Llywodraeth Cynulliad Cymru
Welsh Assembly Government

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Marine Renewable Energy Strategic Framework

Stage 3 - Stakeholder Participation Process

Report by RPS to the Welsh Assembly Government

December 2010

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Appendices

1 Introduction

1.1 Overview

This document has been compiled to facilitate stakeholder participation on the 'Marine Renewable Energy Strategic Framework' (MRESF) for Wales; a three stage project currently being undertaken by RPS within Welsh territorial waters on behalf of the Welsh Assembly Government. The MRESF is aimed at exploring and enabling the potential for renewable energy extraction from Welsh waters, with the intention being to minimise impacts on environmental resources and socio-economic activities, while maximising the potential for sustainable energy production to be gained from Welsh waters. The MRESF project forms part of the Welsh Assembly Government's commitment to promoting economic development of Welsh waters in a truly sustainable manner, and through such, achieving Wales' ambitions for low carbon energy generation and the significant contribution marine energy can make to meeting carbon dioxide and other greenhouse gas emission reduction targets.

To address climate change, the UK Government and the international community have set a number of targets, with the goal of reducing emissions by at least 80% by 2050. In order to meet these targets, the Welsh Assembly Government has committed from 2011 onwards to achieve a 3% annual reduction in Wales's greenhouse gas emissions in areas in which the Assembly has devolved competencies[1]. The Assembly recognises that in order to meet obligations and commitments to reduce carbon emissions and meet renewable-sourced energy targets, it is insufficient to rely on the current portfolio of technology types to deliver, and that marine-sourced energy will be a critical component in the energy portfolio of Wales and the UK. Wales is in an excellent position in terms of available marine resource and has a significant contribution to make in meeting UK targets.

The overall aspirations the Welsh Assembly Government has set for renewable energy generation in Wales were outlined in the Wales Renewable Energy Route Map[1] and

1 Renewable Energy Route Map for Wales – Consultation on a way forward to a leaner, greener and cleaner Wales. February 2008.

subsequent documents[2&3]. Specifically for the marine environment (offshore wind, wave and tidal), these energy aspirations are summarised below:

Technology	Total Capacity (GW)	Load Factor (%)	Annual Energy Output (TWhr)	Deliverable in main by
Offshore wind	6	40	21 (Of which 20% is shared with England)	2015/16
Tidal range	8.5	25	18 (Of which 50% is shared with England)	2022
Tidal stream/ Wave	4	25	9	2025

The MRESF project was commissioned to investigate offshore wind, wave and tidal stream[4] energy, together with the potential for carbon capture and storage (CCS), within Welsh territorial waters[5]. The overall aim of the project is to develop a framework for enabling the achievement of carbon dioxide emission (and other GHG) reduction targets through sustainable development of marine energy projects within Welsh waters.

The MRESF work programme is divided into three stages. Stages 1 and 2 have been undertaken over the past 2 years, with the project outputs from these precursor steps laying the foundation for Stage 3. Stage 3 will now progress through 2010 to develop and deliver the overarching Framework. The focus of this stakeholder participation is the proposed methodology for developing the Framework, with the aim of this document being to support and inform the process.

2 A Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement. March 2010.

3 Ministerial Policy Statement on Marine Energy in Wales. July 2009.

4 It should be noted that tidal range technologies, i.e. lagoons and barrages, are outside the remit of the MRESF project and are thus not considered in any of the data collection or assessment work comprising this initiative. The tidal range resource with the Severn Estuary is subject to a Strategic Environmental Assessment being led by DECC and the Assembly continue to support the undertaking of this study.

5 Territorial waters, as defined by the 1982 United Nations Convention on the Law of the Sea (UNCLOS), extend 12 nautical miles (22km) from baseline (usually the mean low-water mark) of a coastal state unless this area overlaps with another state's territorial sea, in which case the border is taken as the median point between the states' baselines.

Although the project is being undertaken directly for the Welsh Assembly Government, the outputs have been and will continue to be reported to a Steering Group, comprised of the following:

- The Welsh Assembly Government;
- Defence Estates – Ministry of Defence;
- The Crown Estate;
- Countryside Council for Wales;
- Department of Energy and Climate Change (formerly the Department for Business Enterprise and Regulatory Reform); and
- Marine and Fisheries Agency.

1.2 Project Aims and Objectives

As noted in Section 1.1 above, the current stakeholder participation forms a key part of Stage 3 of the MRESF project, providing an opportunity to comment on and provide input to the proposed methodology for the development of the MRESF Framework.

This stakeholder participation document is structured in the following sections:

Section 1 Introduction

Section 2 Background to the MRESF Project

Section 3 The Stakeholder Participation Process and How to be Involved

Section 4 Stakeholder Participation

Section 5 Stakeholder Participation Questionnaire

Section 6 What Happens Next?

