SuperGen Marine Energy Research Phase(2)

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Partners

EPSRC-funded 4 year collaborative project

- University of Edinburgh
- Queen's University Belfast
- Heriot Watt University
- University of Strathclyde
- Lancaster University

Aims and objectives

Generic research with long-term objectives to:

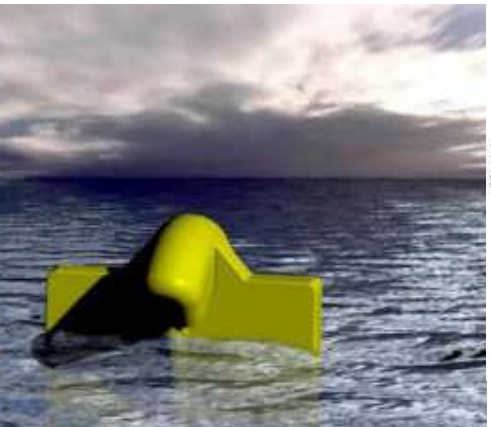
1. To increase knowledge and understanding of device-sea interactions of energy converters from model-scale in the laboratory to full size in the open sea.
2. Reduce risk and uncertainty for stakeholders in the development and deployment of technology;
3. Enable progression of marine technology and energy into true positions in future energy portfolios.

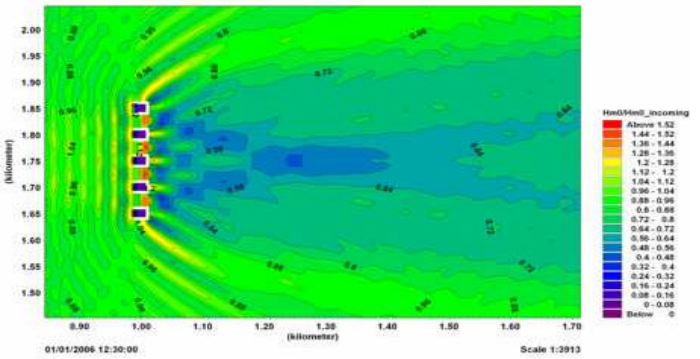
WS1: Numerical and physical convergence

There has been a revolutionary increase in th sophistication of numerical techniques available t allow analysis of wave and tidal current technology.

There has not as yet been a systematic cross technique comparison between many of thes approaches

Can the results of numerical and physical modelling converge to increase confidence?

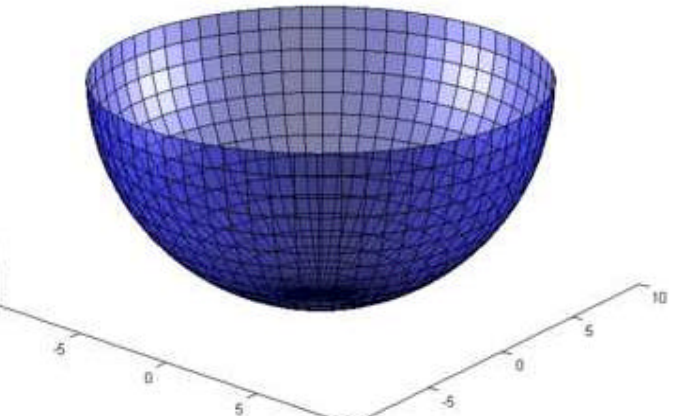


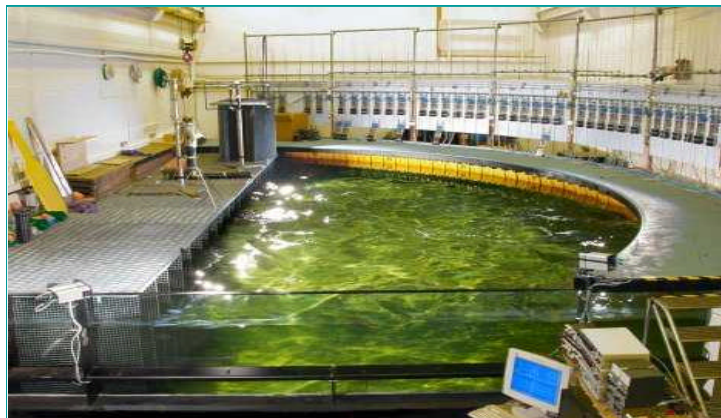


Unidirectional

WS2: Optimisation of collector form & response

- Do optimal designs exist for the physical form and response of the collector in a wave energy converter?
- Can the constraints, parameters and cost function necessary for a systematic optimisation be defined?
- Can genetic algorithms be used to evolve optimal designs , using a combination of numerical modelling and laboratory experimentation, ?

