Supergen Marine Annual Assembly 2011
Session: Onshore testing and modelling

Tidal Energy Resource Characterisation:
Highlights from 4 years of SG phase II activity

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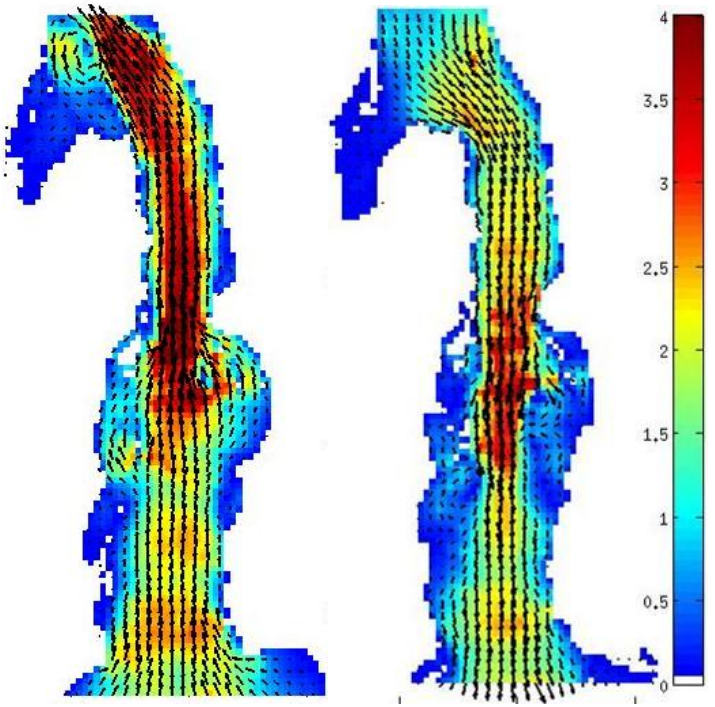
Enhanced tidal hydrodynamic understanding

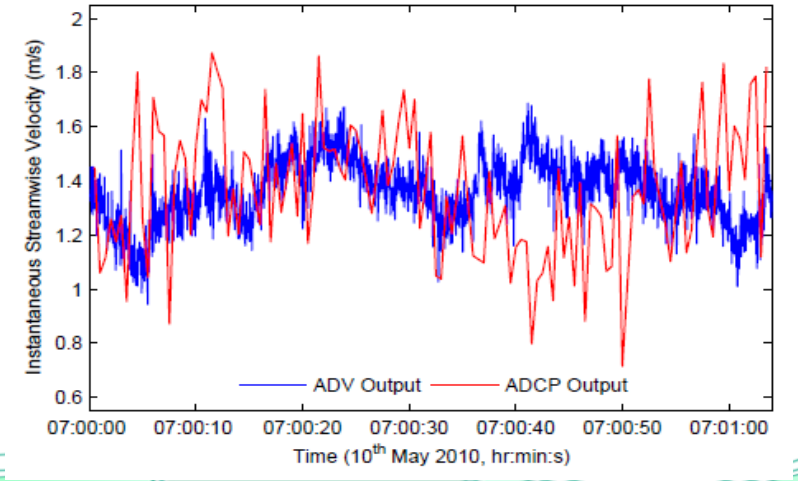
- Identified the physical driving mechanisms of importance for tidal energy locations.

- Assessed the impact of non-tidal forcing on tidal flow dynamics.

- Demonstrated how energy harvesting will alter tidal dynamics using momentum balance techniques.



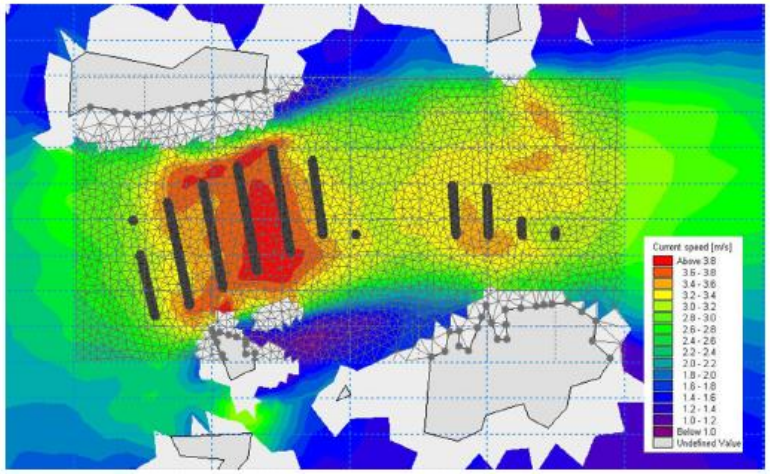
Strangford Narrows simulations (i) Flood tide, (ii) Ebb tide.

