance strategies in different conditions
- Evaluate technology development needs to enable and optimise offshore heavy lift maintenance operations and engage with the market to identify innovative solutions

Tow to port maintenance

This study investigated the key drivers behind using tow-to-port maintenance strategies in a floating wind farm. The main objectives of this work were to:

- Investigate the procedures for disconnecting and reconnecting floating wind units in a large scale wind farm
- Evaluate key challenges and identify solutions to mitigate risks and costs
- Undertake detailed feasibility studies and produce detailed method statements for tow-to-port maintenance operations
- Undertake rigorous logistics assessments for large wind farm maintenance campaigns, with component exchanges on multiple turbines
- Produce robust cost estimates for different maintenance strategies in different conditions
- Evaluate technology development needs to enable and optimise tow-to-port operations and engage with the market to identify innovative solutions

Disconnectable Turret for Renewables (DTR).

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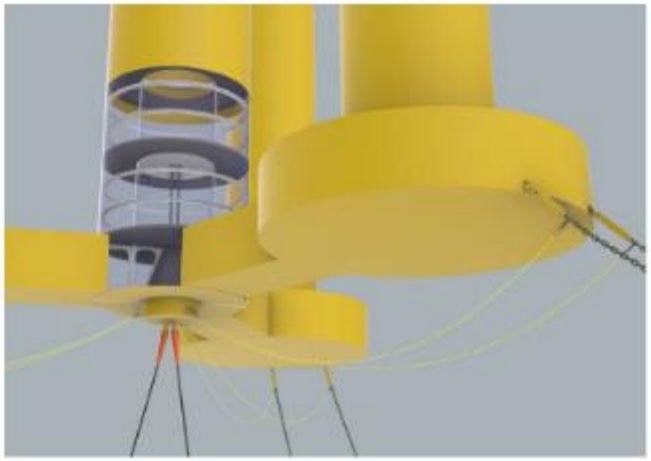
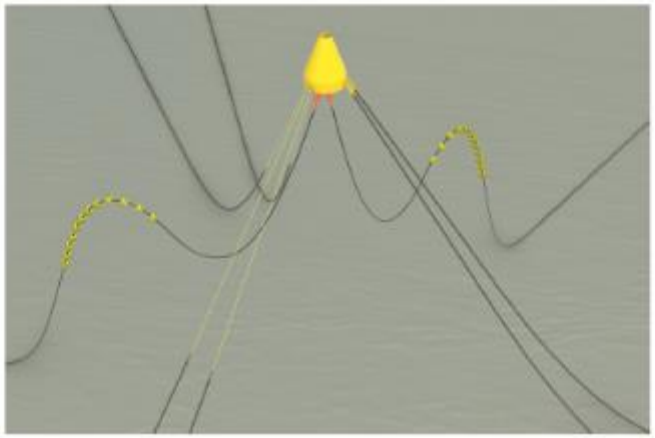
- Lifting between 2 floating structures at heights of 100-150m and greater, present significant safety hazards plus requires very calm seas and low wind conditions.
- The safer option is to tow the FOWT to port, where operations can be performed in more controlled and less weather sensitive location
- Achieving quick connection and disconnection of the mooring lines and power cables or dynamic risers has until now been extremely challenging as they are handled individually and under high tension.
- SBT Energy's Disconnectable Turret for Renewables (DTR) system allowing an efficient 'plug and play' configuration.
- Emergency release of both moorings and power cables is possible into a safe, ready to quickly re-connection configuration, identical to that for the first hook-up.





How Does the DTR Work?