1.3 Stakeholder Participation Questions

The stakeholder participation questions are provided in Section 4 with accompanying text, to enable the reader to link the question to the appropriate information, with all questions collated and reproduced in Section 5. The Questionnaire produced in full in Section 5 is also available as a separate document for ease of completion, and is appended to the stakeholder participation pack. Additional copies are available at http://mresf.rpsgroup.com.

2 Background to the MRESF Project

2.1 Stage 1

Stage 1 of the Wales Marine Renewable Energy Strategic Framework (MRESF) project was undertaken primarily during 2008, and was targeted at broad scale mapping of the marine environment in Welsh waters in GIS (covering environmental, social and economic interests), collating a comprehensive understanding the current status of the wind, wave, tidal stream and carbon capture storage industries and reviewing existing knowledge of the potential impacts associated with such developments. Data gaps in the available information were assessed as a critical component of this phase of the work.

Stakeholder participation was undertaken during Stage 1 to ensure inclusion of appropriate and relevant information, identify the issues and concerns of stakeholders and to raise awareness of the project. Although the stakeholder participation was not public, it did involve contact with some 105 organisations, 79 of which provided a response (involving 132 individuals). The stakeholder list was drawn up in collaboration with the Steering Group (including additions where these were identified during the stakeholder participation process/literature search), with input sought from developers and key stakeholders including regulators, other maritime industries, coastal authorities and those undertaking research. The engagement of stakeholders and industry is seen as key to the success of the project, since the Framework will be an important decision support and governance tool for the Welsh Assembly with respect to maritime development and activities in Welsh waters.

Following the extensive literature review, Stage 1 assessed the available information to highlight potential limitations to development in Welsh waters. Such limitations included the following:

- Practical limitations (e.g. financing, sourcing of materials, grid connection);
- Site specific issues (e.g. resource availability, water depth, distance from shore);
- Support (ranging from local interest to government level and including issues such as financing, research);
- Legislative considerations (e.g. SEA, sustainability, consenting and nature conservation legislation);

- Existing use (i.e. existing human use such as shipping, fisheries and MOD); and
- Data requirements (e.g. quantity and quality of available data, ownership issues and cost of acquisition).

Preliminary constraint mapping in GIS was undertaken for data sets which included spatial extent information (primarily environmental, social and economic data), overlaid on areas documented as offering potentially exploitable wind, wave and tidal stream resource. The resource mapping data was based on National and UK sources, primarily data from the Renewables Atlas, www.renewables-atlas.info, with minor refinements for tidal areas based on established RPS models. The aim of such mapping was to identify which constraints are most relevant in Welsh waters and which coincide with areas of potential resource (and therefore development interest). The constraint mapping undertaken during Stage 1 was preliminary and high level, with the process to be explored in more detail during Stage 3 (see Section 4 for further details).

During the preliminary constraint mapping undertaken as part of Stage 1, each potential constraint was graded on a 1-5 scale by the RPS project team, in consultation with the Steering Group. The aim of grading the constraints is to enable, at a broadscale, an assessment to be made of the potential degree of constraint that each issue may represent for marine renewable developments. The process was undertaken for five broad groups of energy development types, namely wind, tidal stream A (surface piercing), tidal stream B (wholly submerged), wave A (surface piercing) and wave B (wholly submerged). The gradings were made on the following basis:

Grade	Description
No grade	Receptor distribution is presented for informative purposes only and no firm constraint value can be ascribed at the broadscale
1	No likely constraint
2	Constraint assessment/study required, but low likelihood of delay[6]
3	Constraint will require assessment and delay likely, but unlikely to stop development

6 The term 'delay' takes into consideration issues such as potential sensitivity/significance, together with issues such as a requirement for additional data.

Grade	Description
4	Significant issue/constraint – delay and could possibly stop the project
5	Likely to preclude development

It should be noted that where an issue was identified as a key constraint, this does not necessarily translate as a significant impact; in fact, many of the constraints identified related to a lack of data or understanding upon which to assess significance and it is the lack of such information itself that represents the 'constraint'. The process was valuable in the subsequent identification of a number of potential projects aimed at increasing the knowledge base and thus provides a better understanding of the potential constraint on development presented by each issue.

The identification and assessment of data gaps undertaken as part of Stage 1 was comprehensive and has not been repeated in full here. However, the Stage 1 work included a compiled list of data gaps and ongoing research connected to those gaps, which reflected the situation as it existed in 2008. The project team, in consultation with the Steering Group, then prioritised the data gaps, highlighting those issues that represent a greater degree of constraint on development in Welsh waters than others. It was from these prioritised data gaps that the projects taken forward in Stage 2 were drawn.

