MREDS
ICIT
HERIOT WATT UNIVERSITY
Marine Renewable Energy Development in Scotland

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MREDS – building capacity

2008 has been a busy year in the world of renewable energy and a busy one for the MREDS team. We are now making progress in all the work packages and it's certainly encouraging to see a steady stream of proposals being developed, many with partners in other institutions and renewable energy SME's. This Newsletter gives details of some of the year's successes, but there is a lot of additional work in the pipeline and I hope that we will be able to report on this next year.

If forced to single out one initiative it would have to be the award of £1million Strategic Research Development Grant (SDRG) from the Scottish Funding Council to MREDS Workpackage 5 focussing on the environmental effects of marine renewable energy developments. This award enables the appointment of 4 post-doctoral researchers. What is so important about this award is that it is designed to develop research capacity. These appointments significantly strengthen the ability of the MREDS team to generate new proposals and respond to research opportunities.

Another major milestone was the first MREDS steering group meeting held in Orkney on 5th December 2008. The meeting brought researchers funders and industry together. In addition to discussing progress to date, several new avenues for potential future research were identified and I would like to thank all those who took time out of their busy schedule to take part in the meeting. A full report is available at www.mreds.co.uk.

I remain hugely optimistic about 2009. There are several significant developments afoot in the sector. The Crown Estate's decision to lease blocks of the Pentland Firth for tidal energy development, the continued success of EMEC and the Marine Bill immediately spring to mind. MREDS is showing the importance of taking a collaborative approach to research and the importance of establishing links with developers and industry. Strengthening these links is going to be one of my personal priorities for 2009.

Finally, if developers or researchers would like to discuss opportunities for getting involved in MREDS please do not hesitate to get in touch.

Contact: j.c.side@hw.ac.uk

Professor Jonathan Side
Director ICIT

MREDS is a collaborative programme of research focussing on engineering, environmental and socio-economic aspects of marine energy

MESMA Proposal to FP7

ICIT has joined a consortium of 18 European research institute on a project on the Monitoring and Evaluation of Spatially Managed Areas (MESMA) under the EU 7th Framework Programme. MESMA will examine the design, governance, implementation and monitoring of marine Spatially Managed Areas, with ICIT's contribution focussing on fisheries, marine energy developments and the socio-economic implications of such spatial management.

Most European countries still designate ocean space on a case-by-case basis, often at risk of sterilizing designated areas for other activities. Holistic, planned approaches to managing the sea are rare. As competition for marine resources increases particularly in the North of Scotland with emerging demands for licences for marine renewables projects, an *ad hoc* or sectoral approach is considered less and less appropriate for the sustainable management and development of marine resources.

The project leader Dr Jan van Dalfsen of the Netherlands Institute for Marine Resources and Ecosystem Studies noted that the project offered the scientific, technical and socio-economic understanding necessary for future spatial planning in European Seas that would also take cross-boundary developments into account. Whilst the need for integrated marine resource use and planning is recognized, key commitments made to this effect at both the national and international level have been slow to emerge.

More details on MESMA and Spatially Managed Areas are available in the MREDS programme (Workpackage 6 – contact Dr Sandy Kerr), and of the impacts of spatially managed areas on the fishing sector in the work being undertaken on the SRDG (contact Professor Jonathan Side).