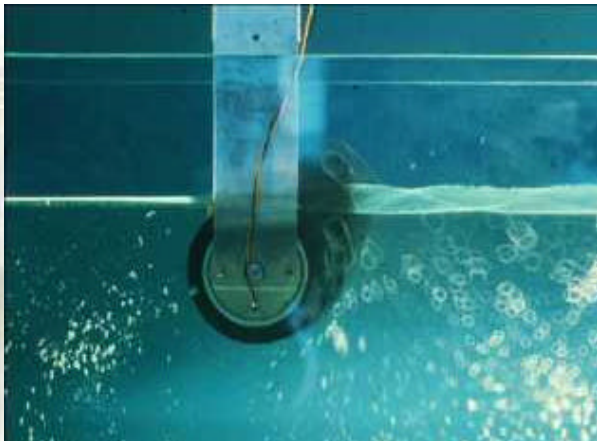




WS3: Combined wave and tidal effects

- How might the design and performance of tidal current devices be affected by waves
- How might the performance of wave power converters be influenced by currents and water level changes?
- Tests will be conducted in the wave tanks at Queens University Belfast and at the University of Edinburgh
- Also in the dedicated 1/10th scale facility being designed and constructed at Portaferry and at EMEC





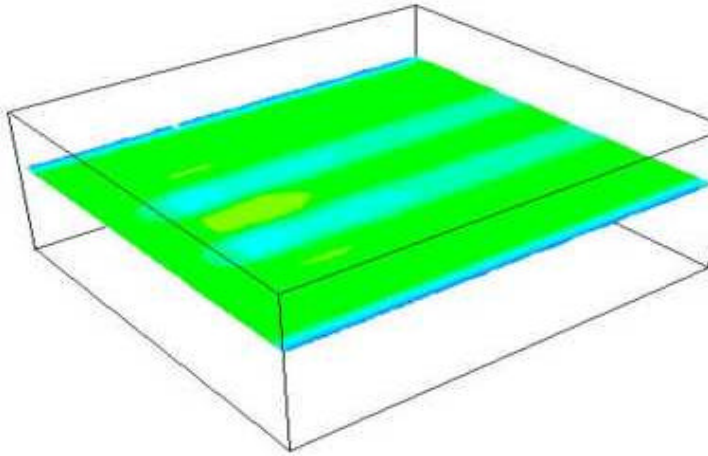
WS4: Arrays, wakes and near field effects

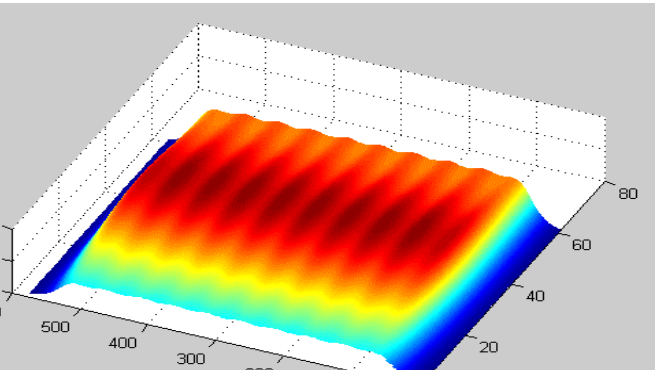
- How does array interaction affect the design optimisation and performance of both tidal current and wave power?
- Are device impacts additive in nature or do more complex cumulative procedures need consideration and, if so, what are they?
- Are cumulative effects different for different device concepts;
  - For example, are the impacts from closely spaced tidal turbines different if they are contra-rotational?

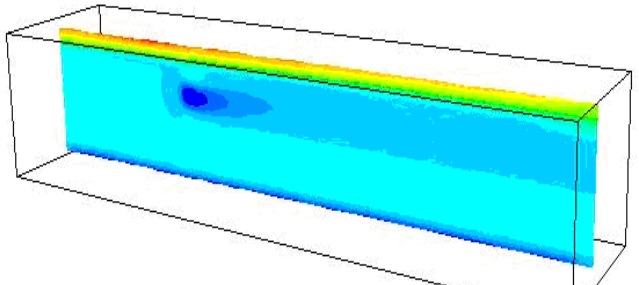
WS4: Aims

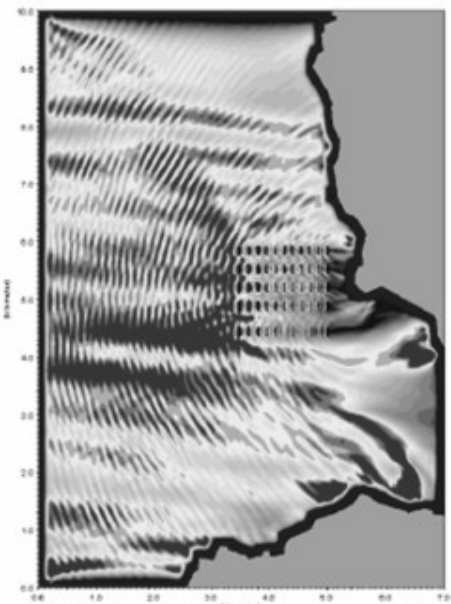
The workstream will determine:

