SUMMARY of Workshop: Tidal Energy and the Marine Environment
Hosted by University of Aberdeen and Robert Gordon University
Thursday 8ᵗʰ March, 2007, Aberdeen University

Purpose : To provide an opportunity for knowledge dialogue concerning the development of tidal energy and the understanding of the interaction of devices with the marine environment and to identify the current knowledge gaps and the challenges in filling those gaps. This interaction took place between engineers, developers, modellers, regulators and ecologists. To this end the consensus was that the meeting was very successful, with a greater awareness between disciplines and that more of this type of cross discipline interaction needs to occur.

Summary
Development and regulatory process

At the spatial and temporal scales at which tidal energy will be extracted there is a general lack of knowledge of both the possible physical and biological effects due to the placement of devices. Over the last few years, the collective group within the SuperGen project has gone some way to producing mathematical models, tank models and supporting work on full scale devices like the SNAIL which can be deployed as collectors of both biological and physical information in the areas of high speed tidal currents. The detailed hydrological models are revealing that the scale or dimensions at which we view the physical process can give very different answers but that physical effects can be felt at least 7 km from the location of deployment.

Developers are acutely aware of the current level of uncertainty and that the best practice is to review the entire 'life cycle' of a development. This requires a much greater level of certainty than we currently have as well as much better coverage of basic baseline data. There is general concern that the current practice in the production of Scoping documents, which are not encompassing, relies too much on desktop studies such that the unknowns remain unknown.

There are environmental guidelines from current European Directives (Birds and Habitat) and UK DTI deployment policies. However, due to the lack of uncertainty concerning the possible environmental effects of tidal development, the statutory advisory bodies stress that this has to be an adaptive/learning process, with a flexible approach which changes with gains in knowledge (as envisaged by regulatory guidance issued by the DTI). This requires a high level of interaction and knowledge dialogue between all interested parties taking into consideration changes to the current regulatory processes. The transposition of the Water Framework Directive into transitional and coastal waters for engineering works not regulated by the Water Environment (Controlled Activities) (Scotland) Regulations 2005, and the introduction of the Marine Bill may coincide with the expansion of prototype energy deployments within and outside designated test facilities.

The DTI Research Advisory Group (RAG) provides the knowledge transfer between statutory groups, government, developers and consultants. DTI and Cowrie have provided the funding and tender opportunities for the vast majority of research projects in the marine renewables arena. However the system needs to be more flexible and inclusive to new concerns, understandings and data gathering techniques. At present there is an under representation of academic input to the various advisory groups.

Current data collection and analysis

It was clear from this exchange of current knowledge that so much less is known about the ecology and exact physics of the marine environment than the equivalent area of study for terrestrial regions where wind renewables have been sited. Ecological effects of tidal mixing on ecosystems are both direct, influencing the ability of animals to catch their prey and indirect, determining the level of primary production which ultimately determines the fate of food availability up the entire trophic chain in marine ecosystems.

At present MCT and EMEC are at the forefront of the novel collection of physical, biological and behavioural data at appropriate biological spatial and temporal scales in the locations of actual tidal device deployment in the UK. The ecological research is coordinated by SMRU (and SMRU Ltd.), and focuses on the visible behaviours of marine mammals and seabirds. The MCT study also covers research on the before and after aspects of tidal deployments on benthos and sediment but there is a gap in the

study of fish and plankton. SMRU is moving towards the establishment of a generic marine mammal monitoring methodology and is putting the data into a risk framework such that levels of probability of specific events/longer term changes can be quantified. They also are investigating the set up of a data gateway.

Desk-top studies by SAMS and CEH have highlighted the large gaps in knowledge of direct and indirect effects of tidal schemes on marine mammals, fish and birds. However models that draw on work from other studies (e.g. boat / propeller strikes on marine mammals, fish behaviour in relation to fishing nets, behavioural strategies, range shifts, population dynamics) increases our understanding of the risks proposed by tidal devices.

Studies at U of Aberdeen are indicating that the amount and location of primary production may play a more important role in determining when and where seabirds and marine mammals spend their time foraging than has previously been thought. These 'hotspots' are very limited in space, but all evidence points towards them being driven mainly by small differences in the amount of tidal mixing and potentially being affected by changes in tidal energy extraction.

As tidal energy extraction development comes closer to a reality more will be demanded to be known about both the direct and indirect ecological effects of the placement of tidal devices and the need for long-term, continuous tidal stream datasets that encompass a range of seasonal and spatial influences. How we get to the point of being able to deliver such needs depends on filling the following gaps and challenges.

Gaps and challenges to fill

Gaps in knowledge dialogue
There is a strong case to be made for more academic (ecological and engineering) input into the established network of statutory government groups, developers and consultants. *How to achieve this –* apply for funding for a working group to develop the following research areas set out below.

Gaps in marine ecology
Ecologists need to investigate the basic behavioural / food web /ecological interactions that are key for a wide range of animals and plant species in areas of high tidal flows. *How to achieve this -* there is good possibility of a Consortium NERC grant application.

Gaps in monitoring techniques/ data analysis
Engineers, ecologist and regulatory bodies need to work together and decide what exactly needs to be monitored/surveyed, and how best/efficiently that can be done: *How to achieve this –* a series of small targeted projects and a greater usage of existing data already being collected by MCT and EMEC. Not all variables can be satisfactorily and cost-effectively measured with existing protocols. What locations will the DAQ kit operate from; seabed, water column, surface, aircraft and satellite all offer different aspects. Possible funding routes can include the DTI, EU, EPSRC and NERC projects with joint Post-doctoral positions and PhD studentships.

Gaps in site specific developments
Developers, engineers, ecologists and regulatory bodies should help each other in choosing appropriate sites for the collection of baseline data and dealing with funding issues for supporting the necessary research: *How to achieve this -* possible funding for larger scale projects from DTI / Cowrie and energy companies. Careful and well resourced application of marine spatial planning (through the marine bill) and Strategic Environmental Assessment (as required by legislation).

List of attendance

Ainsworth, David	MCT
Burnett, Robin	SSE Ltd.
Boyd, Ian	SMRU
Daunt, Frances	CEH
Goucher, Tim	SSE Ltd.
Hartley, John	DTI representative
Hayes, Peter	FRS
Mitchell, Paul	University of Aberdeen
Norris, Jenny	EMEC
Owen, Alan	RGU
Prior, Andrew	JNCC
Ruscoe, John	HW ICIT
Scott, Beth	University of Aberdeen
Thompson, Paul	University of Aberdeen
Wilson, Ben	SAMS

Not present – but involved

Couch, Scott	University of Edinburgh
Crutchfield, Zöe	JNCC
Gibberd, George	Tidal Generation
Heath, Malcolm	E.ON
Meade, Simon	Lunar Energy
Priestley, Ruth	SNH
Side, Jon	HW ICIT
Wratten, Angela	DTI