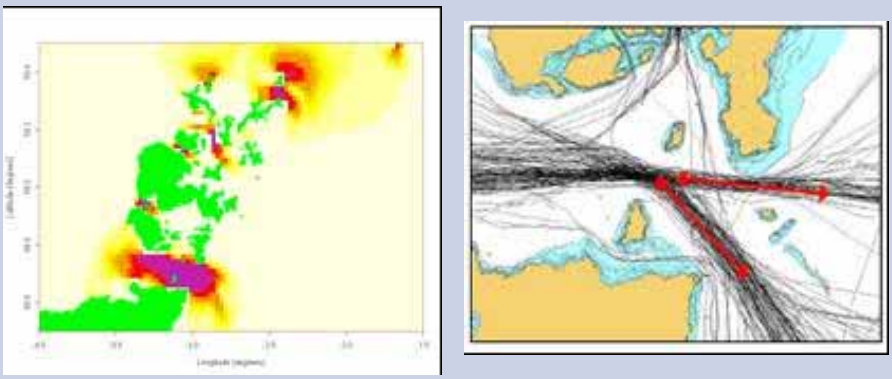


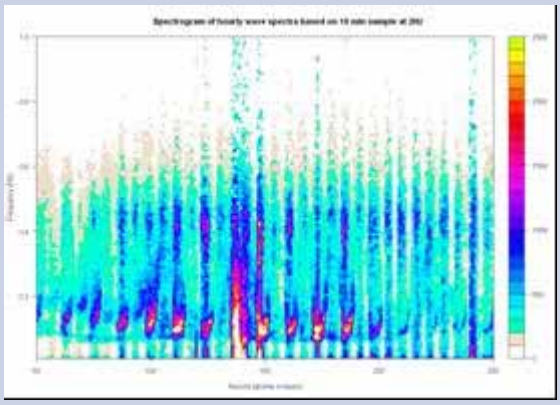
Figure (LHS tidal energy resource in North of Scotland (data from *DTI*), RHS shipping tracks in the Pentland Firth (data from *MARICO*).

ERI Survey Vessel Available for MREDS Projects

Last year the Thurso based Environmental Research Institute purchased the RV Aurora, a 6.2 m catamaran from Cheetah Marine. Over the summer the vessel has been kitted out to comply with Marine and Coastguard Agency workboat category 3. Following successful MCA categorisation, the vessel will be able to operate up to 20 nautical miles from shore. She will provide an ideal platform for research and survey activities within the Pentland Firth, including boat mounted ADCP surveys.

EPSRC Marine turbine blade study

The first meeting of the study group for the EPSRC: Feasibility of an Innovative Methodology for Testing of Marine Turbine Devices in Unsteady Flow took place 5th – 6th June. This 18 month study involves ICIT, Strathclyde University's Department of Naval Architecture and Marine Engineering and Scotrenewables researchers and aims to investigate the hydrodynamic loading on tidal turbine blades under the action of unsteady flow conditions experienced in a wave / current environment.



Unsteady Flow at a Tidal Site

Post Petroleum - Oil Industry Renewable Energy Symposium for Spring of 2009

Professor Patrick Corbett of Heriot-Watt University's Institute of Petroleum Engineering is leading Work Package 2 of MREDS which focuses of linkages between the oil industry and the emerging marine renewables sector. Professor Corbett explained that "the global energy sector is at a crossroads, with some estimates showing us half-way through the easy-to-produce and cheap oil, at the same time society's demand for low-cost and cleaner energy continues to grow. The oil majors are starting to consider a post-petroleum future and the possibility of rebranding themselves as energy companies providing the market with energy from a variety of sources which will doubtless include marine renewables. The time is right to explore how this change may be facilitated". An MREDS symposium will be held in spring 2009 which will explore opportunities for deeper engagement between the oil industry and the marine renewables sector. Dr William Sutton, a graduate from ICITs MSc in Renewable Energy Development, is helping organise the symposium. Dr Sutton commented that "I have over 20yrs experience working in the oil industry and it is clear that there is real opportunity for fruitful collaborations between the two sectors. The marine renewable industry can benefit from the oil sector's experience in offshore operations. Equally marine renewables offer an investment opportunity for companies trying to realign themselves in response to falling fossil fuel supplies". Further details of the symposium will appear on the MREDS web site.

Diving Birds Study

The 3rd meeting of the Total sponsored: Seabird Biodiversity Steering Group Meeting took place on 17th - 18th June. During the two day visit, presentations were made by research staff at ICIT, Guy Sallavuard representing the sponsors: Total Foundation and from Eric Meek of the RSPB. Guy outlined the Total Foundation describing the various worldwide sponsored research projects ranging from dugongs in the Persian Gulf, wild sea salmon off the Faroe Islands, to humpback whales in the Pacific. The visit was concluded with a field study tour to the island of Copinsay, where diving birds were observed and the field instrumentation was demonstrated.

SUPERGEN II – Ecological Workstream kicks off

It is inevitable that the deployment and operation of marine energy extraction devices will disturb the surrounding environment. With the progressive tightening of statutory marine environmental controls, it is essential to be in a position to address the issues that are likely to arise as new controls are introduced, especially as the onus will be on the industry to demonstrate minimal environmental disturbance. Experience has already shown that difficulties in obtaining statutory environmental permission for the deployment of such a device can have serious economic costs.

