Structured innovation for the marine energy sector

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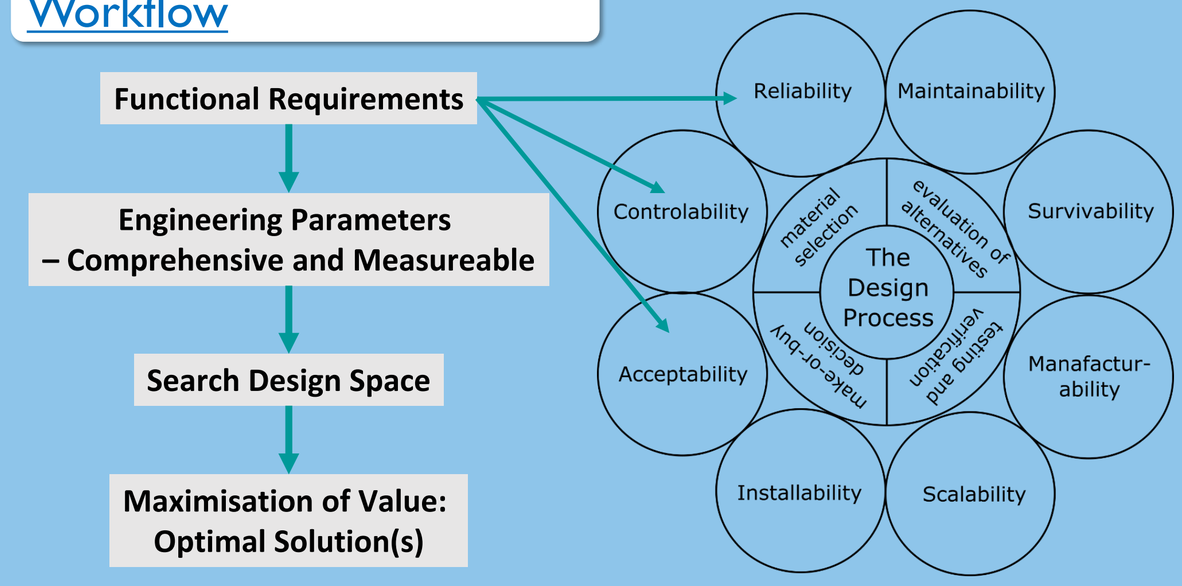
Introduction

The Wave Energy Sector is currently in a conceptual prototyping stage. Several funding bodies are searching for promising innovations through stage-gate programmes. The failure of several developers to reach commercialisation, despite demonstrating high technology readiness, has resulted in this more considered approach to development.

Structured innovation refers to the systematic process of identifying, developing and validating novel technology. A key component of this approach is comprehensive techno-economic assessment which, in the first instance can be used to identify promising concepts within the design space and in the second instance, can be used to assess technological development.

Workflow



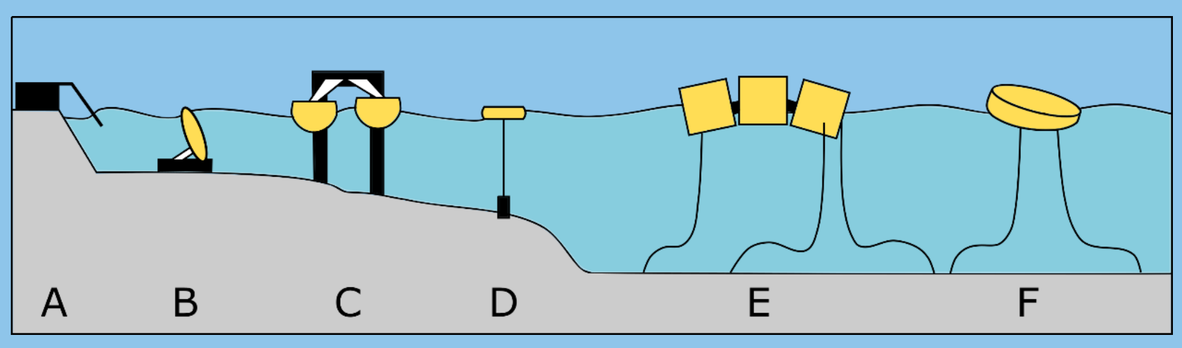


Fig 1: A – Oscillating water column, B – Oscillating wave surge converter, C – Point absorber, D – Heave buoy, E – Attenuator, F – Rotating mass.

