



UKERC Marine Energy Network

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Tasks for Today

- Identify the Goals of a the Research Road Map for Marine Energy – Step 1.
 - Identify short (3 yrs), medium (3-10yrs) and long term (10-20 yrs) goals
 - Review of research priorities.
- People Mapping
 - What are the strengths and weaknesses in the community to address the research priorities identified ?
 - Do we have the right people on the Network List ? Who is missing ?
- Discuss Proposed Format of the Network



Presentation

- General Introduction – why are we here ?
- Road-maps – what are they ?
- Previous work and networks
- Existing Activity
- Format for today's meeting



General Objectives of Future Energy Sources Topic

- To define and up-date the destinations and routes in the 2020 and 2050 sub-topic route plans;
- To increase the communication and coherence of research activity within each of the sub-topics;
- To increase the volume and effectiveness of spend in research in each of the sub-topics;
- To bring about greater stakeholder in-reach into the research agenda and outcomes;
- To engage more fully the beneficiaries of the research through wider dissemination and outreach.



Aims & Objectives

UKERC Marine Network

- To **prioritise research activity** to overcome the gaps in knowledge in Marine Renewable Energy
- To **influence research funding strategies** in Energy Research.
- To **encourage closer collaboration** between academic research groups and technology developers.
- To **seek funding** for collaborative projects from the Research Councils, EU, DTI Carbon Trust.
- To **establish partnerships** with partners outside of the existing Marine Energy Community .
- To **identify a Research Road-Map or Research Atlas** for the Marine Renewable Energy Community up to 2020.



These are the common objectives
for all of us in order to underpin
Marine Renewable Energy R&D
in the UK.



Research Road-Maps for Marine Renewables

- Provide and encourage the use of a structured R&D planning process for the Marine Renewable Energy Community.
- Provide a framework for managing and reviewing complex and dynamic R&D processes to achieve the important future goals of the Marine Renewable Energy Industry.
- Used to support business (marine industry) and government goals.
- Graphically show how specific R&D processes address strategic technical goals that specifically support the marine energy market or policy objectives of the future.



Road-Maps : Basic Principles for MARINE

- Coherency amongst the marine community is important.
- Primary purpose is to influence journey and paths that we take not predict them in advance.
- Process must involve “out of the box” creative thinking.
- Road-maps must provide useful guidance.
- Should communicate visually.
- Should integrate planning and implementation.
- Road-maps are living documents.



Road-maps: The Basic Steps

- There are 3 basic steps
 - Step 1: Choosing the destinations
 - Step 2: Surveying Potential Paths.
 - Step 3: Mapping the Course.



TODAY'S TASK

Step 1: Choosing the Destinations

- Setting short, medium and long term goals for Marine Renewable Energy Technology.
- Includes both Business and Technology goals.
- Goal setting process must choose the critical strategic technology needs of the marine energy community.
- Most difficult, but most important task.



Previous Work

- ETSU reports in the 1980s and 1990s.
 - Reviewed specific devices and identified areas if research required.
- Marine Foresight Panel
 - “Energies from the Sea – Towards 2020”, Office of Science & Technology, April 1999.
- DTI , Wave Energy: Technology Transfer & R&D Recommendations – Ove Arup and Partners, 2000.
 - A comprehensive review of current status of wave energy technology with recommendations for generic R&D.
- WAVENET – European Thematic Network on Wave Energy, report published in 2002.



Previous Work

- Anything missing ?



DTI – Ove Arup Report, 2000

- Main conclusions:
 - Wave Energy Industry is not co-ordinated
 - Technology used in Offshore and other industries can be transferred to the Wave Energy Industry.
 - There are areas where generic R&D would be useful.
 - Lack of investor confidence in the industry.
 - Issues common to both offshore wind and marine



DTI- Ove Arup Key Issues Regulatory Environment, HSE, Design Codes & Verification

- No generic R&D needs were identified.
- Planning and Approvals Process should benefit from work carried out for Offshore wind.
- Design & Verification Processes of the Offshore Oil & Gas industries can be transferred.



DTI- Ove Arup Key Issues Construction Methods & Project Cost Estimation

- Transfer costing information and methods from Offshore Oil & Gas, and onshore civils and manufacturing industries.
- Prepare a full list of industrial parties who would be interested in being involved in the Marine industry.
- A study of fabrication and installation guidelines is required so that the marine industry can benefit from production line philosophy.



DTI- Ove Arup Key Issues Marine Operations

- No generic R&D needs as each device will have different requirements.
- Device developers should work with installation contractors to satisfy their own needs.
- Offshore operators can supply metocean data for tows and provide data for installation windows.