In addition to the MRESF project, a number of additional marine renewable energy projects are currently being funded and/or supported by the Welsh Assembly. It is anticipated that some of these may increase our understanding of the data gaps highlighted by the MRESF project. These include the following:

- Cardiff University project 'Integrated environmental and economical modelling of tidal renewable energy';
- Marine Energy Research Group;
- Cardiff University's SEREN project (http://grc.engineering.cf.ac.uk/news/article.php):
- Marine Energy Task Group for Wales (http://metgwales.org); and
- Low Carbon Research Institute (www.lcri.org.uk).

Carbon Capture and Storage

Research undertaken in Stage 1 highlighted the limitations in the baseline data available to assist in identifying potential sites for CCS in Welsh waters, with just three sites where further work may be beneficial noted within the 12nm limit. From the information presented in Stage 1, it appears that some areas may benefit from further investigation, however it is likely that extensive and detailed survey would be required with associated significant expenditure incurred to progress such potential further at this time. Although additional data may potentially be held by the oil and gas industry, it remains for such data to be identified and sourced, and again the release of such information, if such exists, would incur considerable cost. Given the data limitations and the extent of additional work required to increase the knowledge base, CCS has not been taken forward to Stage 3, beyond the provision of data collated in Stage 1.

Offshore Wind

On 10th December 2007, John Hutton, Secretary of State for Business Enterprise and Regulatory Reform (BERR), announced the commencement of a Strategic Environmental Assessment (SEA) to examine 25 gigawatts (GW) of additional UK offshore wind energy generation capacity by 2020. This followed the 8 GW planned for Rounds 1 and 2. On 4 June 2008, The Crown Estate (TCE) announced proposals for the third round of offshore wind farm leasing ('Round 3').

The environmental report for the Offshore Energy SEA (OESEA)[7] was published for consultation in January 2009, providing consideration of areas identified by TCE as offering 'indicative economic potential for offshore wind' as part of a UK wide assessment. Following the consultation period, the Government's decision on the SEA and TCE's Round 3 Zones was published on the 24th June 2009, which was to adopt a plan/programme for offshore energy, encompassing some 25GW of wind generation capacity and allowing TCE to continue with the competitive leasing round (Round 3). As part of this process, two potential zones were identified within or partially within Welsh waters by the TCE. These were the Irish Sea (which is partially within the 12nm limit for Welsh waters) and the Bristol Channel (which has some overlap with Welsh waters), with both areas subsequently taken forward for further consideration. Through the

7 UK Offshore Energy Strategic Environmental Assessment (UKOESEA). Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil & Gas and Gas Storage. Environmental Report. DECC January 2009. www.offshore-sea.org.uk/consultations/Offshore_Energy_SEA/OES_Environmental_Report.pdf

OESEA process, the environmental implications and spatial interactions of the draft plan were assessed, with a number of Round 3 areas taken forward by DECC[8], for leasing by the TCE[9]; albeit it with amended boundaries.

Consideration of marine renewable (wave and tidal) energy capacity will be included in the next OESEA which has recently been subject to a scoping exercise[10]. Further offshore wind capacity will not be considered as part of this exercise; the existing plan will be in place for a period of 5 years, and any revisions, including further potential offshore wind sites, will be considered as part of the update to that plan and the SEA process. Although offshore wind was included in Stage 1, it has not been considered further in the constraints mapping for Stage 3 (and consequently consideration of potential for sustainable development within Welsh waters) as the OESEA and the MRESF are unlikely to span a period in which additional offshore wind development, beyond Round 3 (and possible Round 1 and 2 extensions) would occur in Welsh waters (i.e. within 12nm). Thus, although there may be potential for future development of offshore wind within Welsh Waters, any such potential would be evaluated in the MRESF, in accordance with an updated OESEA or TCE leasing round. Offshore wind is therefore solely considered within the MRESF project in terms of information gathered in Stage 1, but constraints mapping to identify areas for sustainable development as part of Stage 3 will not include offshore wind.

2.2 Stage 2

Following on from Stage 1, the aim of Stage 2 was essentially to investigate a core number of the key constraints identified in more detail. The project Steering Group considered all the information provided in Stage 1 and, in collaboration with RPS, the following projects were formulated for progression through Stage 2[11]:

8 A Prevailing Wind – Advancing UK Offshore Wind Deployment. DECC June 2009. www.berr.gov.uk/files/file51989.pdf.

9 www.thecrownestate.co.uk/round3

10 UK Offshore Energy Strategic Environmental Assessment (UKOESEA2). Future Leasing/Licensing for Offshore Renewable Energy, Offshore Oil & Gas and Gas Storage and Associated Infrastructure. Scoping for Environment Report. DECC March 2010. www.offshore-sea.org.uk/downloads/OESEA2_Scoping_Document.pdf

11 It should be noted that the work undertaken in Stage 2 was not aimed at down grading the constraints, but instead was undertaken to increase the certainty in the constraint grade assigned. For example, if the constraint grade assigned was precautionary due to a lack of information, increasing the level of information enables the grading to be made on a more scientific basis, whether that is to increase, decrease or remain the same.

