Uncertainty Quantification in Tidal Energy Power Performance Assessment

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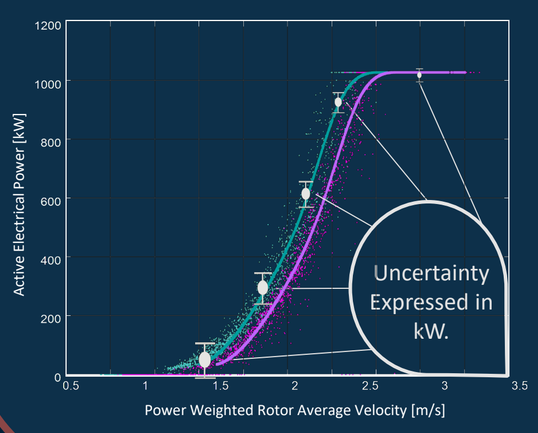
1.INTRODUCTION

Power performance assessment details how efficiently tidal energy converters convert kinetic energy into electrical [1]. Uncertainties arise from model assumptions and the inexact specification of physical and numerical model parameters [2]. Uncertainties can greatly affect power estimates for a given site, thus classifying them and reducing them where possible is important [3].

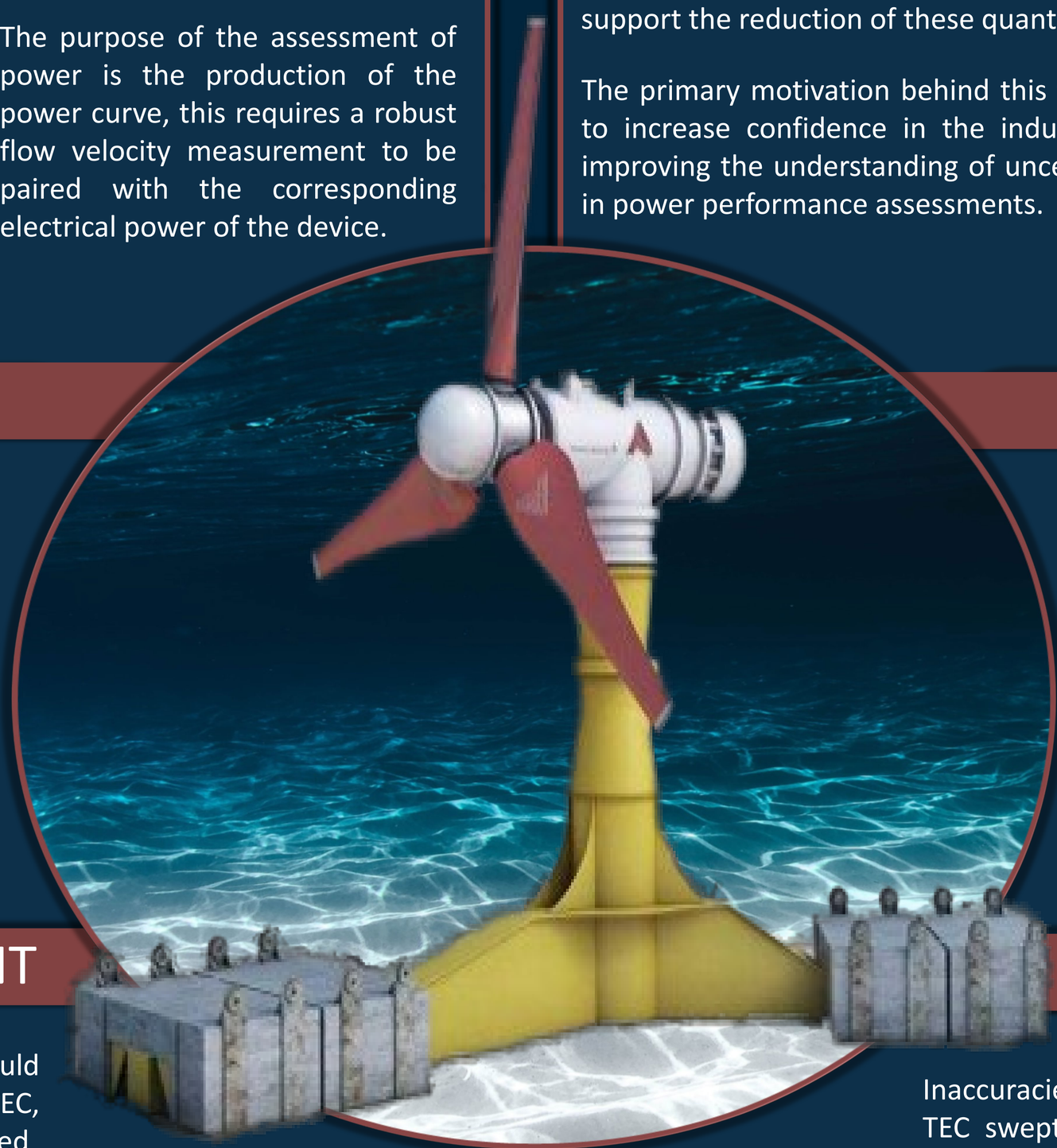


The purpose of the assessment of power is the production of the power curve, this requires a robust flow velocity measurement to be paired with the corresponding electrical power of the device.