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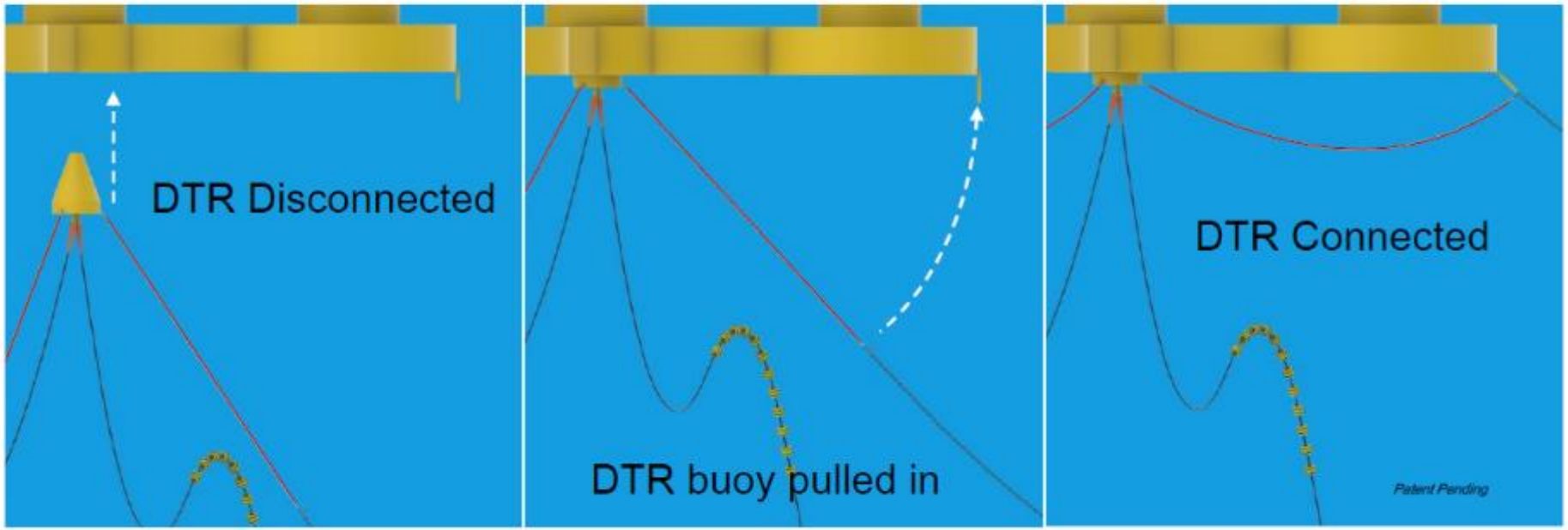
- Our DTR innovation is a simplified version of the buoyant disconnectable turret design used in FPSO's.
- Some of the mooring lines can be connected directly onto the buoy, further reducing offshore handling. The power cables are automatically pulled into the FOWT hull along with the buoy.
- By this novel method any spread moored floating structure can be connected simply and safety, but when disconnected the moorings and risers are safely supported by the DTR buoy.



Cost and Risk Reduction.