DTI- Ove Arup Key Issues Mooring Systems

- Potential for transfer of technology transfer from the offshore industry, with particular reference to synthetic ropes and taut moorings.
- Generic studies: long term fatigue issues of lines and connection points, standard connector designs for mooring attachments and subsea cables.
- Mooring studies required for the leading prototypes being developed.
- Software development to predict the motion of arrays of devices in a given sea-state.



DTI- Ove Arup Key Issues Operations & Maintenance

- No generic research needs as operational strategies will be device dependant.
- Potential for technology transfer from the Offshore Industry.
- Use data on inspection and operation procedures presently used by the offshore industry for the monitoring of subsea or unmanned floating or fixed facilities.



DTI- Ove Arup Key Issues Materials

- A wide range of materials are currently used in the offshore environment, and hence no new materials need be developed in isolation for marine renewables.
- Main issues: corrosion strategy, life cycle analysis, reliability of materials, erosion damage.
- Technology transfer from the offshore oil and gas industry.
- No generic research required.



DTI- Ove Arup Key Issues

Hydraulic systems

- Investigate using water as the hydraulic fluid.
- Dynamic seals development and testing.
- Better hydraulic machines with high part load efficiencies.
- Technology transfer from other industries to facilitate prototype development.
- Work required to improve reliability and economic returns for commercial systems.



DTI- Ove Arup Key Issues Pneumatic Systems

- Applicable to OWCs, which are considered to be mature.
- Work required to compare different turbines, in particular their efficiency.
- Novel materials from the aerospace industry could be used for design and fabrication.
- Resistance to aggressive environments, value engineering, long maintenance life require further investigation.



DTI- Ove Arup Key Issues Subsea Cables & Connectors

- The only generic R&D project of value for the Marine Energy Industry as a whole.
- Development of a standardised, flexible connector is required.
- Potential for technology transfer from both static and dynamic connectors from the offshore oil and gas industry



DTI- Ove Arup Key Issues Control Systems

- Requires accurate models of specific devices.
- Modelling and forecasting the wave input on a real time basis needs to be addressed.
- Facility to remotely reconfigure a wave energy device would be very useful.
- Potential for technology transfer from areas of system control, remote control and monitoring from the offshore oil and gas industry.



DTI- Ove Arup Key Issues

Power Quality and Grid Connection

- Grid map is required for the west coast of the UK.
- Study of grid capacity required to recommend areas of upgrading.
- Testing and development of power conditioning modules for use in marine systems.
- Energy storage during downtime.
- Remote condition monitoring of devices and intervention strategies should be developed.
- Investigation into potential for fault detection and the effective intervention strategies in grids.



WAVENET – Summary, 2002

- Covered a wide range of aspects
 - Environmental
 - Planning
 - Economics of Wave Energy
 - Financing Wave Energy Projects
 - Industrial Benefit & Job Creation
 - R&D requirements for 1st and 4th Generation Wave Energy Devices.
 - Power Quality and Grid Connection
 - Generic Technologies



DTI & WAVENET

- In developing the Marine Energy Research Road Map we need to review the output from these studies and include existing activities – TODAY'S TASK



Existing Activity

- The Carbon Trust:
 - Marine Energy Challenge – report to be published end of summer 2005.
 - European Marine Energy Centre, Orkney
- EPSRC: Supergen Marine
 - Edinburgh, Lancaster, RGU, Heriot- Watt & Fraser-Allander Institute
 - £2.7M to do generic research
- DTI Programmes:
 - funded a number of technology developers to build prototypes.
 - Marine Energy Deployment Fund.
- EU Coordinated Action on Ocean Energy
 - Started November 2004, with 40 partners from EU countries and Canada
- International Energy Agency:
 - Ocean Energy Systems Group



The Carbon Trust Marine Energy Challenge

Objectives:

- To identify, through engineering design, if the £/kWh generation cost of existing wave and tidal technologies can be reduced .
- To provide - if generation costs can be reduced - the wave and tidal industry with detailed 'next-generation' prototype design drawings of re-designed components to accelerate their development to commercial success
- To highlight - if generation costs can be reduced - 'generic' component areas that could create new businesses providing wave and tidal (and potentially off-shore wind) ancillary equipment or services

Wave and tidal power technology developers could also benefit through:

- Independent review of the cost and performance of their device
- Technology transfer from engineering design organisations to reduce installed cost and/or enhance generation performance
- Detailed engineering report, including design drawings, to further develop prototypes, or support future technical due-diligence required by potential investors



EPSRC SuperGen – Marine

Aims

- To increase knowledge and understanding of the extraction of energy from the sea
- To reduce uncertainties for future stakeholders in the development and deployment of the technology
- To enable progression of new marine energy concepts and devices into true position in a future energy portfolio.

