Subsea & Drilling Brazil Conference

Wave & Tidal Energy Projects: A Cross-sector Opportunity

Graham Whitehead – Research Associate
Agenda

- Who is NSRI and what do we do
- Success Stories in UK
- Challenges facing industry
- Possible solutions, strategies & opportunities
NSRI Overview

Vision Statement

NSRI is dedicated to advancing underwater technology and sharing cross industry knowledge within the subsea domain, to accelerate economic growth within the Blue Economy.

- Identify and engage research & business opportunity
- NSRI is not a funding organisation, however promotes & brokers funding opportunities
- Matchmaker; industry and academia, users, developers and entrepreneurs
- Clarify industrial challenges and promote best practice
- Promote technological advancement and user adoption
- Stimulate the UK industry and research to address future needs
Blue Economy – A Global Opportunity

- Oil & Gas
- Wind
- Wave & Tidal
- Deepsea Mining
- Aquaculture
- Storage
- Defence

- Comms & Controls Systems
- Power Systems
- Metals & Coatings
- Composites – Structural & Buoyancy
- Condition Monitoring

Identify needs - framing research & facilitating testing
Increase Efficiency
Knowledge sharing
Unlocking global opportunities
Economic Growth

Global subsea markets are predicted to grow from £50bn to £140bn by 2035...

Ref; Scottish Enterprise reports

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Blue Economy – Market Accelerator
Definitions

- Wave
- Tidal current

- Not considered here:
  - Tidal lagoons
  - Tidal barrages
  - Salinity gradient
  - Ocean thermal energy conversion
UK Test Facilities

- 31 devices
- 20 developers
- 11 countries

Active Areas

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Blue Economy – Market Accelerator
Orbital Marine Power

2010 | 1/5th scale

2011-13 | SR250

Over 4000 Hours of operation

one week 116 GWh
7% Orkney demand

2016-18 | SR1-2000

2019 | SR2-2000

cumulative generation 2 GWh
MeyGen

ANDRITZ HYDRO Hammerfest | Hs1000 | 1 MW

Atlantis | AR1000 | 1 MW

MeyGen | 4 x 1.5 mw turbines

Total generation 5 gwh in 25 days

1 gwh in 25 days
Wello Oy

SURVIVAL
1 Year on site
18 Metre waves

2017-20 | 1 MW Penguin WECs
2018/19 | 2 x new Penguin
Applications to Oil & Gas

EC-OG Power Hub

OPT Power Buoy

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Blue Economy – Market Accelerator
Market Conditions

- Small number of deployments to date
- Challenging route to market

Policy paper
Contract for Difference

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Wave & Tidal – Common Challenges

Reducing costs by knowledge transfer and working together
- Bringing together the oil & gas and wave & tidal industries
- 50+ ideas / solutions generated across themes’ technical challenges

Electrical Power & Distribution
- Turbine / Generator Marinising
- Connectors
- Arrays
- Power Cables

Foundations & Moorings
- Location
- Loading
- Anchoring
- Mooring Lines
- Connectors

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Wave & Tidal – Common Challenges

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Materials & Corrosion
- Coatings
- Poor Cathodic Protection
- QC / Inspection
- Differential Materials
- Maintenance

Integrity & Inspection
- Design for Inspection & Maintenance
- Data Management Strategy (collect, store, interpret)
- Risk Evaluation

Installation
- Environment Conditions
- Vessel Selection
- Divers or Diverless
- Skills & Experience
- Regulations & Safety

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Opportunities – Technological Development

Impact-Manageability Matrix of Technological Development Themed Opportunities

1. **Electrical**: Offshoring the transformer, simplifies cable array, significant cost reduction
2. **Standard Sensor Technology**: Applicable for multiple devices, avoid over-protective IP.
3. **Electrical**: Standardised wet-mate connector for marine renewables.
4. **Corrosion**: Simulation & testing to establish industry benchmarks.
5. **Foundations**: New anchoring concepts for thin sediment seabed (eg rock anchors, mono-piles)
6. **Moorings**: Using mooring systems to gather data; environmental, loading, integrity.
7. **Installation**: New generation of vessels for multiple deployments.
Impact-Manageability Matrix of Learning & Experiential Themed Opportunities

1. Installation: Share best practices between O&G and wave & tidal.
2. Skills training: Identify missing wave & tidal skillsets and target.
3. Installation: Bridging O&G and wave & tidal industry standards / process.
4. Electrical: Power cable standards appropriate for wave & tidal applications.
5. Learning: Relationship brokers to improve sharing of experiences; technical, financial, R&D.
6. Integrity: O&G lifecycle best practice modified for wave & tidal.
7. Corrosion: Raise awareness to issue mitigate through design.
Wave & Tidal – Cost Reduction Framework

- Governance, Policy & Culture
- Technology & Innovation
- Market UK & Global
- Processes, Standards & Practices

**Sector Efficiency Opportunities**

**Government, Policy & Culture**
- Needs Strong Government Support
- Funding Support Opportunities
- Regional Incentivisation
- Private Investment Networks
- Cultural ‘working together’

**Technology & Innovation**
- Power & Comms Array Optimisation
- Sensors & Connectors
- Seabed Anchoring Solutions
- Conditioning / Data Monitoring
- Data Capturing & Processing
- Industry common spares portal

**Knowledge & Experience Transfer**

**Market UK & Globally**
- Wave & Tidal Developer Community
- Subsea Supply Chain Diversification
- Onshore & Offshore Test Centres
- Training & Education
- Skills and Competency Framework

**Processes, Standards & Practices**
- Best Practice Guidelines
- Cross Industry Peer Review Scheme
- Design Standards (fit for purpose)
- Test & Qualification Standards
- Modularisation / Standardisation
- Lesson Learned (reliability)

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Blue Economy – Market Accelerator
Wave & Tidal – Conclusions & Opportunity

- Sector is innovative and has good understanding of applicability and limitations of many existing technologies

- Cost Reduction is key to compete in offshore renewables space

- **Opportunities are global**
  - Challenge areas identified
  - Integrated approach to problem solving & knowledge share
  - Bespoke deployment vessels, techniques & equipment
  - Optimising detection of, consequences of, and response to partial failures

Wave & Tidal Energy Projects

- Useful data or reference sources

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