

HARNESSING SCOTLAND'S MARINE ENERGY POTENTIAL

DEVELOPING ACADEMIC CAPACITY AND
SUPPORTING R&D

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86. Scotland has a long history of excellence in research and development of marine energy. The Universities of Edinburgh, Heriot Watt, Robert Gordon and Strathclyde are internationally recognised centres of expertise.

87. The continued development of marine research and academic expertise is vital if Scotland is to maintain its pre-eminence in this field and support its emerging marine energy industry. The sector needs Scotland's research base to play a significant role in securing the future of first generation marine energy devices; developing second generation marine technology and evolving components, performance monitoring and maintenance techniques.

87. If the Scottish academic sector is to rise to this challenge the Scottish Higher Educational Funding Council and individual institutions need to review their commitment to and investment in the emerging marine energy industry. The SuperGen programme can contribute by coordinating and expanding research programmes to include further institutions and companies.

88. The recently established Intermediary Technology Institute - Energy (ITI(E)) has a key role to play in forging stronger links between Scotland's research community and industry. MEG considers that the ITI (E) can make a significant contribution to the development of a thriving marine energy sector in Scotland through fast-tracking development of new device concepts, monitoring and measurement equipment, as well as 2nd and 3rd generation device technology.

89. The new UK Energy Research Centre is an important milestone in encouraging joint working and coordination of energy research within the UK academic sector. Plans articulated to develop Scotland as a Centre for Marine Energy, as a part of the overall Centre strategy, are to be welcomed. A Scotland based Marine Energy Centre could significantly inform ITI (E)'s decisions on investments in the emerging marine energy sector. MEG strongly supports this development.

Actions

- The Scottish academic sector – funding councils, Universities Scotland and individual institutions should *review and reinforce existing capability in marine energy undergraduate teaching, research and development to meet the future demand for graduate skills and consolidate the research base.*

Actions

- Scottish Executive, the enterprise agencies, EMEC and ITI(E) should continue to work with existing and new initiatives such as SuperGen, Marine Energy Challenge and UKERC to maximise the synergies and opportunities that will establish marine energy technology and its manufacturing industry.

Agenda



SuperGen Marine Energy Research Consortium

UK Energy Research Centre

Research Landscape

UK Centre for Marine Renewable Energy

Progress against actions

The SuperGen Marine Energy Research Consortium



Sponsors

4 year collaborative project

Supported by EPSRC



EPSRC

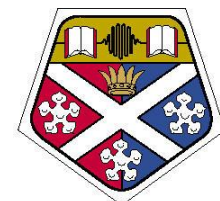
Engineering and Physical Sciences
Research Council

Partners

4 year collaborative project

Supported by EPSRC

- University of Edinburgh
- The Robert Gordon University
- Heriot Watt University
- The University of Strathclyde
- Lancaster University



Collaborators

- EMEC Orkney,
- Talisman Energy,
- The Clean Energy Company,
- Umitech,
- Corus,
- Marine Current Turbines,
- The Engineering Business,
- IT Power,
- Siemens – formerly PTL (UK),
- Ocean Power Delivery,
- Artemis Intelligent Power Ltd,
- Edinburgh Designs,
- South West Electrolysers,
- Natural Power Company,
- Entec
- Conoco Europe Gas Ltd,
- INEOS Chlor,
- Scottish Power,
- Scottish & Southern Energy,
- Qinetiq,
- SEPA,
- SNH,
- CEFAS,
- HIE,
- Crown Estates,
- Met Office,
- Sgurr Energy,
- Aalborg University,
- Wavegen,
- Lunar Energy,
- Swansea University Turbines



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.

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

Work packages

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



UK Energy Research Centre

- Sits within Towards a Sustainable Energy Economy
 - Managing uncertainties
 - Keeping the nuclear option open
 - Renewables
 - Carbon management
- Sits alongside:
 - SUPERGEN Initiative (Sustainable Power Generation and Supply), EPSRC
 - EPSRC fusion programme
 - Carbon Vision Partnership (Carbon Trust/research councils)
 - Tyndall Centre on Climate Change
 - UK Centre for Marine Renewable Energy

UKERC

UK Energy Research Centre



UK Energy Research Centre

Vertical themes

- | | |
|-------------------------------------|-----------|
| 1. Demand reduction | Oxford |
| 2. Future sources of energy | Edinburgh |
| 3. Energy infrastructure and supply | UMIST |

Horizontal themes

- | | |
|------------------------------------------|-----|
| A. Energy systems and modelling | PSI |
| B. Environmental sustainability | CEH |
| C. Materials for advanced energy systems | ICL |

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Future sources of energy

- Biomass
- Carbon management
- Fuel cells
- Marine
- Nuclear fusion
- Photovoltaic

Edinburgh

UKERC

UK Energy Research Centre



UK Energy Research Centre

Environmental sustainability

- Transport
 - Biomass
 - Offshore Energy
- CEH
Southampton
Edinburgh

UKERC

UK Energy Research Centre



Research Roadmaps

- Identifying the sequence of research problems to be overcome before new technologies can be commercially viable.
- Work with the research community and stakeholders to identify existing maps, fill in gaps and bring these together into a single “atlas”
- Consensus-based, interdisciplinary and dynamic
- Need to be scenario-based
- Collaboration with DTI (energy and innovation groups)