Workstream 10 in Supergen II, a collaborative project between ICIT and Dr Graham Savage of Queen's University Belfast, is an attempt to provide some answers to questions critical to these issues:

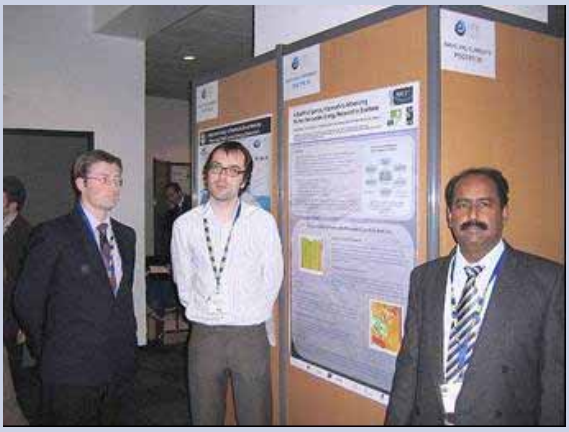
1. What are the principal ecological consequences of the extraction of tidal and wave energy in coastal and more offshore zones?
2. To what extent can such changes be predicted from forecasts of change in the ambient flow field, energy and associated particulate regimes?
3. To what extent are these likely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

Professor Jonathan Side explained "Difficulties in predicting ecological responses to the extraction of marine energy arise for several reasons. Firstly for the majority of organisms, the responses associated with a change in their exposure to variations in energy regime (often accompanied by changes in sediment load and abrasive and mechanical perturbation) are not well understood. Secondly these responses, to what ecologists aggregate in the term "exposure" will vary with the stage of the life cycle of the organism, and its sensitivity to extreme perturbation events as well as to the degree of ambient exposure. Even less well understood are the impacts that species changes may have on local community structure and functioning, as other biotic factors such as competition, come into play. Even where the physical change induced by the energy extraction device is relatively small, the ecological consequences may take time to manifest, but may still be observable in the longer term."

Concerns focus on what ecological metrics to measure, how, and how often and the extent to which change may be observable against other natural variability, and the increasing alteration to marine ecosystems as a consequence of climate change.

Presentation at the International Conference on Ocean Energy

A delegation from the MREDS project participated in the International Conference on Ocean Energy held at Brest, France during 15 - 17, October 2008 and presented a poster titled 'A Multidisciplinary Approach to Advancing Marine Renewable Energy Research in Scotland'.



Dr. Pandian (right), Mr. Robert Beharie (left), both from ICIT, Orkney and Dr. Mark Shields (centre) from ERI,

Supergen Workshop in Orkney

ICIT recently hosted a doctoral training programme for 23 PhD students funded by the EPSRC Supergen Marine programme. Dr. David Ingram from Edinburgh University explained that "Supergen Marine is a collaborative research programme involving five UK universities. The programme focuses on the potential future exploitation of marine energy resources in our seas". Professor Jonathan Side from ICIT noted that most of the "Supergen students are mainly engineers: the trip to Orkney has given them a better understanding of the environment in which wave and tidal energy devices will be placed". The students received presentations from Orkney based companies including EMEC, Scotrenewables, Xodus Aurora and Aquatera. One of the PhD students Bob Beharie commented that "the strength and depth of marine renewables activity in Orkney makes it a magnet for anyone interested in the sector". For more information about ICIT and Supergen go to www.icit.org.uk and www.supergen-marine.org.uk.

RASCAL (PF) a Tidal and Wave Energy Monitoring Scheme for the Pentland Firth

The group recently met at ICIT to discuss the development of a comprehensive wave and tidal current, data acquisition project for the Pentland Firth. The project called RASCAL (PF) is jointly led by ICIT in Orkney and the Environmental Research Institute (ERI) in Thurso. Dr Stuart Gibb (ERI) described the project as "an essential prerequisite to any serious renewable energy development of the Pentland Firth". The wider project team includes experts from Heriot-Watt University, ERI, University of Sheffield, Edinburgh University and Stanford (California). Professor Side (ICIT) explained that "we know there is a tremendous amount of energy in the Pentland Firth. However our knowledge of the complex tidal currents there, and how they interact with waves, is extremely limited. We know that existing models of the tidal regime in 'the Firth' fail to describe what is really happening and RASCAL (PF) will address this problem." The project team plan to install novel HF Radar technology in Caithness and Orkney, in addition to using more conventional data recording techniques. This will allow the team to develop the first accurate model of the tidal flow in the Pentland Firth. For more information about the project contact J.C.Side@hw.ac.uk

Left To right: Dr Rob Harris, Professor Margot Gerritsen, Professor Lucy Wyatt, Dr Sandy Kerr, Dr Pandian Pitchai, Dr Mark Shields, Professor Jonathan Side, Dr Karl Stephen, Dr Scott Couch, Dr David Woolf, Emmanuel Osalusi

Supergen PhD students returning from a trip around Scapa Flow aboard the MV Guide

Leading Wave Energy Developer Supports Heriot-Watt Student

Heriot-Watt Student Gregory Blower, recently received a £2,000 award from AWS Ocean Energy. As a result, Gregory spent the summer at ICIT working with AWS Ocean Energy on the company's wave energy device which is due to be deployed at EMEC in 2009.

