European Marine Energy Centre: the development of a targeted environmental monitoring strategy and the streamlining of marine renewables consents in Scotland

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Abstract

As the first facility of its kind anywhere in the world, EMEC provides wave and tidal developers with open-sea grid-connected testing facilities for single devices and small arrays. In addition to its technical and operational services, EMEC also provides in-depth assistance with all matters relating to the consenting of devices, which includes regular close liaison with regulators and stakeholders.

For devices being tested for the first time in the open sea, interactions with wildlife and other sea users need to be well understood. Primarily an operational test facility, there is also a key role for EMEC to play in establishing and facilitating monitoring of devices regarding their potential impacts on the receiving environment and other sea users.

This paper presents an update on the environmental monitoring work underway at EMEC, together with work being undertaken by EMEC in the development of a Monitoring Strategy, which may be used as a basis for consistent monitoring by developers of individual units and small arrays of devices on test at the wave and tidal sites.

The paper also presents EMEC's work to streamline the consents process for the marine renewables industry in Scotland (under contract from Marine Scotland).

Keywords: Environmental impacts of wave and tidal energy devices, Marine energy environmental impacts, Marine energy environmental monitoring strategy.

Acronyms

DECC: UK Department of Energy and Climate Change
EMEC: European Marine Energy Centre
ETI: Energy Technologies Institute
HIE: Highlands & Islands Enterprise
MAG: Monitoring Advisory Group
RAG: Research Advisory Group
ROV: Remote Operated Vehicle (underwater video camera)
SAMS: Scottish Association for Marine Science
SMRU: Sea Mammal Research Unit
SNH: Scottish Natural Heritage
UKERC: United Kingdom Energy Research Centre
Prioritisation levels: H High M Medium L Low

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1 Introduction

The European Marine Energy Centre (EMEC) has been established in the UK as a test facility for wave and tidal devices. The centre provides developers of wave and tidal energy conversion devices with open-sea cable-connected testing facilities which feed into the UK grid. The wave site, off Billia Croo bay on the west coast of Mainland Orkney, has been operational since 2003, and the tidal site at the Fall of Warness, Eday (one of Orkney's North Isles) opened in 2006.

EMEC offers the test facility to a range of developers, for testing single devices and small arrays [1]. It provides developers with detailed site information, in terms of the resource available, the environmental characteristics, and meteorological data. There is a range of additional support, including assistance with legislation and consenting issues as well as technical and operational matters [1, 2].

Developers who have tested their devices at EMEC's facilities include AW Energy, Pelamis and OpenHydro, with Aquamarine Power Ltd's Oyster (wave), and TGL's tidal turbine, being installed in summer 2009. At the time of preparation all berths have been allocated and deployments planned for summer 2009 onwards.

2 Environmental Sensitivities and Monitoring underway

The potential for negative (or positive) interactions between elements of the receiving environment and marine energy devices is as yet unknown and in need of study. Being a test demonstration site it is recognised that priority should be given to studying the elements that might be affected at these sites, rather than the full range of possible impacts that may be associated with the marine energy industries.

To date the onus has been on the establishment of appropriate methodologies and the collection of

baseline datasets to inform on these areas of sensitivity. At the time of writing, EMEC is seeing the installation and initial testing of devices at both sites. Once devices are in place and generating long-term, then monitoring of devices will be put in place, with EMEC, regulators, expert advisors and developers involved in all monitoring activities.

EMEC Monitoring Advisory Group (MAG) and Research Advisory Group (RAG).

The outputs from EMEC monitoring projects – at the tidal site, the wave site and future projects awaiting funding – are discussed in detail at the EMEC Monitoring Advisory Group, and are summarised at the EMEC Research Advisory Group meetings.

All discussions at the MAG bear in mind the specific environmental sensitivities found at the EMEC test sites, and discussions cover both general issues (related to baseline data gathering and generic device-related issues) and specific (related to particular devices). The MAG, chaired by EMEC, is also an appropriate vehicle for discussion between regulators and developers regarding any specific monitoring requirements that may be associated with consenting, or for advice on device-specific monitoring.