- Work Areas 1 and 2 – Distribution of marine mammals in Welsh waters and collision risk with marine renewable devices (with a focus on high tidal flow areas);
- Work Area 3 – Underwater marine renewable devices and assessment of risk to diving birds (with a focus on high tidal flow areas);
- Work Area 4 – Collision risk of fish with wave and tidal devices;
- Work Area 5 – Potential effects of wave and tidal devices on military interests; and
- Work Area 6 – Positive effects of marine renewables.

Of the above projects, work areas 4, 5 and 6 were wholly desk based, with primary fieldwork being undertaken to increase the knowledge base for in work areas 1, 2 and 3.

2.3 Stage 3

The purpose of Stage 3 is to bring together the findings from Stage 1 and 2 and use them as the foundation on which to build the MRESF Framework. The methodology for Stage 3 has been discussed between RPS, the Welsh Assembly Government and the Steering Group, with a plan for undertaking the work prepared. It is this plan for Stage 3 that is the subject of the current stakeholder participation. Information on how to be involved in the stakeholder participation process is provided in Section 3, with the planned Stage 3 methodology and stakeholder participation questions on this proposed methodology outlined in Section 4. The complete stakeholder participation questionnaire is also provided in Section 5.[12]

12 The questionnaire is also available as a separate document online at http://mresf.rpsgroup.com and in the consultation package. This should be completed and returned by email to mresf@rpsgroup.com or alternatively to the postal address provided on the website and given in Section 3.

3 The Stakeholder Participation Process and How to be Involved

Stakeholder participation was an important part of Stage 1, as it enabled numerous interested individuals and groups to raise issues of importance to them for inclusion in the project at an early stage. The information gained proved invaluable during Stage 1, particularly as part of the literature search and for understanding the current status of the industry, but also for identifying the key data gaps that were considered for inclusion into Stage 2.

This document has been developed to provide the opportunity for key individuals and organisations to comment on the proposed methodology for Stage 3. The stakeholder participation process is also intended to highlight where additional relevant research is planned, is in progress or has been completed since the finalisation of the literature review in Stage 1.

The outputs from Stage 3 will provide the Welsh Assembly Government with a strategic framework for the sustainable development of the marine renewable energy industries in Welsh waters, highlighting the potential energy generation capacity within Welsh waters which can be achieved whilst minimising associated effects on the existing environment (physical, biological and socio-economic). It will also highlight which geographic areas and potential constraints may benefit from further research and/or negotiation to increase the potential energy return or development opportunity. As such, it is important for interested parties to have a continued input to the process to help ensure the integrity and acceptability of the results.

It is intended that the Stage 3 stakeholder participation process will be extended to those individuals and organisations who were contacted during Stage 1 and Stage 2 of the project and any others identified during the stakeholder participation process for which the project is of relevance. The list includes individuals and organisations from a range of backgrounds, including the following:

- Developers;
- Academics;
- Research Groups;
- NGO's;
- Unitary Authorities; and

- Government Departments and Agencies.

The stakeholder participation process is being planned through two main routes. These are essentially via the stakeholder questionnaire, which is presented in Section 5, and also available at http://mresf.rpsgroup.com/, together with two workshops. The first workshop will be held at the Novotel in Cardiff on the 6th July 2010 and the second at SOAS in London on the 20th July 2010. Further details will be provided on the project website.

Completed questionnaires providing comment on the proposed methodology for Stage 3 can be sent to the following contact points:

MRESF Project Team
RPS Planning and Development
Conrad House
Beaufort Square
Chepstow
Monmouthshire
NP16 5EP
Tel: 01291 621821
Fax: 01291 627827
Email: mresf@rpsgroup.com

Website: http://mresf.rpsgroup.com/

Responses from representative groups should indicate the people and organisations they represent.

Responses may be made available for public inspection in the Welsh Assembly Government library. The Welsh Assembly Government will assume that you do not object to this openness unless notified otherwise. If you reply by email, any confidentiality clause automatically generated by your provider will not be taken into account unless you specifically request confidentiality. Stakeholder responses may also be included in a statistical summary and a summary of responses may subsequently be published on the Welsh Assembly Government's website.

This stakeholder participation process is being conducted in accordance with the Welsh Assembly Government's guidance on written consultations http://wales.gov.uk/consultations/aboutconsultation?lang=en).

4 Stakeholder Participation

This following section is intended to outline the key principles upon which the Stage 3 of the MRESF development project will be based, and which represents the primary focus of this stakeholder participation exercise. Briefly, this stage will be predominantly desk-based, being targeted towards the identification of the best potential areas for sustainable wave and tidal stream development in Welsh waters, based on the data sourced and generated during the two previous stages of the project, and the stakeholder participation process undertaken for Stage 3.