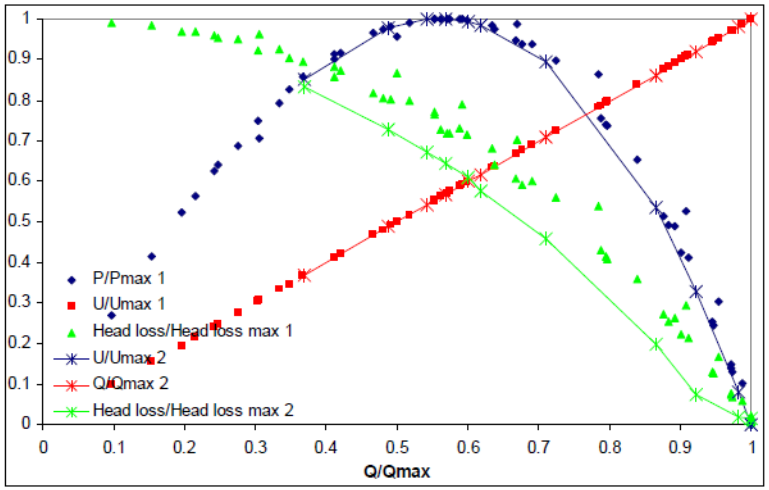


- Assessed the ability of existing instrumentation technologies to provide input data appropriate for (i) yield assessment, (ii) device design.

Modelling energy extraction and far-field impact

- Developed appropriate methodologies for adapting existing tidal hydrodynamic modelling tools for renewable application.
- Used these tools to quantify the impact of various levels of energy extraction.
- Differences in far-field impact of energy extraction due to the different physical driving mechanisms have been quantified.
- Developed parametric resource assessment methodologies based upon enhanced understanding of energy extraction impacts.