The environmental monitoring that has been put in place at EMEC is therefore aimed specifically at addressing the sensitivities found in the receiving environments at its test sites. The remainder of section 2 describes these sensitivities, together with the monitoring projects that have been established to provide relevant related data. Section 3 discusses some additional monitoring projects for which additional funding is being sought.

2.1 Tidal site environmental sensitivities

The key issues to consider for all marine mammals and diving birds relate to concerns over the potential for damage to wildlife that may occur as a direct or indirect result of collision between the animal and moving underwater device parts. There are also concerns about the potential for disturbance or harm to marine wildlife species that may be caused by water-borne noise associated with construction, operation, and decommissioning processes, or disturbance that may lead to species being deterred or displaced from their habitual breeding and/or feeding grounds [3], [8].

Orkney is recognized as an important area for a number of marine species, with various conservation and protected sites in the areas surrounding the tidal test site. Full details of all sites are available from the EIA for the tidal site, available online from EMEC [3]. The main species in question are summarised below.

Common Seals

Common seals pup in early June and July, and this is followed by a moulting period in late July and early August. The closest haulout sites are at Seal Skerry and The Graand (on the coast of Eday) and on Muckle Holm and Little Green Holm, which lie on the western edge of the tidal test site. There is also a European protected population on the nearby island of Sanday.

Grey Seals

The grey seal breeding season is from early October to late November. The moulting period follows in January to March (females), and March to May (males). Grey seal breeding colonies are located adjacent to the tidal test site on Muckle and Little Green Holms, with a European Protected SAC some 8km to the north on the islands of Faray and Holm of Faray.

Harbour Porpoise

Although there are no resident populations of Harbour Porpoise, the wildlife observations project has shown a moderate number of sightings in the months from July to September. This species has European Protected Species status.

Cetaceans

Minke whale, Risso, Orca and White-beaked dolphins have been recorded in the Fall of Warness during the summer months. They carry a high European Protective Species status, but are present in extremely low numbers with a sporadic occurrence.

Diving Birds

Bird species are present all year round and of note there is a cormorant breeding colony on Little Green Holm (April-June) adjacent to the test site. The potential for birds to collide with moving underwater turbines is a key unknown, yet methods to monitor for any such effects remain elusive.

2.2 Tidal site projects underway

a) Wildlife Displacement –Observations Programme

The wildlife monitoring project [4] records the abundance, detailed distribution and behaviour of marine wildlife in and around the test site, as visible from the sea surface. It aims to detect change or displacement that is detectable at the surface, which may be attributable to the presence and operation of marine energy devices.

The project involves an observer located on a hillside overlooking the test site, with a good view across the whole site. The area is conceptually divided into a matrix, with grid ‘cells’ referenced according to a simple alpha-numeric system.

The observer uses binoculars and a telescope to scan the area according to a pre-defined pattern, for 20 hours a week. All observations of wildlife are recorded to species level where possible, including behaviour, and referenced to a specific grid cell or range of cells.

In addition to wildlife data, a range of meteorological data needs to be recorded. This is used

to inform on the accuracy accorded to observations collected under different environmental conditions. The keeping of accurate records on meteorological conditions (wind speed and direction, precipitation, visibility) as well as tidal state, time of day, any other activities in the area, etc, is a key factor in the success of the study, since visibility of wildlife on and around the sea surface is significantly affected by the prevailing wind direction and strength, any precipitation, tidal conditions, light conditions, etc. In fact, where wind strength exceeds 4 on the Beaufort Scale, observations are not collected, since the white-capping of the sea surface renders observations so unclear as to be of relatively little use.

Data is analysed (by SMRU Ltd) annually using general additive models. As data accumulate, the analysis seeks to detect any specific patterns of distribution around the site, which can be used in future comparison with data acquired as devices are deployed. If any changes in abundance, distribution or behaviour are detected in future, then the presence of devices in the water will be one of a number of possible causal factors, to be assessed together with any other changes at the site.