Commenting on his project he said "This is a fantastic opportunity for me to work with a leading wave energy company. It also means that I can study in Orkney which is fast emerging as a global centre for marine renewables research and it's also a great place to be with a real buzz about it".

Ben Yeats Project Development Manager at AWS Ocean Energy and himself a Heriot-Watt alumni comments; "AWS was delighted to support Gregory over the summer. We are a dynamic research focused organisation and we place great value on our links with academia." For more information about studying at the Orkney Campus and AWS Ocean Ltd.

Predicting The Tides - A Nuffield Scholarship Study at ICIT

Tidal height information is useful in many fields of coastal life but it is of vital importance to those involved in the planning of tidal energy projects. John Morrison, a student from Stromness Academy spent the summer at ICIT completing a project on tidal prediction under the Nuffield Scholarship scheme. He presented the completed project on Wednesday the 20th August to a group of staff, PhD students and both his head-teacher and parents.

This study used data on water elevation from Acoustic Doppler Current Profiler (ADCP) measurements, recorded between 12th March -13th April 2007, at the European Marine Energy Centre's Fall of Warness tidal test site in Orkney. Harmonic analysis using the method of least squares and iterative use of Fourier analysis on the residuals has enabled a prediction of tidal heights up until 2017. These predictions compare favourably with commercially available software and the 2008 tide tables for Orkney.

MSPs visit Orkney to Learn about Marine Renewable Energy

In August 2008 Michael Russell, MSP and Minister for the Environment visited the EMEC tidal energy site and took the opportunity to meet ICIT staff and other local stake holders involved in the development of the wave and tidal energy sector in Orkney. Mr Russell was impressed with the progress being made and the way in which academia public and private sectors are working together in Orkney. Dr Sandy Kerr from ICIT commented that "it is great to see the level of commitment being shown by both Hollyrood and Westminster governments to the sector. It was also a great opportunity to highlight the need for high quality research and innovation across a number of fronts, not just device design but other areas like environmental monitoring, energy storage, and maintenance". Later in August Jim Mather, MSP and Minister for Energy Enterprise and Tourism visited Orkney and met various energy stakeholders.

Visiting the Open Hydro device at the EMEC test facility: Dr Gareth Davies (OREF/Aquatera), Dr Sandy Kerr (ICIT/Heriot-Watt), Michael Russel (MSP Minister for the Environment), Steve Ray (SGRPID), Gail Churchill (SNH), Niel Kermode (EMEC), Elaine Mitchell & Scott Sutherland (Scottish Government)

Left to right: John Morrison, Emmanuel Osalusi, Piya Parnphumeesup, John Ruscoe, Dr. Pandian Pitchai

SRDG Appointments

The award of a £1million Scottish Funding Council SRDG grant to ICIT and ERI is aimed at developing capacity in the region to conduct research into the ecological effects of marine renewable technologies. As part of this package four post doctoral research posts have been created :-.

Dr. Mark Shields began working as a Post Doctoral Research Associate at the ERI in November 2007. He arrived from the Scottish Association for Marine Science where he completed his PhD on deep sea biology in the Arctic. His research will focus on addressing potential environmental issues related to marine renewable energy devices, particularly benthic and pelagic ecological communities.

Dr Pandian Pitchai joined ICIT in March 2008. He had previously conducted research in coastal processes at the Institute of Ocean Management in Chennai in India. His particular interest in modeling the coastal effects (erosion and sedimentation) of marine energy devices. Initially this will involve the adaptation of software to describe coastal processes around the key tidal Energy sites in Orkney and the Pentland Firth.

Dr Michael Bell joined ICIT in December 2008 as a post-doctoral research associate on the SRDG programme. He was previously a shellfish scientist with the Centre for Environment, Fisheries & Aquaculture Science in Lowestoft, before leaving to work as a freelance fisheries research consultant based in Lowestoft and then Orkney. His research interests centre around science in support of sustainable exploitation of fish and shellfish stocks, the focus of which will be brought to bear in examining the ecological consequences of marine renewable energy developments.

Dr Eric Grist has recently been appointed to a postdoctoral researcher post at ERI. He was previously a Senior Research Scientist at the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Division of Marine and Atmospheric Research, Hobart, Tasmania, Australia. His research experience has focused on developing models which utilise a variety of mathematical and statistical approaches to understand key ecological-environmental coupled mechanisms. These include models to describe community responses to pollutants, safe threshold estimation using species sensitivity distributions and risk models to describe the transmission of pathogens through environmental pathways.