Challenges of the structured approach

- Scanning the totality of design space to make sure every potential winner is covered.
- Balance between achieving design consensus to promote cost-reduction and allowing flexibility in design to avoid design fixation.
- Identifying comprehensive and measurable indicators of techno-economic performance at early stages of development.
- Finding achievable targets for wave energy development and finding application to niche markets in which the technology can prove its worth.

Preliminary study: Reverse LCOE

- Calculated expenditures and technical parameters based on a target 'competitive' cost of energy of 15pence/kWh.
- 6 cost centres: Structure and prime mover, PTO, foundation or moorings, installation, grid connection, operations and maintenance.
- 5 devices types with differing performance characteristics and dimensions.
- Aim: to explore feasibility of commercial wave energy based on current technology.

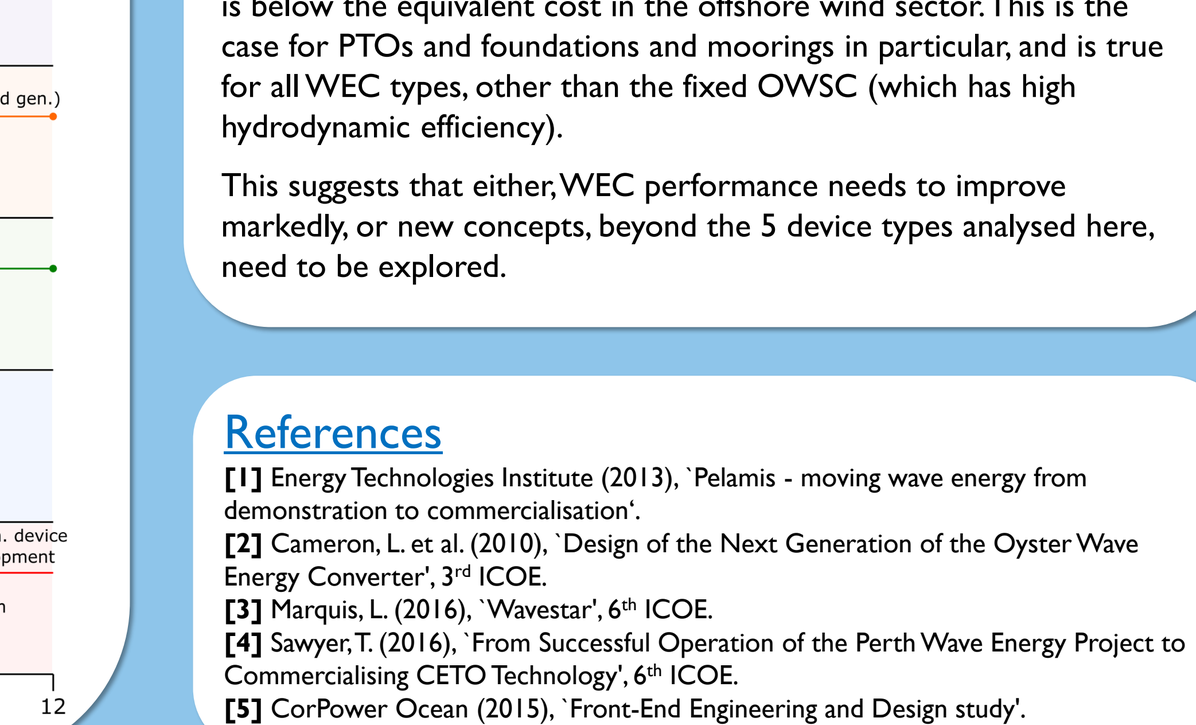