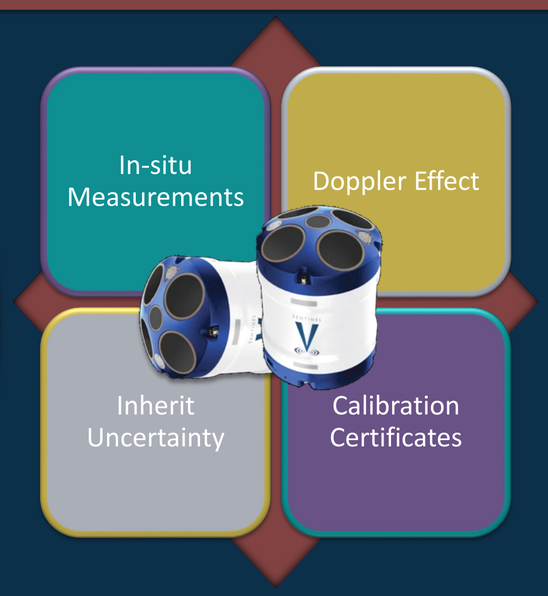
2.KNOWLEDGE GAP

A better understanding of uncertainty in power performance, at this stage, will better prepare developers for producing an accurate power curve for their tidal energy converter device. Additionally, help locate areas of large uncertainty, which then further work can support the reduction of these quantities.

The primary motivation behind this work is to increase confidence in the industry by improving the understanding of uncertainty in power performance assessments.



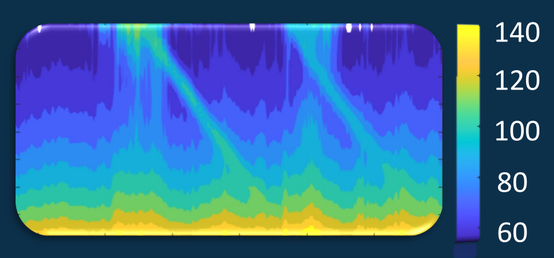
3. INSTRUMENT



4. INTERFERENCE

Distance between neighbouring ADCPs should be situated *3x* the signal range.

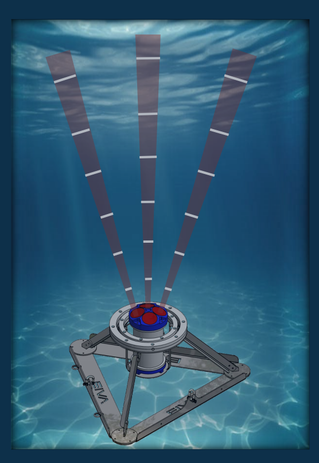
Interference occurred during periods of instability from one ADCP – 25% data removed.