The project was funded by HIE in 2005, for the commissioning of SMRU Ltd to develop the methodology; for the collection of the first year's data; and for the associated data analysis and annual report (also by SMRU Ltd). Funding since July 2006 has been provided by EMEC, with contributions from SNH, although these funding streams are not sustainable.

b) Sub-Surface Interactions – Active Sonar System

Whilst the presence and behaviour of marine wildlife at the sea surface can be relatively accurately recorded and analysed, the acquisition of similar data from under the surface, within the water column, is notoriously difficult. Such data represent the majority of wildlife presence in the sea, yet methods for assessment and identification remain elusive or technically difficult / unreliable.

There are various ways in which acoustic data can be *passively* acquired, i.e., by recording the sound emissions of different species and identifying against a database of known acoustic properties of the sounds emitted by different species. However, acquiring visual images from underwater can be difficult, since underwater cameras are prone to fouling of lenses, and require an artificial light source to sample in deep water or during hours of darkness. Any artificial light source has the potential to disrupt natural behaviour, so rendering data thus acquired of limited use in the study of behaviour.

There have already been investigations into the potential for using *active* sonar scanners to provide underwater imagery. Such approaches are based on the shape and reflective properties of an object that has sound waves actively directed at it.

Initial studies around Marine Current Turbine's SeaGen device in 2006-7 indicated that this technology may have potential as a monitoring tool for investigating the underwater behaviour of a variety of marine wildlife species. However, the state of development of the sonar scanners tested was found to be very limiting in relation to the output that it could provide, giving limited information on the specific activities and behaviour of various key species underwater.

Several companies manufacture such sonar scanners, and the aim of this project, which sees EMEC and SMRU Ltd jointly funded by DECC RAG, is to encourage further refinements to existing sonar equipment, aiming to provide a monitoring tool specifically honed to the needs of the marine energy industry.

Together with the sonar developer/s and SMRU Ltd., EMEC is involved in testing the suitability and performance of the improved sonar equipment, and has the agreement of developers deployed at the tidal site for tests to be carried out in the vicinity of their devices. Testing will also be carried out on tidal devices deployed elsewhere in the UK (e.g, MCT's SeaGen device, deployed in Strangford Narrows).

c) Tidal Rapid Seabed Ecology – ROV analysis

This project initially utilises the large catalogue of existing EMEC ROV camera data, which has been collected for various purposes, to provide information on seabed ecology at the tidal site. It is expected that the project will output recommendations for future specific ecological data surveys by ROV in this high-energy environment. Funding for the project was agreed by DECC RAG in 2007.

d) Acoustic Characterisation and Monitoring

One of the concerns expressed by regulatory bodies and their advisors is the as-yet-unknown potential for acoustic output from marine energy devices in operation to have an effect on the behaviour, distribution or health of marine wildlife.

In 2006, funding from HIE enabled EMEC to commission SAMS to develop and test a methodology for the acoustic characterisation of the tidal site [5]. This included the collection of some baseline data, which will form the basis of long term monitoring once devices are deployed and operating.

The methodology developed by SAMS under this commission, known as the Drifting Ears, is specifically aimed at acoustic data collection from the high energy environment that is characteristic of a tidal site. Specifically, it avoids the problem of frictional noise associated with suspending a hydrophone from a static vessel or other static object.

The methodology involves the deployment of wide-meshwork drogues, in each of which a hydrophone is suspended. Each drogue has a tag-along pod associated with it, which contains the recording equipment and a GPS unit for tracking the precise course for which data has been collected.

The method relies on the hydrophones and associated equipment being deployed at the top of a

tidal stream to be surveyed, and allowed to drift with the tidal stream, then being collected at the bottom of the survey area.

EMEC has funding agreed that will enable further baseline data to be collected, over a range of tidal and meteorological conditions. This will allow a more comprehensive baseline dataset to be collected, which will be available to developers deploying at the EMEC tidal test site.

The equipment and methodology will also be available initially for developers deploying at EMEC to use. It is EMEC's intention to make available this methodology for application and wider use by the industry as appropriate.

2.3 Wave site environmental sensitivities

There are fewer sensitive species at the EMEC wave site compared to the tidal site [6]. However, within the context of population decline of some species, it is important to monitor for the presence and behaviour of key species.

Marine Mammals

Particular attention needs to be given to all marine mammals, particularly the common seal, which has suffered a severe decline in Orkney since 2008.