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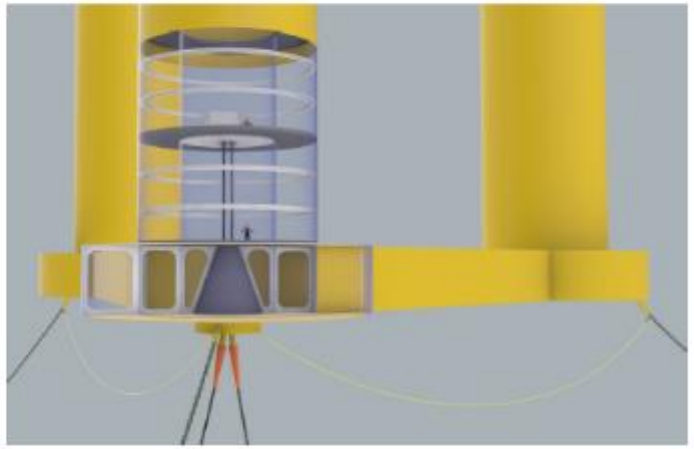
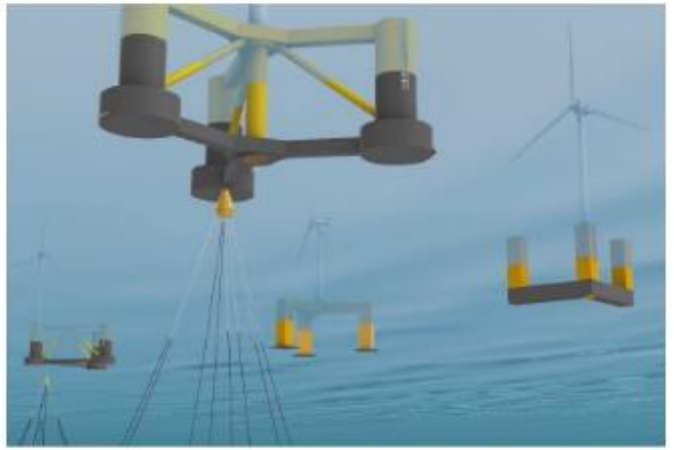
- Reduced cost, risks and duration for connection, disconnection and reconnection operations.
- Improves economic case for tow-to-port for upgrade/major maintenance, increasing local content value and maximise tasks alongside (which would normally be performed offshore).
- Potentially allow 'flow-through' of power when disconnected, which is not possible if cable ends are laid down on the seabed.
- No swivel bearing or electrical swivel required and DTR buoy cost comparable to traditional disconnectable cable I-tube arrangements.
- Reduced insurance premiums - less frequent / less costly repairs.
- Maximise commissioning before FOWT arrival (less time to first power).
- Reduce LCoE!





Safety and Environment.

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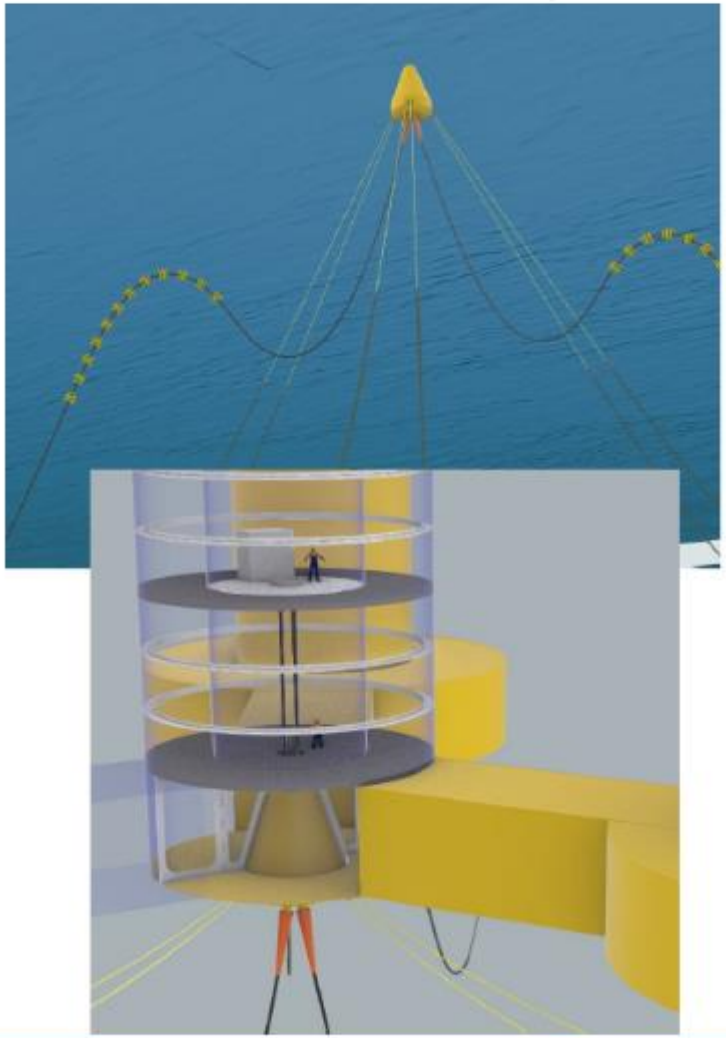
- Tow to port avoids extreme lifting heights between moving objects at sea (very high risk operation).
- No mooring line handling on deck – mooring lines not recovered to deck.
- Minimise or eliminate power cable handling in the hull - Potential for use of wet-mate or dry-mate connectors.
- Avoids the need for the hook-up vessel to thrust towards the FOWT hull during the mooring pull-ins.
- No laying down of mooring lines or power cables on the seabed – Vital for deep-water where cross-overs and clashing is difficult to avoid.
- Shorter weather window and higher sea-states possible for operations therefore hence less fuel used in standby.
- Improves offshore safety by putting people at less risk.