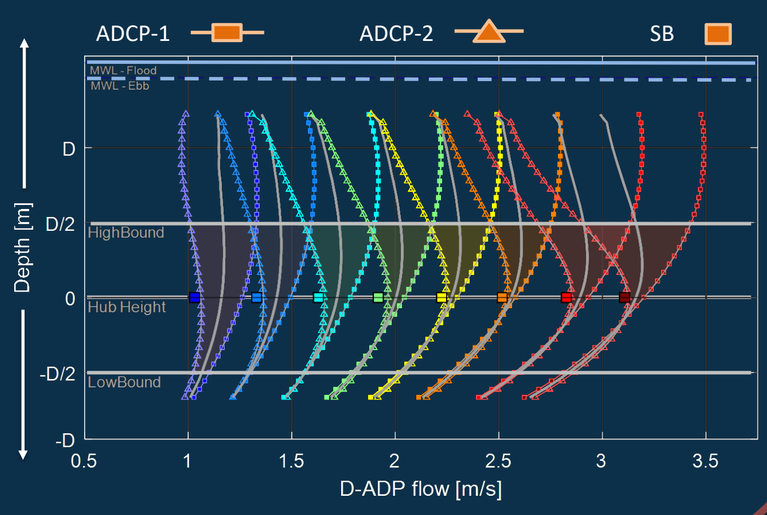


5. ADCP PLACEMENT

The IEC state where ADCPs should be situated in relation to the TEC, two deployments have been used to analyse standardised placement in terms of the potential impact to PPA and AEP.

- Energy yield production varied by 0.5% and 8.1% for the in-line and adjacent configurations, respectively.
- Flow structures were found - advised to use in-line at this berth.

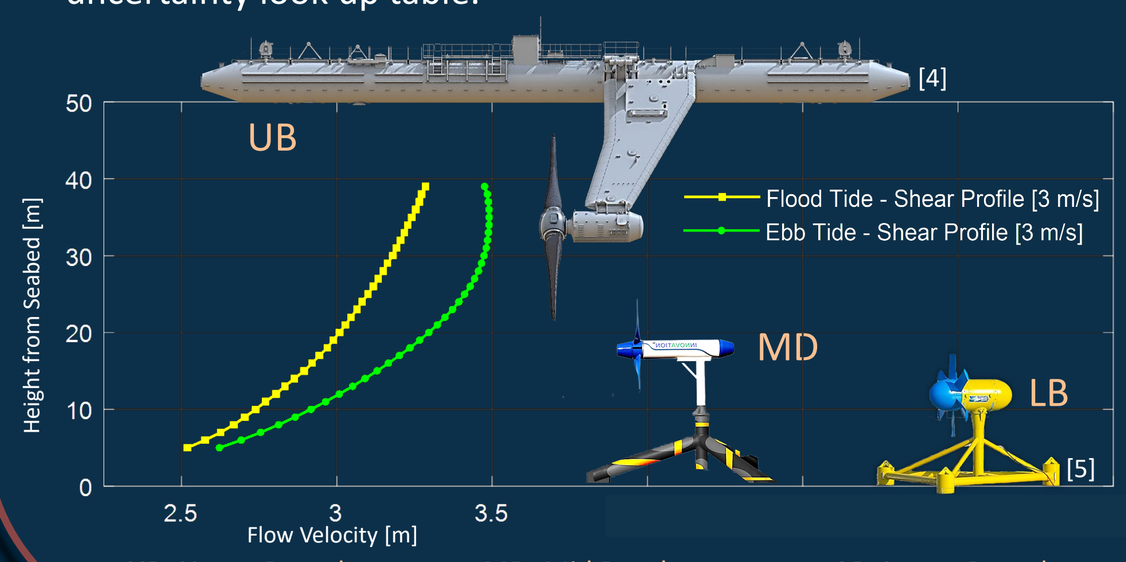




6. UNCERTAINTY

Inaccuracies in vertical mapping of the TEC swept area can impact the power curve, thus over/under estimate the AEP.

- Vertical velocity in the water column assumed to follow the 1/7th power law velocity profile – can be used to create uncertainty look up table.
- Three TEC concepts were studied, to analyse the misalignment uncertainty along the water column.



UB: Upper Bound. **MD**: Mid Depth. **LB**: Lower Bound.

REFERENCES

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