The development of the Framework will involve the assessment of various potential scenarios for marine renewable energy development in Welsh waters. It is intended to use the outputs from the scenario testing to assess areas for development potential, based on both the degree of constraint presented by existing interests but also on the available wave and tidal stream resource in the context of the renewable energy potential in Wales (as outlined in the Welsh Assembly Governments 'Energy Policy Statement', http://wales.gov.uk/docs/desh/policy/100315energystatementen.pdf). By investigating how the renewable energy potential within Wales' fits with the existing constraints, the Framework for marine renewable energy will be placed within a sustainable development context.

As a reflection of the geographic nature of both the potential resource and the potential constraints, much of the output from the constraints assessment aspects of Stage 3 will be presented in a GIS format and, to ensure transparency and auditability, the decision making pathway will be clearly defined and described. Both the mapped scenarios and the project reporting (including all reports from Stages 1, 2 and 3) will be available on a project specific 'MRESF' website.

4.1 Data Sources

An integral part of Stage 1 of the MRESF project was a literature review and data acquisition, describing and mapping in GIS the existing natural and human (social and economic) environmental baseline for Welsh waters out to 12nm, in order to facilitate the constraints mapping exercise. This included the wind, wave and tidal stream resource and potential sites for carbon capture storage (CCS). The metadata held by RPS for the MRESF project is provided in *Appendix A.*

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.01 In addition to the data listed in the Metadata sheets in *Appendix A*; which are grouped by topic, do you hold data of relevance to the MRESF project?

4.2 Potential Limitations on the Development of Marine Renewables

Following the extensive literature review, Stage 1 assessed the available information to highlight potential limitations on the development of marine renewables in Welsh waters. Such limitations included the following:

- Practical limitations (e.g. financing, sourcing of materials, grid connection etc);
- Site specific issues (e.g. resource availability, water depth, distance from shore etc);
- Support (ranging from local interest to government level and including issues such as financing, research etc);
- Legislative considerations (e.g. SEA, sustainability, consenting and nature conservation legislation);
- Existing use (i.e. existing human use such as shipping, fisheries and MOD); and
- Data requirements (e.g. quantity and quality of available data, ownership issues and cost of acquisition).

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.02 Using a scale of low, medium and high, how would you rank the above limitations on marine renewable energy development in Welsh waters?

4.3 Grading Constraints

Once the baseline environment of Welsh waters has been mapped in GIS (including the physical and biological environment, social and economic data), where such data are available, the information will be used to map potential constraints on the development of marine renewable energy. During the preliminary constraint mapping undertaken as part of Stage 1 each potential constraint was graded by the RPS project team in consultation with the Steering Group on a 1-5 scale. The aim of grading the constraints is to enable, at a broadscale, an assessment to be made of the potential degree of constraint that each issue may represent for marine renewable developments. The process was undertaken for five broad groups of energy development types, namely wind, tidal stream (surface piercing), tidal stream (wholly submerged), wave (surface piercing) and wave (wholly submerged). The gradings were made on the following basis:

Grade	Description
No grade	Receptor distribution is presented for informative purposes only and no firm constraint value can be ascribed at the broadscale
1	No likely constraint
2	Constraint assessment/study required, but low likelihood of delay
3	Constraint will require assessment and delay likely, but unlikely to stop development
4	Significant issue/constraint – delay and could possibly stop the project
5	Likely to preclude development

Note: The term ‘delay’ takes into consideration issues such as potential sensitivity/significance, together with issues such as a requirement for additional data

Although it is not intended to undertake a full revision of the constraint rankings applied during Stage 3, where new data are available (e.g. from the Stage 2 projects and projects undertaken elsewhere) the information will be considered to determine whether the level of constraint should be changed. In addition, the constraint gradings are currently applied as a ‘blanket’ across the entire data layer. For example, all areas of marine mammal populations carry the same constraint grade. However, for Stage 3, it is intended to look more closely at the constraint grades for each data layer and, where appropriate, ‘sub-layers’ may be created, for example where the degree of constraint represented within a layer is geographically variable or is of variable importance and therefore degree of potential constraint. Should changes be applied to the existing

constraint grades, this will be carried out in consultation with the Steering Group, with any 'sub-layers' created carefully documented to ensure auditability of the process.

It should be noted that the work undertaken in Stage 2 was not aimed at down-grading the constraints, but instead was undertaken to increase the *certainty* in the constraint grade assigned. For example, if the constraint grade assigned was precautionary due to a lack of information, increasing the level of information enables the grading to be made on a more scientific basis, whether that is to increase, decrease or remain the same.

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.03 Do you consider the approach to constraint grades appropriate?