Technical and Integrity.

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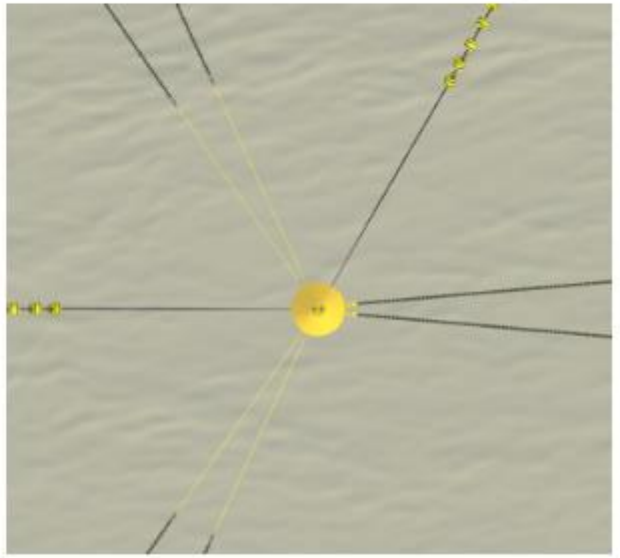
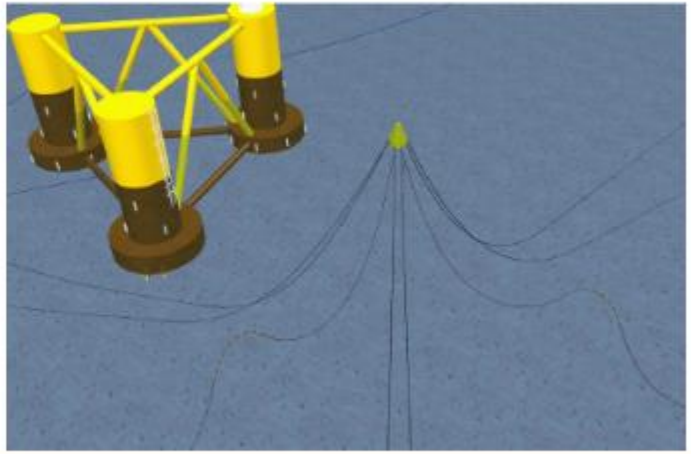
- No swivels or bearings required.
- Central or offset turbine location on hull and can be used with semi-sub, spar or barge designs.
- Potential for quick / emergency disconnect of entire system remotely.
- Power cable and mooring ends not lowered onto the seabed (suspended from DTR). Less risk of clash or twisting of moorings and cables from the normal laydown/recovery operations.
- Reduced risk of handling damage and subsequent expensive repairs.
- Potential for connecting both power cables in buoy to maintain circuit.
- Key solution for deep water where buoys can support free-spanning power cables, removing need for seabed sections or riser anchors and minimising the power cable length.





Our Energy Transition Brochure

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We have developed a detailed brochure, illustrating our full products and solutions range, available on request.

Thanks for listening.

www.sbt-energy.com

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