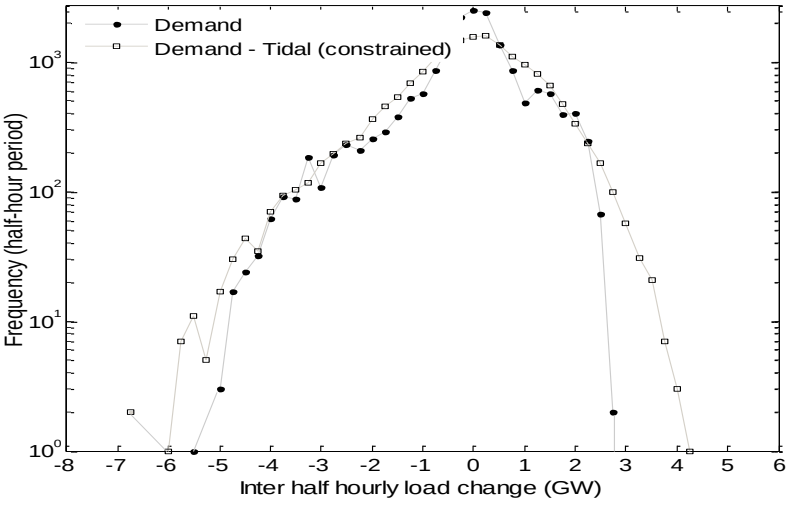


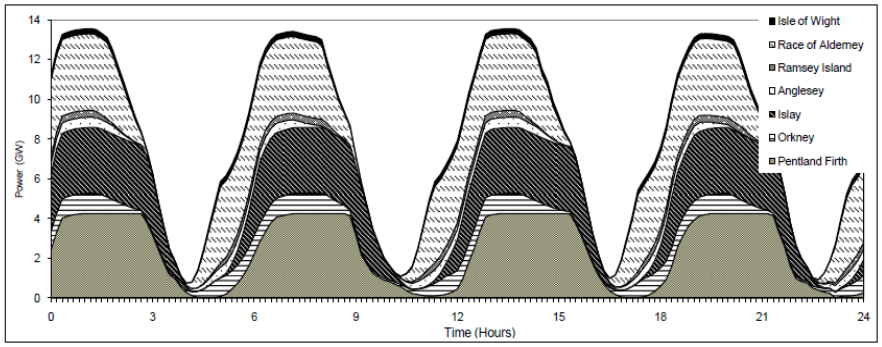
Enhanced UK resource quantification

- Collaboration with Carbon Trust, Black & Veatch & River Modelling Inc. (USA).
- SG: Marine methods adopted and applied to enable re-assessment of the UK Tidal Current Resource & Economics.
    - Theoretical resource ≈ 200 TWh/y.
    - Technical resource = 29 TWh/y.
    - Practical resource = 20.6 TWh/y.
- On a like-for-like comparison with 2004/5 assessment, 55% increase in UK technical resource potential (7.5% of 2010 UK energy demand).

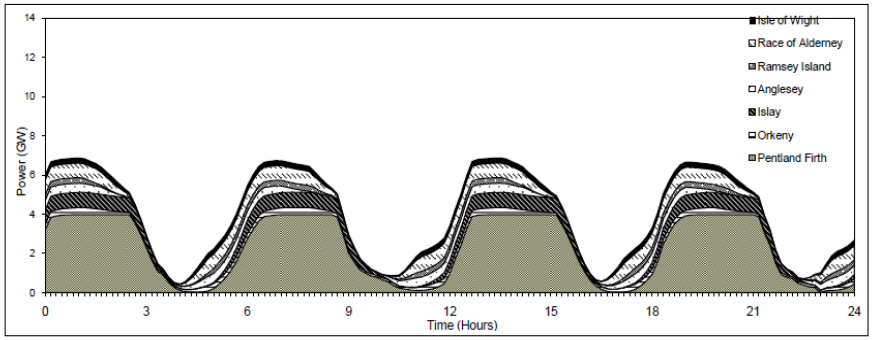
Assessing tidal variability and phasing

- Collaboration with Supergen FlexNet.
- Developed methodologies to combine tidal datasets to produce spatial *and* temporal resolution around the UK.
- Used these methodologies to develop large-scale tidal energy development scenarios in UK coastal waters.
- Identified that many of the key UK resource locations are in phase.





Technical resource (farm method) scenario (Spring tide).