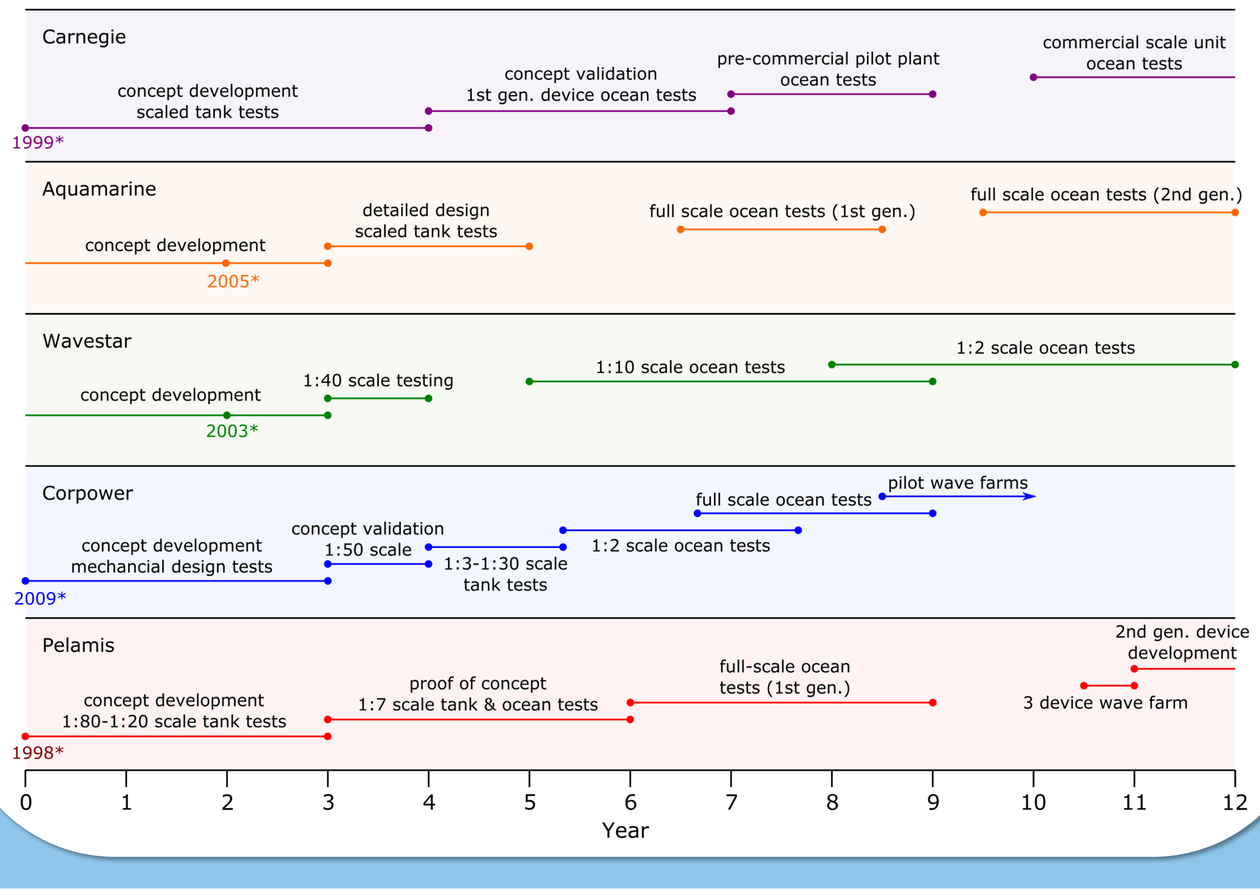


Fig 2: Available PTO expenditure for different Wave Energy Converters, in comparison with drivetrain costs for offshore wind

Structured Innovation? – sourced from [1-5]



Conclusions

The analysis showed that, based on existing values for performance and conversion efficiency, the expenditure available for certain cost centres is below the equivalent cost in the offshore wind sector. This is the case for PTOs and foundations and moorings in particular, and is true for all WEC types, other than the fixed OWSC (which has high hydrodynamic efficiency).

This suggests that either, WEC performance needs to improve markedly, or new concepts, beyond the 5 device types analysed here, need to be explored.

References

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[3] Marquis, L. (2016), `Wavestar', 6th ICOE.
[4] Sawyer, T. (2016), `From Successful Operation of the Perth Wave Energy Project to Commercialising CETO Technology', 6th ICOE.
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