Generic outcomes 3-10 yr horizon leading on to paths to equipment and energy markets.

UKERC

UK Energy Research Centre



EPSRC SuperGen - Marine

Collaborators

- Talisman Energy,
- The Clean Energy Company,
- Umitech,
- Corus,
- Marine Current Turbines,
- IT Power,
- Power Technologies (UK),
- Artemis Intelligent Power Ltd,
- South West Electrolysers,
- EMEC Orkney
- Conoco Europe Gas Ltd,
- INEOS Chlor,
- Scottish Power,
- Scottish & Southern Energy,
- Qinetiq,
- SEPA,
- SNH,
- Seapower,
- CEFAS,
- HIE,
- Crown Estates



EPSRC SuperGen - Marine

Work packages

1. Appraisal of marine energy resource and interaction between converters and fluid environment.
2. Development of methodologies for device evaluation and optimisation.
3. Engineering Guidance
4. Offshore energy conversion and power conditioning
5. Chemical conversion and transport of marine energy
6. Network Interaction of Marine Energy
7. Lifetime economics



EPSRC SuperGen - Marine

8. Moorings and Foundations
9. Novel control systems for marine energy converters
10. Full-scale Field Validation
11. Establishment and Assessment of Laboratory Testing Procedures of Tidal Current Energy Devices
12. Economic, Environmental & Social Impact of New Marine Technologies for the Production of Electricity
13. Dissemination and Outreach



International Energy Agency Ocean Energy Systems

- The Implementing Agreement on Ocean Energy Systems commenced in October 2001.
- The Agreement's mission is to enhance international collaboration to make ocean energy technologies a significant energy option in the mid-term future.
- Through the promotion of research, development, demonstration and information exchange and dissemination, the Agreement's objective is to lead to the deployment and commercialization of Ocean Energy Technologies.
- Current priorities are ocean waves and marine current systems.



EU Coordination Action on Ocean Energy

- To disseminate the knowledge and promote the technologies, the Coordination Action on Ocean Energy will organize dedicated interactive workshops in six monthly intervals over 3 years, as a vehicle to exchange, present and analyse information important for Ocean Energy Development.
- The following five workshops are planned:
 - 1 Modelling of Ocean Energy Systems, Aalborg, 5-6 April 2005
 - 2 Component Technologies and Power Take-off, Upsalla, 3-4 November 2005
 - 3 System design, Construction, Reliability & Safety
 - 4 Performance Monitoring of Ocean Energy Systems
 - 5 Environmental, Economics, Development Policy and Promotion of Opportunities
- Coordinator: Kim Nielsen (KIN@ramboll.dk)



Format of the UKERC Marine Network

- Propose breaking up into specialist groups:
 - Resource modelling and prediction
 - Testing: prototype testing at all scales
 - Device Modelling
 - Device Engineering
 - Materials
 - Power Take Off, Electrical Systems and Control
 - Environmental, Socio-Economic
- Specialist Groups meet to survey and map out the potential paths (Steps 2 & 3) to satisfy Step 1.
- Output from these sub-groups is collated to form the research road map.
- Identify sources of funding for collaborative projects across the network and with other themes in the UKERC, such as Environmental Sustainability, Materials & Energy Infrastructure and Supply.



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- People Mapping
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Remaining Agenda for Today

11:15 – 11:30	Break
11:30 – 12:30	Review R&D Priorities (ALL)
12:30 – 13:00	Lunch
13:00 – 15:00	Identify the Goals for Road Mapping (2 groups)
15:00 – 15:15	Break
15:15 – 15:45	Format of the Network and Wrap UP



Discussion Groups

Group A – Tidal

Ian Bryden - RGU
Luke Myers - Southampton
Peter Fraenkel - MCT
John Callaghan - Carbon Trust
Doug Everard - NaREC
Richard Boud – ENTEC
Matthew Rea – Edinburgh Designs
Jamie Taylor – Edinburgh University
John Dering – Marine Foresight Panel
Markus Mueller – Edinburgh University
Thomas Boehme – Edinburgh University
Gareth Gretton – University of Edinburgh

Group B – Wave

George Agidis - Lancaster University
Robin Wallace - Edinburgh University
Trevor Whittaker - Queens' Belfast
Stephen Salter - Edinburgh University
Nigel Balthrop - Glas/Strath
Greame Mackie - Wavegen
Gus Cammaert – DNV
Tom Thorpe - consultant
John Dering – Marine Foresight Panel
Gareth Harrison – Edinburgh University
Grant Allan – Fraser of Allander Institute
Gregory Payne – Artemis Intelligent Power