Breakthroughs in WEC arrays

Shared moorings and cablings in the WETFEET project

Keri Collins, Ben Howey, Martyn Hann, Gregorio Iglesias, Deborah Greaves, Plymouth University
Pedro Vicente, WavEC Offshore Renewables, **Violette Harnois**, INNOSEA

WETFEET project overview

The WETFEET project was created in response to the need to identify the technological barriers that currently prevent the development of wave energy. WETFEET concentrates on technology breakthroughs in four key areas, one of which is array configurations, moorings and cables.

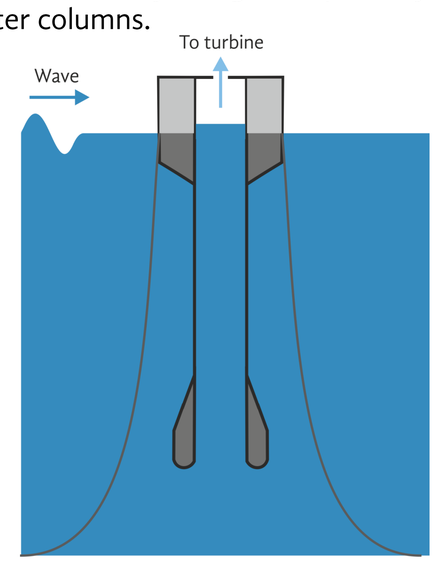
Work package (WP) 6 focuses on the performance assessment of arrays with shared mooring and cabling. Here, performance is characterised not just in terms of the power production of the array but also in terms of material cost savings, ocean space utilisation and operation and maintenance (O&M) costs.

WP6 will focus on arrays of two types of device: a flexibly-moored array using the Sparbuoy (Fig. 1) and a rigid compact array using generic oscillating water columns.

The Sparbuoy is a type of oscillating water column (OWC) developed at the Instituto Superior Técnico, Lisbon.

Scan here for more information regarding the Sparbuoy

Scan here for a video presentation of previous testing



Array configuration selection and performance assessment are subject to numerous criteria:

Imposed constraints
- Moorings based on 3-point catenary moorings
- Width of the Plymouth Ocean Basin
- 5 devices to be tested
- Scope (line length to depth ratio) not less than 3
- No smaller than 1:40 scale
- All devices accessible from outside array

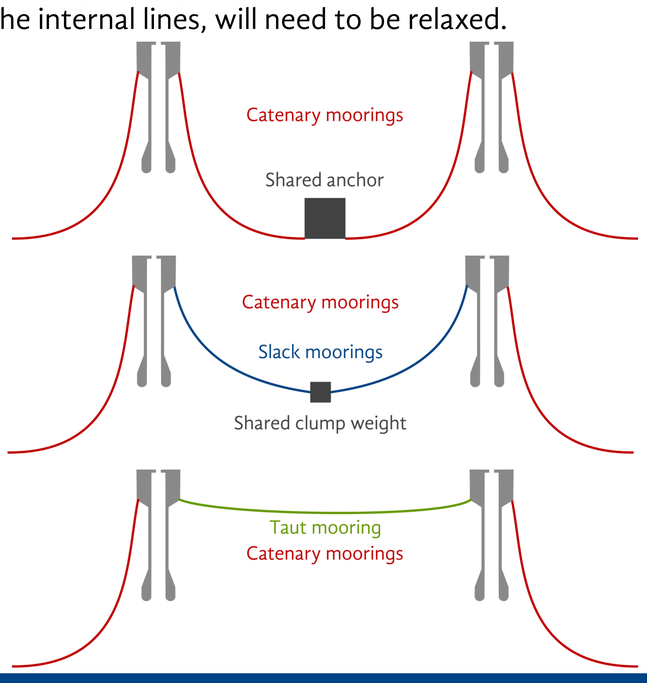
Assumptions
- O&M costs proportional to materials costs
- Smaller footprint is better
- Performance loss can be mitigated by CAPEX cost saving
- Scope for non-catenary lines can be relaxed

For the rigid compact arrays, the goal is to choose an arrangement that will allow device interaction and survivability to be investigated. For the flexibly-moored arrays, the methodology is to investigate progressively higher degrees of shared components. To do this other constraints, such as the scope on the internal lines, will need to be relaxed.