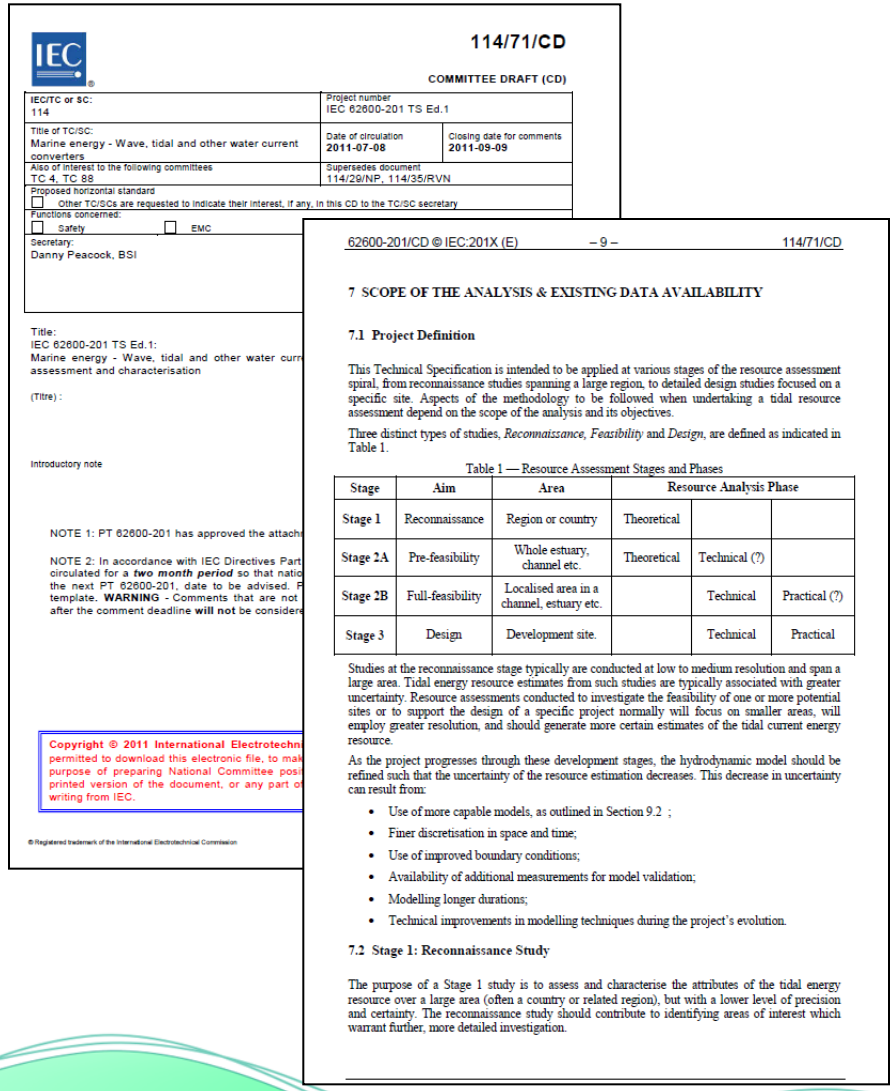


Technical resource (enhanced flux method) scenario (Spring tide).

- Scenarios enable assessment of the impact of tidal current and barrage operation on the UK electricity system.

Standards development

- UK technical delegate to the international IEC Tidal Resource Characterisation panel.
- Major contributing author to the existing Technical Specification draft:
  - SG Marine meant that we were in an excellent position to provide input.
- Responding to knowledge gaps in existing understanding identified by the IEC document development:
  - Optimising ADCP set-up.
  - Quantifying accuracy and error sources in energy yield assessment methodologies.



114/71/CD

COMMITTEE DRAFT (CD)

IEC/TC or SC: 114	Project number: IEC 62600-201 TS Ed.1	
Title of TC/SC: Marine energy - Wave, tidal and other water current converters	Date of circulation: 2011-07-08	Closing date for comments: 2011-09-09
Also of interest to the following committees: TC 4, TC 88	Supersedes document: 114/29/NP, 114/35/RVN	
Proposed horizontal standard: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the TC/SC secretary		
Functions concerned: ☐ Safety ☐ EMC		
Secretary: Danny Peacock, BSI		

Title:
IEC 62600-201 TS Ed.1:
Marine energy - Wave, tidal and other water curr
assessment and characterisation

(Titre) :

Introductory note

NOTE 1: PT 62600-201 has approved the attach

NOTE 2: In accordance with IEC Directives Part
circulated for a ***two month period*** so that natio
the next PT 62600-201, date to be advised. F
template. **WARNING** - Comments that are not
after the comment deadline **will not** be considere

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7 SCOPE OF THE ANALYSIS & EXISTING DATA AVAILABILITY

7.1 Project Definition

This Technical Specification is intended to be applied at various stages of the resource assessment spiral, from reconnaissance studies spanning a large region, to detailed design studies focused on a specific site. Aspects of the methodology to be followed when undertaking a tidal resource assessment depend on the scope of the analysis and its objectives.

Three distinct types of studies, *Reconnaissance, Feasibility* and *Design*, are defined as indicated in Table 1.

Table 1 — Resource Assessment Stages and Phases

Stage	Aim	Area	Resource Analysis Phase		
Stage 1	Reconnaissance	Region or country	Theoretical		
Stage 2A	Pre-feasibility	Whole estuary, channel etc.	Theoretical	Technical (?)	
Stage 2B	Full-feasibility	Localised area in a channel, estuary etc.		Technical	Practical (?)
Stage 3	Design	Development site.		Technical	Practical

Studies at the reconnaissance stage typically are conducted at low to medium resolution and span a large area. Tidal energy resource estimates from such studies are typically associated with greater uncertainty. Resource assessments conducted to investigate the feasibility of one or more potential sites or to support the design of a specific project normally will focus on smaller areas, will employ greater resolution, and should generate more certain estimates of the tidal current energy resource.