4.4 Data Gaps and Uncertainty

Of particular relevance to the constraints mapping process are the issues of data gaps and uncertainty. Essentially, the data available are underpinned primarily by surveys and modelling. Patchiness in data coverage can cause problems; for example on maps of marine mammal distribution, it can be difficult to determine whether the apparent lack of species in a particular area within a GIS dataset occurs because such species are actually absent from the area; or conversely that the apparent absence is the result of no data. Confidence in the quality of data is also important, with differences in the recording method/detail/scale/age/extent of available data raising issues in terms of what information can be relied upon to portray an accurate and contemporary picture of existing conditions.

The method by which data gaps and confidence are addressed in the Framework, and the level of acceptance of the approach employed amongst statutory bodies, stakeholders and developers, is a critical component of the MRESF. In order to ensure acceptability and comparability across Welsh and adjacent waters, discussions are on-going between the project team and other organisations working on the same aspect for other projects and initiatives (including The Crown Estates MaRS team, the Welsh Marine Conservation Zone (MCZ) team and the Countryside Council for Wales (CCW)). Although the approach to data gaps/uncertainty is currently being developed, drawing on methods applied in previous large scale mapping projects, it is anticipated that it will

include an assessment of the data, with mapping where feasible, to indicate issues such as the following:

- Confidence in the dataset (potentially to be ranked 1-5, based on standardised criteria such as age, level of data processing etc); and
- Extent of data (depending on available information presented as a description or mapped).

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.04 Have you addressed the issues of data gaps and uncertainty in large scale data sets previously and do you view the type of approach proposed for dealing with data gaps and uncertainty as appropriate?

Q.05 When considering data gaps and uncertainty, please highlight the relative importance of the following:

- Method of data collection/generation
- Consideration of raw data extent
- Level of data processing undertaken
- Age of data
- Detail of data (e.g. fine/broad)

The identification and assessment of data gaps undertaken as part of Stage 1 was comprehensive and has not been repeated in full here. However, the Stage 1 work included compiling a list of data gaps and ongoing research connected to those gaps, which reflected the situation as it existed in 2008. The project team, in consultation with the Steering Group, then prioritised the data gaps, highlighting those issues that represent a greater degree of constraint on development in Welsh waters than others. It was from these prioritised data gaps that the projects taken forward in Stage 2 were drawn. In order for the project to remain current, and to provide a view on the remaining key data constraints, the information will be updated during Stage 3. Input to this during the stakeholder participation process is sought, as it is anticipated that individuals and organisations on the stakeholder list will be aware of projects that have not as yet been

highlighted during the MRESF project. A summary of the information sourced during Stage 1, with updates made in 2010, is presented in *Appendix B* (please note that the table does not include completed work).

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.06 Can you add to or update the list presented in *Appendix B*?

4.5 Potential Generation Capacity

In order to determine the achievability of the marine renewable energy potential (outlined in the Welsh Assembly's Energy Policy Statement) in a sustainable manner, it is necessary to make an assessment of the potential generation capacity of Welsh waters. Essentially, this will involve making a consideration of the available energy per unit area and assessing how much of that is likely to be extractable, based on practical issues such as device efficiency, device density/spacing in arrays, potential downtime (e.g. around low water/high water for tidal stream devices) etc. It is important to acknowledge that such assessments have attracted a degree of discussion in the wider literature, and that this is a potentially complex topic. The recently announced £8 million project titled 'Performance Testing of Wave and Tidal Array Systems' (PerAWaT), indicates the potential depth of the issue, and the provision of such detail is considered to be outside the scope of the current project. However, in order to assess the sustainability of energy extraction and to provide a Framework that aims towards achieving the marine renewable energy potential in Wales, it is necessary to understand at a broad level what proportion of the available energy in Welsh waters has the potential to be converted to electricity.

Given the current debate on the various approaches available to do this, a high level and clearly auditable approach to the assessment has been devised. Please note that at present, a number of these relate primarily to tidal stream devices. We are currently investigating the appropriate values for wave devices, with these being a particular item for stakeholder engagement and discussion at the workshops. The information highlighted to date can be summarised as follows:

- Determination of the total area offering economically viable resource for wave or tidal stream devices comprising:

  - 2 m/s minimum tidal speed

  - 10kW/m minimum wave energy

- Minimum array size of 30MW (small/early stage commercial scale developments)

- Minimum area of 2km^2 - the estimated area required for a 30MW generation project[13]

- Potential requirement for a correction factor to reflect the fact that even if all constraints are accommodated, the development of 100% of the remaining area for wave / tidal will not be realistic; therefore the application of a proportion of the total available area needs to be employed; suggestion is 30%;

- Actual average power output based on a load factor of 25%;

- Reduction of 2% power generation potential to accommodate redundancy in the project (arising from device maintenance/periodic component failure etc).

The detailed constraints mapping component of Stage 3 will provide the estimate of total area considered 'available' for sustainable development i.e. minimising impacts on environmental sensitivities, socio-economic uses and activities.