Diving Birds

Although there are fewer concerns about the potential from harmful effects of wave energy devices, attention needs to be paid to diving bird behaviour in the vicinity of all moving underwater structures.

2.4 Wave site projects underway

The most recent monitoring programmes established at EMEC are the wildlife observations projects – by direct human observer, and by high resolution camera – at the wave test site.

a) Wildlife Displacement –Observations Programme

This observations programme [7] sees a human observer recording observations data from a high vantage point on a hillside overlooking the wave site. Section 2.2 describes its sister programme, established in 2005 at the tidal test site at the Fall of Warness. The rationale for the two programmes is common to both, but the methodologies used to collect observations over the water surface differ significantly. The protocol developed (by SMRU Ltd) for the tidal site was specific for the conditions at the tidal site, based on the presence of a well-defined channel between two land masses. This makes it possible to assign clear boundaries to the survey area, over a known distance, which allows an observer to assign data to the grid matrix with a high degree of accuracy.

In contrast, the requirements for data collection at an open-sea site typical of a wave energy device deployment site, are very different, with no clearly defined finite limit to the extent of sea area that needs to be surveyed.

The methodology used to scan the area of open sea in the vicinity of the wave test site again relies on an observer located on a hillside above the site [3]. In the case of EMEC's Billia Croo wave site, the observer is based inside an old coastguard lookout hut, which EMEC leases from a local landowner. Observations are again for 20 hours a week, taken using a pair of 'big-eye' binoculars that are mounted on a tripod fixed within the lookout building.

The rationale and type of data gathered for the observations is the same as that for the tidal project: an observer records marine wildlife presence to species level where possible, along with information on behaviour, and location. Whereas in the tidal project, animal location is recorded by reference to grid cells on a conceptual matrix, for the open sea extending from the wave site, location is recorded by triangulation, using the angel of declination of the big-eyes and the horizontal angle as measured from a compass.

Scanning is carried out methodically across the survey area, which is a pre-defined hemisphere centering on the observer. Meteorological data are also recorded. Records are entered onto a database, with data subsequently being input directly into the analytical program.

At the time of writing, this method has been initiated and is under test.

The project has been funded by nPower (Juice) and SNH, until the end of 2009, after which additional funding will be required

b) Surface Interactions with Wave Devices – High Specification Camera Observations

This project aims to assess the adequacy of collecting surface wildlife observations data (abundance, distribution and behaviour) by high resolution camera, and to explore the possibility of using a camera for data collection, rather than a human observer on the hillside overlooking a deployment site.

The programme uses a high resolution camera that has been installed onto the top of the old coastguard lookout hut overlooking the EMEC wave site. Data is transmitted live to the EMEC offices, where it is sampled and viewed by EMEC staff. Data is collected over a period that partly overlaps with the dataset collected under the human observation project. At the end of the data collection period, the two datasets will be subject to a comparative analysis, aiming to assess the degree of correlation between the two sets. If data collection by the camera compares favourably with human observer data, then the camera will be the principal method of data collection in future.

The results from the correlation of these two observation methodologies are likely to be applicable at other deployment sites, provided that power for the camera, and data transmission infrastructure can be provided, and that a suitably high vantage point overlooking the site is available.

The camera for this project was funded by nPower (Juice) with observations also part-funded by SNH, until November 2009.

3 Monitoring to be developed

There are still a few monitoring projects that EMEC wishes to put in place, for which additional funding is required and is being sought.

3.1 Underwater acoustic investigation in and around a wave energy device test area

One of the key concerns relating to the marine energy industries relates to the potential for acoustic output from wave and / or tidal energy devices to have a harmful effect on marine wildlife.

Section 2.2 described the 'Drifting Ears' project, which EMEC has had developed in order to characterise the acoustic properties of its tidal test site.

The key objectives of this proposed project are:

- To develop a methodology for accurately measuring and describing the acoustic characteristics of the Billia Croo wave test site (which experiences very different energy and flow characteristics to those prevailing at the tidal site).
- To provide an acoustic description of the EMEC wave test site in the absence of any wave devices, giving a 'baseline' dataset for future comparison once devices are deployed and operating, using the same methods and equipment.
- As appropriate, to make the method available to other wave energy device developers deploying at similar sites, for use in assessing the acoustic output from their devices. This will benefit the developing wave energy industry.