Research Networks

Work with the research community and stakeholders to

- Identify extant and
- Missing skills and facilities,
- Fill in gaps and bring these together into a single “network”



Marine Network and Road Map

22 invitees attended intense workshop in
Edinburgh on 14th April

For each of Wave and Tidal Technologies, mapped

- Short term output (2-3 years)
 - Showstoppers, enablers, make-feasibles
- Medium term output (3-10 years)
 - Essential, desirable, ideally available
- Long term output (10-15 years)
 - Drivers down cost curves



Marine Network and Road Map

Initial outcomes

Term	Wave	Tidal
Short	67	60
Medium	53	
Long	16	

Items of generic, component or method research – not device specific. Device development needs to focus.

Vary from 3 -36 months in duration depending on needs, and will be addressed where appropriate in collaboration.

Will advise RCUK planning.

UKERC

UK Energy Research Centre

Scottish Research Landscape

- SuperGen1 Marine – RGU, HWU, Sclyde, UoE
- SuperGen1 FNT – Strathclyde, UoE
- SuperGen3 Distributed Generation – Strathclyde
- SuperGen5 Energy Infrastructure – Strathclyde, UoE
- UK Energy Research Centre – Edinburgh
- National DG Centre – Strathclyde
- National CoE in Energy Utilisation - Strathclyde
- SHEFC Research Partnership – HWU & UoE
- RCUK Science and Innovation Award - Strathclyde
- SE Proof of Concept Awards – RGU (2) Sclyde, UoE
- EU CA Ocean Energy – Strathclyde, RGU, HWU, UoE
- EU Wavetrain Partners - Edinburgh

Scottish Research Landscape

- This is from a skills complement of around 12 full-time academics, 12 RAs, and 18 PGs
 - Scotland is punching above its weight
 - Working with long-time and new partners
- Age distribution bi-modal, many retirements
 - There are replacement and some new blood vacancies
- In many cases, the industry that we have is from the original research base
- Must continue to provide research support and training
- Specifically in Reliability, Survivability, Operability and Maintainability of 2nd ,generation devices

UK Centre for Marine Renewable Energy

UoE, Edinburgh

RGU, Aberdeen

NaREC, Blyth

EMEC, Orkney

Down this axis

wave and tidal current device designers,
developers

tank-test facilities ranging from 1/100 scale
through 1/10 to full-scale at sea, enabling
concept, component, subsystem and full
systems development and testing.

several hundred person years of knowledge,
experience, literature and data

facilities that represent a collective investment
to date of well over £50M.



UK Centre for Marine Renewable Energy

The Centre will, on an inclusive basis:

- Provide informed guidance and strategic policy to industry, government and other stakeholders
- Provide an authoritative voice on resource assessment, exploitation and environmental impact
- Provide a conduit between the industry, government and academia
- Ensure a coherent and focussed R&D and standardisation framework
- Identify gaps and barriers to development and provide solutions
- Ensure good communications between all stakeholders

UK Centre for Marine Renewable Energy

Will interact with the

- Department of Trade and Industry,
- Scottish Executive and Welsh Assembly Government,
- RDAs,
- Environmental Agencies & NGOs,
- Infrastructure and finance community,
- Equipment developers,
- SMEs
- Trade associations and the wider national and international stakeholder community to ensure closer policy linkage, engagement and inclusion.

UK Centre for Marine Renewable Energy

Has the following programme themes:

- Resource Assessment
- Site Evaluation Methodologies
- Environmental benefit and impact
- Standards and certification
- Technology review
- Industry Deployment
- Internationalisation
- Socio Economic Implications
- Dissemination, inreach and outreach
- Interaction with existing and new funding programmes

Actions

- *Review and reinforce existing capability in marine energy undergraduate teaching, research and development to meet the future demand for graduate skills and consolidate the research base.*
- This is one of the more precious and vulnerable resources – maintained to date by their own initiatives and increased collaboration
- It requires longer term security than successive, competitively won fixed term contracts provide.
- PIs and staff are redoubling efforts to win contracts.
- Need to explore more sustainable options

Actions

- Scottish Executive, the enterprise agencies, EMEC and ITI(E) should continue to work with existing and new initiatives such as SuperGen, Marine Energy Challenge and UKERC to maximise the synergies and opportunities that will establish marine energy technology and its manufacturing industry.
- Working links with EMEC & NaREC secure
- UKERC establishing
 - Articles and MoU drafted
 - Main and Advisory Boards outlined
 - Preliminary business plan agreed
 - Proposal engaged
 - Existing resources mapped onto objectives
 - European links evolving

Actions

- Scottish Executive, the enterprise agencies, EMEC and ITI(E) should continue to work with existing and new initiatives such as SuperGen, Marine Energy Challenge and UKERC to maximise the synergies and opportunities that will establish marine energy technology and its manufacturing industry.
- UKERC marine research network can better integrate UK and European research effort.
- Scottish research base progressively (re)establishing itself internationally but this is a renaissance that must be maintained.