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.07 Is the proposed approach for assessing potential generation capacity appropriate to the project?

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13 The spacing of devices can be as small as 50m apart as long as the devices are not positioned within the shadow of adjacent devices. If the layout of the site does result in devices being placed within the tidal shadow of another device, then it is likely that there will be a requirement to have a minimum of 10x diameter separation; i.e. if 15m rotor diameter is used on the unit, the devices would need to be 150m apart. In order to err on the conservative side, this scenario run has been made assuming that turbines would need to be set at this 150m distance, thus each turbine would require 0.07km^2 area, a minimum 30 device farm would therefore require approximately a 2km^2 area.

4.6 Development of the Framework

The intention is to use the baseline data (environmental, social and economic) collated during Stage 1, with any subsequent additions, together with the areas in Welsh waters identified as holding potentially exploitable levels of wind, wave and tidal stream energy, to explore various approaches to identifying potential development areas. The aim is to take consideration of sustainability (i.e. the existing social, environmental and economic realities of Welsh waters) while looking to maximise the potential for renewable energy. The scenarios have been selected to enable a greater understanding of what the implications of the existing constraints are for renewable energy development in Welsh waters and, for the marine renewable energy potential in Wales to be met, how this can be managed.

The scenarios to be tested are described below; together with indicative GIS maps to illustrate the principles behind the methodology.

The development of the Framework will involve the assessment of various potential scenarios for marine renewable energy development in Welsh waters. It is intended to use the outputs from the scenario testing to assess areas for development potential, based on both the degree of constraint presented by existing interests but also on the available wave and tidal stream resource in the context of the renewable energy potential in Wales (as outlined in the Welsh Assembly Governments 'Energy Policy Statement', http://wales.gov.uk/docs/desh/policy/100315energystatementen.pdf). By investigating how the renewable energy potential within Welsh waters fits with the existing constraints, the Framework for marine renewable energy will be placed within a sustainable development context.

As a reflection of the geographic nature of both the potential resource and the potential constraints, much of the output from the constraint management aspects of Stage 3 will be presented in a GIS format and, to ensure transparency and auditability, the decision making pathway will be clearly defined and described. Both the mapped scenarios and the project reporting (including all reports from Stages 1, 2 and 3) will be available on a project specific website http://mresf.rpsgroup.com.

We propose to test and develop the following "scenarios". At each stage, the potential generation capacity and resource area will be provided as an output (see Figure 1 and Figures 2a to c):

- **Scenario 1 'Maximum Energy Generation'.** The maximum amount of marine renewable energy that could be developed if no constraints were in place. The scenario will essentially draw on the Renewables Atlas, with additions where held by RPS, with the only limitation on potential energy generation capacity being the minimum energy requirements (anticipated to be set at 2m/s for tidal stream and 10kW/m for wave energy, based on known requirements of developers).

- **Scenario 2 'Maximum Achievability'**. What is feasible from an engineering/practical constraints perspective? What effect do device type requirements such as depth/distance from shore and issues such as timescale to grid connection have on Scenario 1? What is most realistic from a technology perspective within 5 years? The scenario will need to incorporate device type information such as generalised array layout and assumptions on energy efficiency of devices.

- **Scenario 3a 'Least Impacting Ecologically'**. What are the implications for renewable energy generation of overlaying the ecological constraints on Scenario 1? The scenario will be tested by looking at how the current constraint rankings affect the available resource, together with assessing how making provision for site specifics could affect this, i.e. developing sub-layers within an ecological data layer where the level of constraint may not be consistent across the entire layer. The ecological data layers to be used will include data layers provided in *Appendix A*.

- **Scenario 3b 'Least Impacting for Existing Use'**. What are the implications for renewable energy generation of overlaying existing use (social and economic) constraints on Scenario 1? i.e. developing sub-layers within a socio-economic data layer where the level of constraint may not be consistent across the entire layer. The socio-economic data layers to be used will include data layers provided in *Appendix A*.

- **Scenario 4 'Most Sustainable for individual device types'** Taking consideration of the outputs from Scenarios 1-3, this scenario will explore the potential effect of different combinations of environmental and socio-economic constraints on each marine renewable device type in terms of potential energy generation. In each case, the maximum potential energy generation will be calculated.

- **Scenario 5 'Most Sustainable for marine renewables'**. Can the marine renewable energy potential in Wales, as described in the Welsh Assembly's Energy Policy Statement[14], be met, whilst balancing environmental, economic and social aspects? The entire marine renewable (wave and tidal stream) resource would be considered for all device types modelled individually in Scenario 4, including the potential for overlaps between potential resource areas and which look at which device type could potentially offer the most sustainable use of that resource.

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.08 Do you consider the proposed scenarios are appropriate for testing the sustainability of the Framework?