3.2 Monitoring of the fishery in a no-take zone established at the Billia Croo wave test site

Another key potentially problematic issue facing the marine energy industries relates to commercial fisheries, specifically in regard to areas of sea that may have been traditionally fished. Such areas may subsequently be allocated leases for device deployment. The potential unavailability of such areas for ongoing use for fishing may be the source of conflict between fishers and energy producers.

EMEC wishes to develop a monitoring project that will see it working with expert fisheries advisors and local fishers, to monitor the release of juvenile shellfish into a no-fished area. The project will involve establishing a no-take zone around the wave test site, releasing juveniles into the area, and monitoring the local effects. The project has the following objectives:

- To examine the effects of a no-take fishing zone established around a wave test site with operating wave energy devices, where juvenile shellfish stocks are introduced into the area.
- To raise awareness among Scottish fishermen's groups of the advantages of a no-take zone in regard to stock preservation, and of the knock-on (positive) effects on the surrounding stocks.

3.3 Funding at multi-developer sites

The issue of funding environmental monitoring at test sites is an important one that is not easily resolved. Where there are multiple developers at various different stages of development of their testing / deployment plans, it is no trivial matter to assess relative gains to be made from shared funding of such projects. If the financial burden is placed on initial/early developers, this may be viewed as overly onerous on them, with the potential to give benefits to competitors in the future.

To date, EMEC has approached a variety of sources for funding of early monitoring – much of which constitutes baseline monitoring in advance of device deployment.

4 Monitoring Strategy

EMEC and the marine energy developer community have been experiencing a growing need for guidance on monitoring requirements and methods, in relation to specific potential environmental impacts issues. In 2004, in recognition of this need, EMEC initiated a series of consultations with experts, aimed at gathering expert advice and ultimately leading to the development of an environmental impact monitoring strategy for developers using the EMEC test sites.

The first step in the development of this strategy was to gain agreement from a range of experts – each having knowledge of the issues relating to the potential environmental impacts of wave and tidal energy devices – regarding the issues on which EMEC should concentrate its efforts.

4.1 Background: EMEC Environmental Impacts Workshop, 2004.

In 2004 EMEC held a workshop to discuss the environmental impacts of wave and tidal energy devices, from the perspective of the test centre. The workshop was kindly hosted by UKERC at Edinburgh University, and attended by a range of UK regulators and academics. At this workshop EMEC presented its EIA Guidance for Developers [8], which was honed to the needs of developers deploying test devices at EMEC's facilities. The potential environmental impact issues relating to the wave and tidal energy industries were discussed specifically in relation to the environmental sensitivities pertaining to the EMEC test site locations.

The workshop unanimously agreed that EMEC should concentrate its efforts on initiating monitoring of those issues that relate to its sensitivities.

The second aim of the 2004 workshop was to gain agreement on which methods were best to use for those issues requiring monitoring at EMEC, and to identify

where the relevant expertise in these areas lay. This aim proved over-ambitious for the time, and was left unresolved, partly because, for some of the issues to be monitored, there were no accepted best available methods.

4.2 EMEC Regulatory Workshop on Environmental Impacts, September 2008.

This aim of the 2004 workshop was able to be further pursued when funding was made available in 2008 (although the funding stream was then cut short). This enabled EMEC to hold a meeting of the major UK regulators involved in decision-making from a licensing perspective. The workshop aimed specifically to gain consensus on the relative prioritisation of potential environmental impacts of the wave and tidal energy industries. It also aimed to take up the second aim from the 2004 workshop, i.e., the identification of the best or most appropriate methods to use for monitoring of those aspects for which monitoring was advised.

The Workshop discussion ranged widely over the potential marine issues arising from marine renewable energy developments. No significant attention was given to on-shore issues, such as the need for associated shore bases, works required for connection to the gird, etc. Terrestrial interactions were largely outside the scope of the workshop, as in most cases the issues that are likely to arise are not unique to renewable energy developments, and are addressed through existing consents (e.g., Planning).