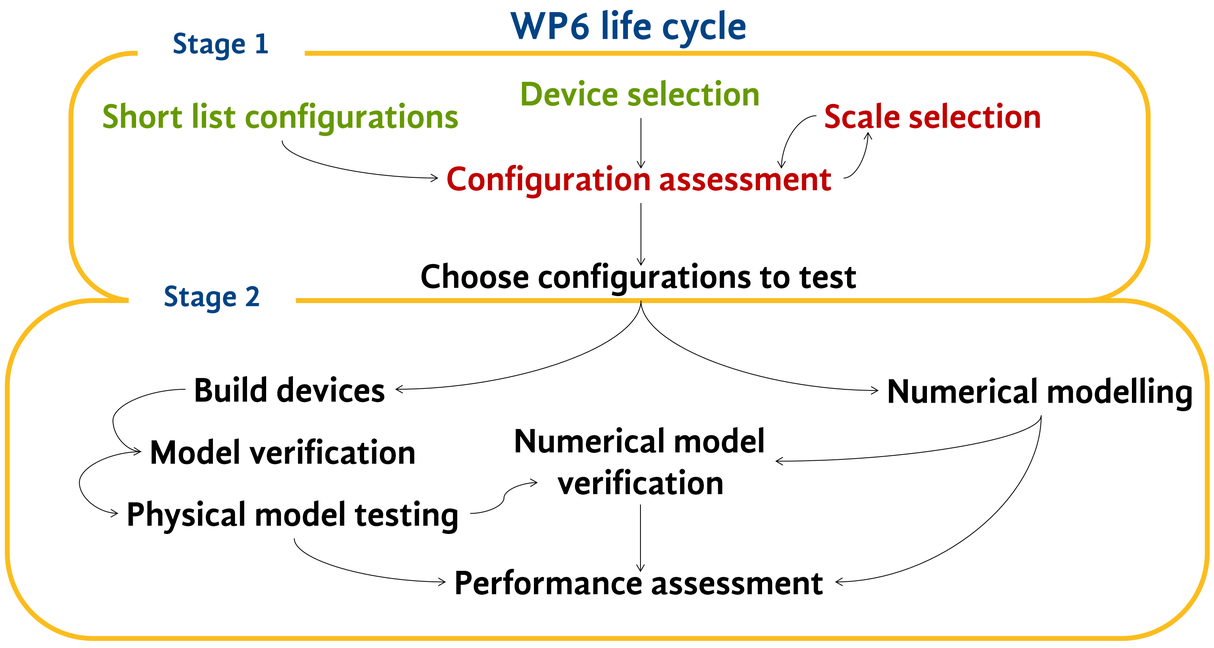
Step 1: Share anchor points

Step 2: Replace two catenary lines with a slack line and clump weight/buoy arrangement

Step 3: Replace slack line with taut line



WP6 life cycle



Physical model testing will be undertaken in the Ocean Basin at Plymouth University. This is a 15.5 m wide by 35 m long, deep-water facility capable of running a variety of waves and sea states with the option to include currents in both the transverse and longitudinal directions.

Scan here for a 360° view of the Plymouth Ocean Basin

Plymouth Ocean Basin

Numerical models of the arrays will be built with the time-domain program OrcaFlex, which models the mooring lines based on lumped mass theory. Floater hydrodynamics can be modelled by importing externally calculated hydrodynamic databases. These hydrodynamic databases will be calculated with the linear potential flow solver, NEMOH. Multi-body interactions can then be imported in Orcaflex.

Final performance assessment will quantify several metrics. These can be grouped into five principal categories:

- **Cost** → **Has money been saved** with shared components compared to individually moored devices? Is the installation more complicated?
- **Performance** → **How have the altered mooring arrangements changed the hydrodynamic response** and array interactions? Is behaviour more narrow-banded? Do certain wave frequencies make more difference?
- **Survivability** → **Is the array more susceptible to collisions,** extreme loadings or component failure with shared mooring components?
- **Environmental impact** → **Would fewer anchors lead to less seabed disruption?** What about ecological impacts?
- **Sea space utilisation** → **Could more compact arrays allow larger farms to be deployed?** Are compact arrays more likely to get consent?

More information

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