- *The local impact of devices on the physical environment*: This has been done at a “resource”, scale
- *The additive effects of arrays of devices*: This will allow the identification of optimal configurations for arrays of principal device concepts
- *Data required to assess the environmental impacts of marine energy conversion:*





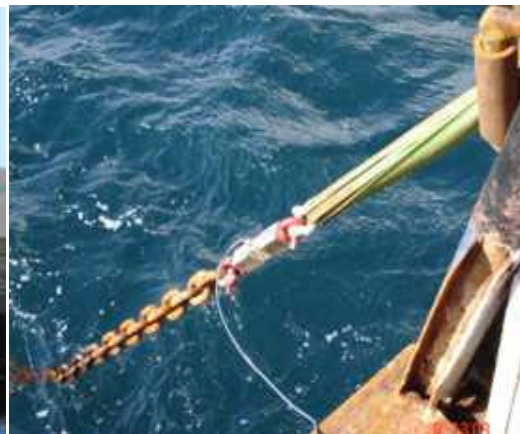




WS5: Power take-off and conditioning

WS6: Moorings and positioning

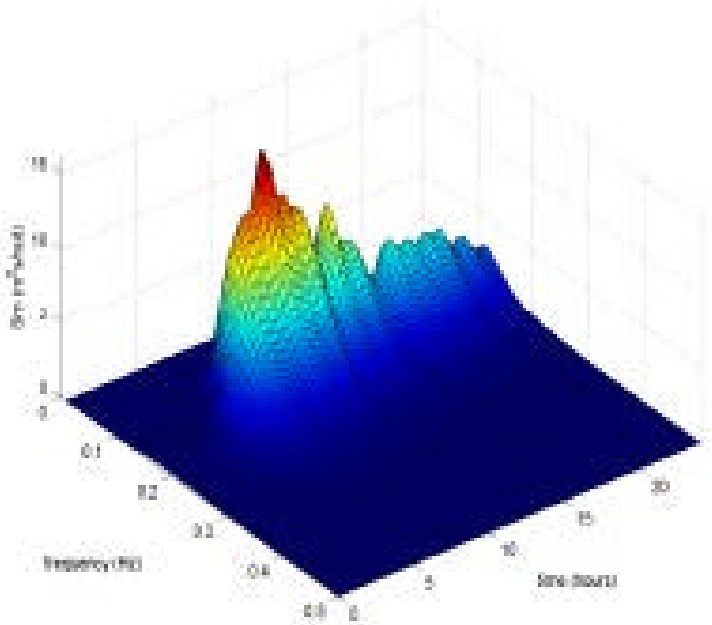
- How can a mooring arrangement for an array of wave energy or tidal devices be designed to ensure safe but economic operation?
- Within Supergen 1, research concentrated on issues associated with the very specific needs of mooring systems for devices which extracted wave energy.