Workshop Outputs

The 2008 workshop fulfilled its aims well in respect of gaining agreement from all regulators and experts present, on the relative prioritisation that should be accorded to the possible environmental impact issues of marine energy devices, with a consensus being reached around the table. The aim of identifying the *best* methods to use for monitoring was fulfilled in part, with the meeting using participants' expertise to list relevant methods that are being developed or are in use.

The discussion did not extend to the production of a specific advisory list of methods that *should* be adopted for monitoring for specific issues: this will be site-specific and may be device-specific. However, this work is being developed further by SNH in conjunction with the Scottish Government's Marine Energy Spatial Planning Group (Research Subgroup). EMEC is an active participant on each of these groups, and can ensure that relevant findings are transmitted (both ways) between developers and government.

Relative Prioritisation of the Need for Methodologies to Investigate the Main Environmental Impact Issues –consensus reached

Table 1 shows the issues on which the meeting centred. The potential receptors are shown in bold type, and the nature of the potential impact is shown in normal type, within each receptor section of the table. Note that the Priority Level refers to the priority level for the production of methodologies.

Interactions: Receptor of interaction in bold type; Nature of interaction in normal type	Priority Level
Wildlife, particularly marine mammals & birds. Including other species e.g. basking sharks	
Collision with devices, especially tidal turbines	H
Alteration to wildlife behaviour, e.g., reduction in access to feeding areas (mammals and birds), avoidance arising from "barrier effects" of arrays of devices in restricted waters.	H
Entanglement of wildlife in moorings	L
Damage to hearing (mammals and fish) primarily from survey (e.g. seismics) activities, and construction work (pile driving)	L
Underwater noise - construction	L
Underwater noise - operation	M
Seabed, habitats and species	
Physical disturbance of the seabed	M
Alteration to sediment movements	L
Alterations to benthic faunal communities through changes in flow or wave exposure	M
Vibration	L
Navigation	
Surface vessels, merchant shipping, fishing vessels, naval vessels	H
Submarine navigation	H
Commercial fisheries	
Limitation of access of fishers to actual or potential fishing grounds	H
Impacts on fish spawning grounds	L
Direct impacts of devices on fish	L
Marine productivity	
Alteration of primary production in development areas	L
Aesthetic impact	
Visual impact of objects on the sea surface	M
Impact on marine (underwater) landscape	M
Miscellaneous (wide range of interactions seen in other industries)	
Leaching of antifoulants from devices	L
Chemical and oil spill risks	L
Redistribution of contaminants, primarily contaminated sediment	L
Changes in turbidity	L
Debris loss	L
Impacts on marine archaeology	L
Recreational users	L/M

Table 1: Prioritisation of the need for methodologies to investigate the main environmental impact issues relating to wave and tidal energy industries

The prioritisations of the need for these methodologies are expressed as High, Medium or Low. These relative prioritisation bands relate to the urgency with which the different issues need to be further developed. The prioritisation of an issue reflects the need for monitoring methods pertaining to that issue to be developed. Thus, where there are well-accepted methods for monitoring for an issue, the relative prioritisation accorded to it will be low. This does not mean that the issue itself is deemed to be of low importance, but rather it is a reflection of the fact that there are already adequate methods for data collection in place elsewhere for monitoring for its potential effects.

Thus, it is those issues which have been accorded a High relative priorisation, that the industries need to concentrate on in terms of data collection and protocol development for monitoring.

Interactions: Receptor of interaction (bold type) Nature of interaction (normal type)	Monitoring by:
Wildlife, particularly marine mammals & birds. Including other species e.g. basking sharks	
Collision with devices, especially tidal turbines	Active sonar (see 2.2 b)
Alteration to wildlife behaviour, e.g., reduction in access to feeding areas (mammals and birds), avoidance arising from "barrier effects" of arrays of devices in restricted waters.	Wildlife and camera observations (see 2.2 a; 4.2 a & b)
Underwater noise - operation	Acoustic monitoring (see 2.2d & 3.1)
Seabed, habitats and species	
Physical disturbance of the seabed	ROV (see 2.2 c)
Alterations to benthic faunal communities through changes in flow or wave exposure	ROV (see 2.2 c)
Navigation	
Surface vessels, merchant shipping, fishing vessels, naval vessels	Ongoing consultation. Detailed study requires funding.
Submarine navigation	None planned
Commercial fisheries	
Limitation of access of fishers to actual or potential fishing grounds	Fisheries Monitoring. (see 3.2)
Aesthetic impact	
Visual impact of objects on the sea surface	Ongoing local consultation
Impact on marine (underwater) landscape	Detailed study requires funding

