

Development of International Standards and Certification schemes for Marine Energy Technologies

Deliverable D.1.6.1

Recommendations for procedures adaptation: TS 62600-201 - Tidal energy resource assessment and characterization

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 low-carbon technologies

TS62600-201
TIDAL RESOURCE ASSESSMENT

TS62600-30
ELECTRICAL POWER

TS62600-200
POWER PERFORMANCE ASSESSMENT

TS62600-40
UNDERWATER ACOUSTICS

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Revision history

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1. Introduction

Description: Report with recommendations for procedures adaptation to 62600-201 Tidal energy resource assessment and characterization.

This report describes the methodology used by EMEC to derive recommendations on the suitability and usability of the 62600-201 TS for tidal energy resource assessment and characterization using the Tocardo T2SI turbine installation at Oosterschelde as a case study.

2. References

- /1/ IEC TS 62600-200, Part 200: Electricity producing tidal energy converters - Power performance assessment
- /2/ IEC TS 62600-201, Part 201: Tidal energy resource assessment and characterization
- /3/ 2016R0076 - OTP Yield Performance Check - Tocardo
- /4/ 2012M0045 - Method of calculation of annual energy yield - Tocardo

3. Methodology - 62600-201 Tidal energy resource assessment and characterization

Tocardo provided EMEC with internal documentation on the resource assessment carried out by Tocardo on their T2Si installation at Oosterschelde (Ref. /3/ and Ref. /4/). EMEC have reviewed this documentation against the 62600-201 TS to identify gaps and variations in the processes, and recommendations based upon these evaluations.

3.1. Review scope

3.1.1. Oosterschelde resource assessment

The resource assessment carried out by Tocardo was an internal document (Ref. /4/ and Ref. /3/) and did not make reference to the IEC 62600-201 TS, therefore there are many areas of the document not compliant with the recommended methodology. For the purposes of the recommendations in this document, the variations are described and the reasons given by Tocardo for these variations are explored to determine if the IEC methodology would have been feasible in this context.

4. Technical requirements

4.1. Comparison

The Tocardo resource assessment process used for the Tocardo Oosterschelde deployment is compared to the TS 62600-201 below and will be used to outline the recommendations regarding the TS 62600-201 later in this document.

| 62600-201 | Tocado resource assessment | Comments |
|---|---|---|
| 1.Scope/2.Normative references/3.Terms and definitions/4.Symbols, units and abbreviations | | |
| 5.Methodology overview | Tocado using head height measurements rather than modelling tidal harmonic forcing constituents. | Future head heights could be modelled using tidal harmonic forcing constituents. |
| 6.Data Collection | <p>ADCP data collection period only around 1 week (min 35 days recommended).</p> <p>Horizontal and vertical ADCPs deployed.</p> <p>No comments on interference from dam structure in ADCP measurements.</p> <p>Data collection details not presented.</p> <p>No measurements of upstream/downstream flow.</p> <p>No investigation into stratification or sediment transport.</p> | <p>Questions arise on the suitability of using ADCPs in the context of a dam structure, further investigation is required on the ideal current flow measurement method for small enclosed flows with high spatial variability.</p> <p>Further investigation into measurements needed to accurately characterise flow around dam structure required.</p> |
| 7.Model development and outputs | <p>Hydrodynamic modelling would be suggested in this case where there is an enclosed flow with turbines covering a significant portion of the flow area.</p> <p>The study carried out only satisfies the “Stage 1: Feasibility study” part of the TS, detailed hydrodynamic modelling would be required for increased accuracy predictions.</p> <p>Some calculations and correlations are carried out to determine the “lens effect” of the tidal flow through the structure, largely through correlation of measurements with predicted values, rather than hydrodynamic modelling.</p> <p>Assumptions of uncertainties are not included in the extrapolation of velocity profiles.</p> <p>The effects of energy extraction by the turbines within the enclosed flow on the resource</p> | <p>Development of a standardised methodology for hydrodynamic modelling the flow through a dam structure is required for deployments of this type.</p> <p>Correlating measured velocities against theoretical values can be used as a first phase in a feasibility study.</p> |

| 62600-201 | Tocado resource assessment | Comments |
|--|--|--|
| | modelling has not been investigated in this preliminary study. | |
| 8.Data analysis and results presentation | <p>Analysis focussed on calculation of compensation factors for the “lens effect” of the flow through the dam structure for flood increasing, flood decreasing, ebb increasing and ebb decreasing tides, using a binned arithmetic average approach.</p> <p>Extrapolation to annual energy production/ flow distribution used measured head height values from previous years.</p> <p>Reasons for various thresholds for application of compensation factors is not clear.</p> | Validity of velocity compensation could be increased using averaged or fitted values with a standard distribution. |
| 9.Reporting of results | | |

TABLE 1 - CONTENT COMPARISON BETWEEN 62600-201 AND TOCARDO RESOURCE ASSESSMENT

5. Main observations and recommendations

5.1. Technical requirements

Considering the comments in Table 1 - Content comparison between TS 62600-201 and the Tocardo resource assessment document (*Ref. /4/*), the main comments and recommendations are presented below.

- Using measured head heights at either side of the dam structure as inputs to calculated tidal flow resource is feasible for the preliminary/feasibility study stage of a resource assessment.
- Calculating compensation factors for predicted velocities using measured values is feasible for preliminary studies, though uncertainty values and standard distributions should be used to represent the flow more accurately.
- Compensation factors should be calculated for four scenarios when characterising the flow conditions; flood increasing, flood decreasing, ebb increasing, and ebb decreasing because there is significant variation between these scenarios.
- Longer term annual estimates should use tidal harmonic constituent analysis to predict head heights.
- The feasibility of using ADCP measurements to characterize the flow in a dam structure is questionable, particularly in an array situation where there is likely to be a significant variation between deployment locations.
- Further work is required to determine an appropriate standardized method of flow characterisation measurement in a dam structure with high spatial flow variability.
- The methodology in the TS for hydrodynamic modelling of tidal flows is not suitable for use in the context of tidal turbines deployed within a barrage.
- Further work is required to determine a standardized methodology for hydrodynamic modelling of the tidal resource, including the effects of turbine deployments on the estimated annual resource around the dam structure.