WS7: Advanced control/network integration

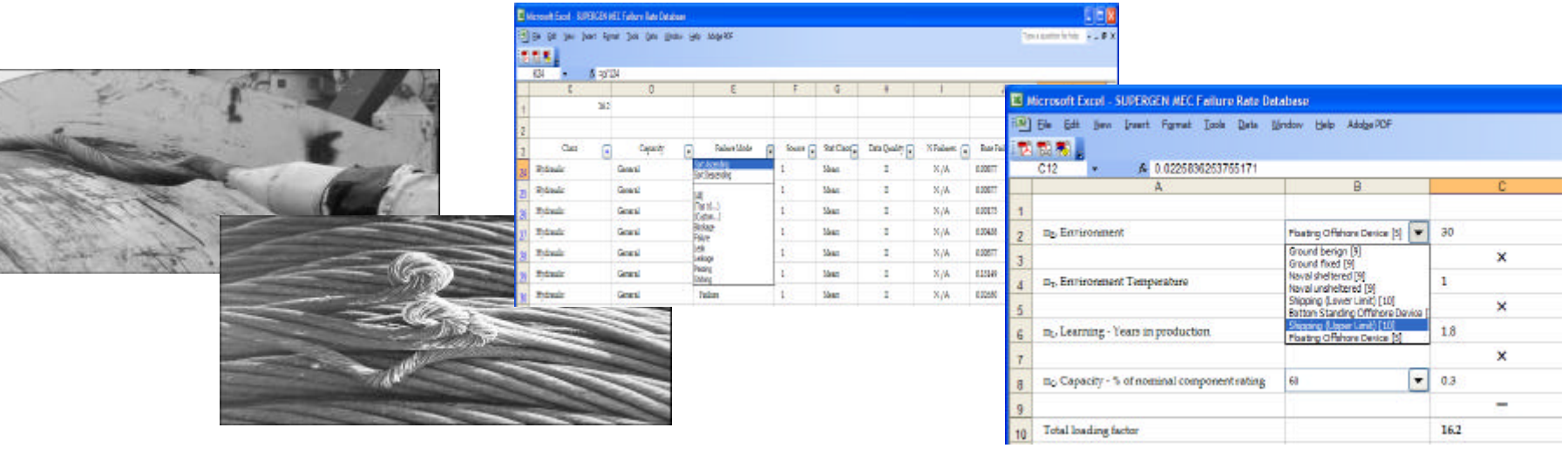
- Can non-linear, continuously adapting control techniques be developed and proved to optimise energy extraction and at the same time ensure device survivability for MECs operating in the real sea?

- What will be the improvements in electricity network integration of single or multiple devices?
- How might this be integrated with distributed management of the network edges?



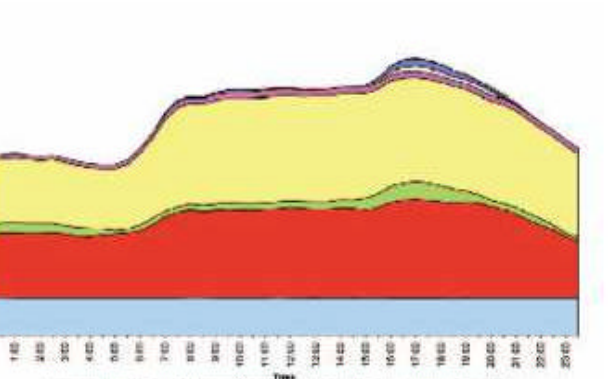
WS8: Reliability

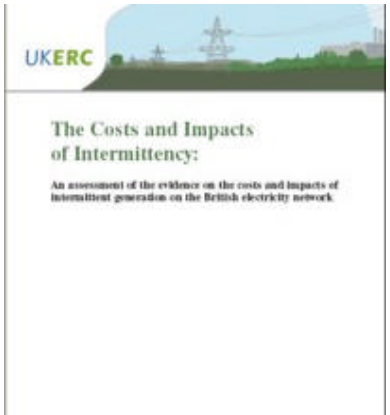
- How can an effective method to quantify the reliability of marine energy conversion systems be developed subject to the scarcity of industry-specific component failure rates and environmental data?

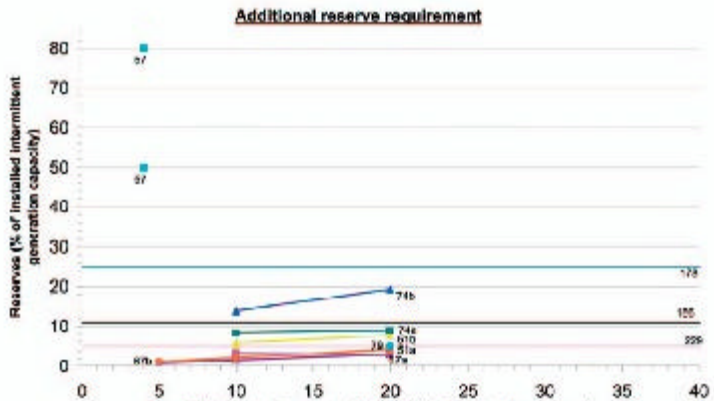


WS9: Economic analysis of variability and penetration

- Is it possible to predict the pattern and timing of future uptake of marine energy by the market, recognising its nature and location?
- How will their variability impact upon the rest of the electricity network and electricity consumers, especially considering the peripherality of generation sites?







WS10: Ecological Consequences of Tidal and Wave Energy Conversion

- What are the principal ecological consequences of the extraction of tidal and wave energy in coastal and more offshore zones?
- To what extent can such changes be predicted from forecasts of change in the ambient flow field, energy and associated particulate regimes?
- To what extent are these observable in the field and amenable to compliance monitoring for statutory purposes?