Table 2: EMEC proposed environmental monitoring strategy showing issues and monitoring projects for data collection

In producing this strategy, EMEC aims to encourage the monitoring of different devices in a consistent way, using the best available methods. This enriches its service to the developing marine energy industries by seeking to gain clarification on the extent of the many unknown issues that need to be addressed in advance of commercial-scale development.

Table 2 shows those issues identified in Table 1 as having Medium or High priority, together with the monitoring project at EMEC which best addresses the need to provide information for that issue.

As with Table 1, potential receptors are shown in bold, and the nature of the potential impact is shown in normal type, within each receptor section of the table.

At the time of writing, the strategy is still under development.

4.4 From Consensus to Strategy

The EMEC monitoring strategy has evolved from discussions with regulators and their key advisors across the UK. It takes into consideration consensus views on the relative prioritisation of key potential impacts from a generic point of view, together with the specific sensitivities which relate to the EMEC test sites themselves.

It is important to keep information on the status of any sensitivity updated, particularly in the context of a long-term test site which will see a variety of devices deployed over its lifespan. EMEC uses the wildlife observations data it collects to update its records, and updated data is fully considered in the development and ongoing assessment of the monitoring strategy.

4.5 Use of Methodologies

EMEC is committed to the collection and analysis of marine monitoring data using robust methodologies for data collection, which are appropriate both to the reasons for the data requirement, and to the site location. This commitment is shared by regulators and expert advisors to the regulatory process. All parties are in agreement that in order for meaningful outputs to emerge from data collection programmes, the methodologies used need to be aligned to appropriate and meaningful analysis techniques.

With the development of protocols by various parties for use by the marine energy industry, one of the challenges will be ensuring the consistency of use of freely available methodologies. Of key importance will be ensuring that amendments to standard methodologies are carried out in a manner which does not compromise the quality of datasets collected, nor their appropriateness for their associated analytical frameworks. Analytical methodologies will also be of key importance to the comparability of the findings of data collection programmes from different locations.

Through its involvement in the development of Standards for the marine energy industry [9], and its involvement in Equimar [10], whose aim it to deliver a suite of protocols for the equitable evaluation of marine

energy converters, EMEC is keen, and well-placed, to provide relevant input to these and other projects as appropriate, with the aim of ensuring wide dissemination and consistent usage of best available methodologies and practices.

5 Streamlining of Consents

EMEC has gained extensive experience of liaison with regulators, expert advisors and device developers over a wide range of issues relating to the consenting of marine energy devices, and the consenting process itself.

This hands-on experience has made EMEC well-placed to take on work recently for the Scottish Government, aiming to streamline the consents process for the marine energy industries.

This work is undertaken under contract from Marine Scotland, as part of a wider project to produce a guideline document for developers wishing to deploy marine energy devices within the UK regulatory system. The work also involves the preparation of specific guidance on EIA and Appropriate Assessment (this strand is being led by XodusAURORA – an environmental consultancy based in Stromess, Orkney).

This joint project will see the development of a guidance document which will serve all concerned with the marine energy industries and their licensing. It aims at simplification, clarification, and providing essential information to regulators and developers alike, and is likely to further develop in line with increasing knowledge about the unknowns associated with these industries.

6 Other work on environmental impacts

A range of other projects related to the issues involved in clarification of the environmental impacts of wave and tidal energy devices have been initiated by the Scottish Government and these are, at the time of writing, under development

There has also been recent action taken elsewhere in the UK and wider afield, looking to fill the remaining knowledge gaps in this key area. Of note, within the UK, are recent workshops initiated by NERC and UKERC, to which EMEC has contributed input. There is also support from the ETI for research into this area, with projects agreed for funding that involve EMEC. At the time of writing further detail of the ETI research in embargoed, but it is hoped that detail will be able to be reported by the time of the conference.

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