As the project progresses through these development stages, the hydrodynamic model should be refined such that the uncertainty of the resource estimation decreases. This decrease in uncertainty can result from:

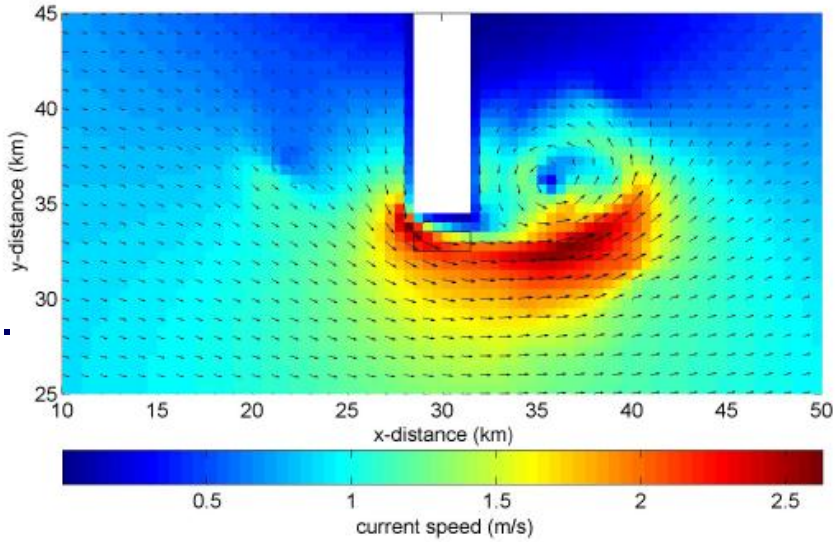
- Use of more capable models, as outlined in Section 9.2 ;
- Finer discretisation in space and time;
- Use of improved boundary conditions;
- Availability of additional measurements for model validation;
- Modelling longer durations;
- Technical improvements in modelling techniques during the project's evolution.

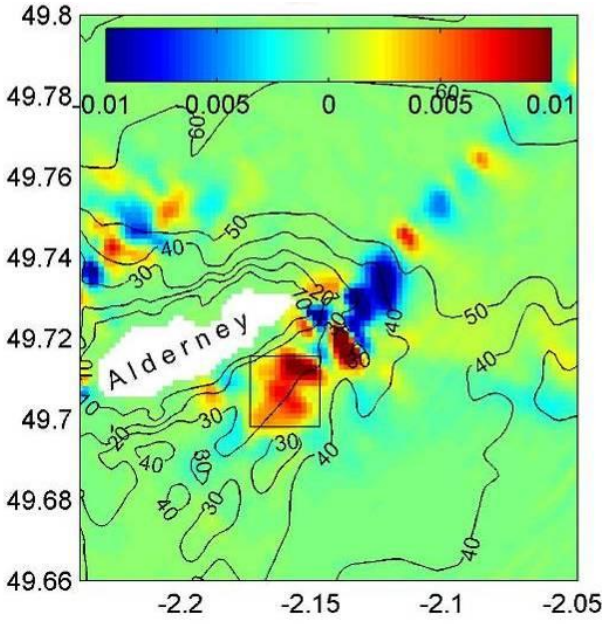
7.2 Stage 1: Reconnaissance Study

The purpose of a Stage 1 study is to assess and characterise the attributes of the tidal energy resource over a large area (often a country or related region), but with a lower level of precision and certainty. The reconnaissance study should contribute to identifying areas of interest which warrant further, more detailed investigation.

Sediment transport and tidal energy harvesting

- Collaboration with School of Ocean Sciences, Bangor University.
- 1st known journal publication focussed on the impact of tidal current energy operation on sediment transport dynamics.





- Various geographic locations simulated to consider various tidal regimes:
  - Bristol Channel.
  - Portland Bill.
  - Race of Alderney.

Summary

• Developed the next generation of resource characterisation tools and methodologies that are enabling the development of the sector.

• Application of these tools and methodologies have enabled breakthrough developments in understanding of tidal energy issues.

• Using enhance understanding to develop frameworks to quantify and reduce risk in tidal energy projects.

• Provide direct support to tidal energy project and technology developers as well as guiding government policy at home and abroad.