Q.09 The Welsh Assembly Government Energy Policy Statement describes sustainable development as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs' (http://wales.gov.uk/docs/desh/policy/100331energystatementen.pdf), given this description, do you view the sustainable approach adopted by the MRESF project to be appropriate?

Q.10 Is a 5-year timescale for the MRESF Framework realistic, taking into consideration the need for the Framework to provide certainty to the industry while being adaptive to the status of the industry and to be current in terms of understanding of the environment (human, social and natural) and the level of constraint that the various factors present to development?

Following the scenario development, potential areas for development will be assessed both according to the level of constraint evident but also on the potential importance of the area for renewable energy generation. The combination of the two aspects is important when considering sustainability. It is not intended to green light or red flag areas, but instead to use the information collected and tested in the scenarios to provide

14 A Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement. March 2010.

a framework for sustainable development – i.e. balancing the demands on the marine environment including existing environmental, social and economic issues with the drive towards marine renewable energy.

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.11 Do you view the approach to grading areas for potential development as appropriate?

4.7 Stakeholders

The Stage 3 stakeholder participation process will be extended to those individuals and organisations who were contacted during Stage 1 and Stage 2 (*Appendix C*) and any other individuals/organisations identified during this Stage 3 stakeholder participation process for which the project is of relevance. The list includes individuals and organisations from a range of backgrounds, including the following:

- Developers;
- Academics;
- Research Groups;
- NGO's;
- Unitary Authorities; and
- Government Departments and Agencies.

STAKEHOLDER PARTICIPATION QUESTION (see Section 5 for the complete Questionnaire)

Q.12 In addition to the list of stakeholders provided in *Appendix C*, are there any other individuals and/or organisations that you feel should be included in the stakeholder participation process?

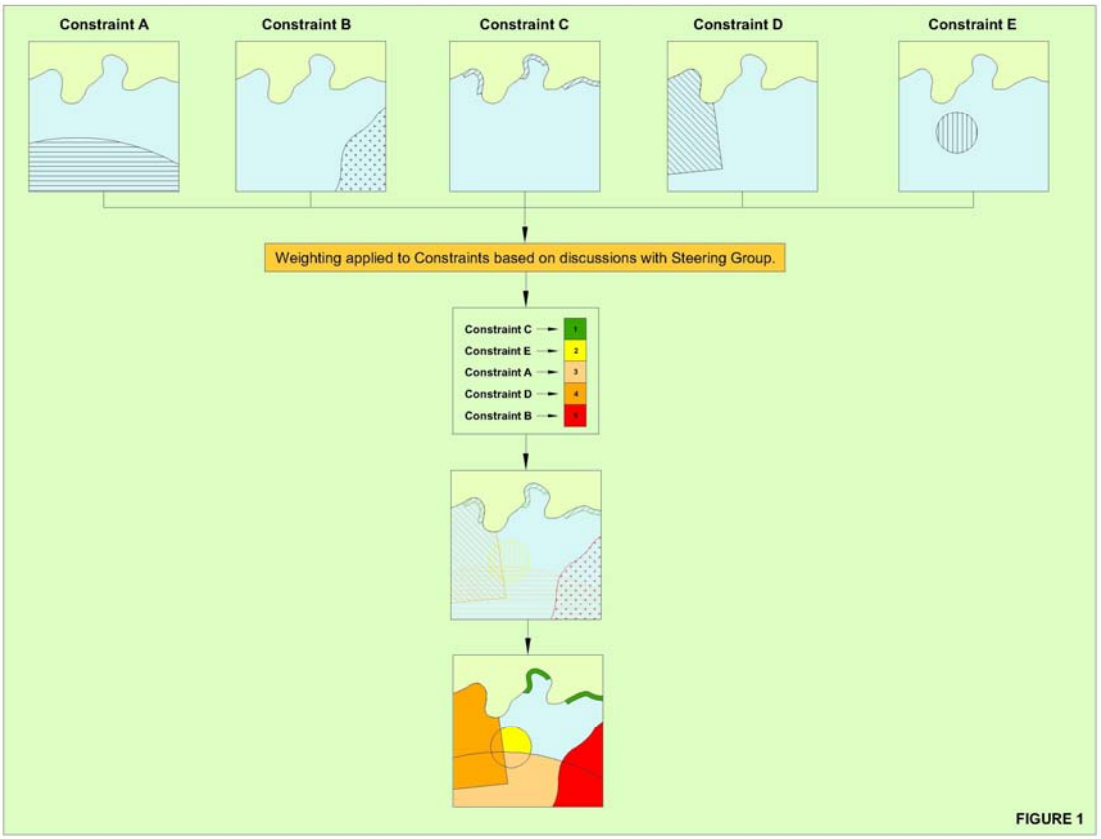

Figure 1 Flow diagram illustrating the use of constraints weightings to be used in constraints mapping

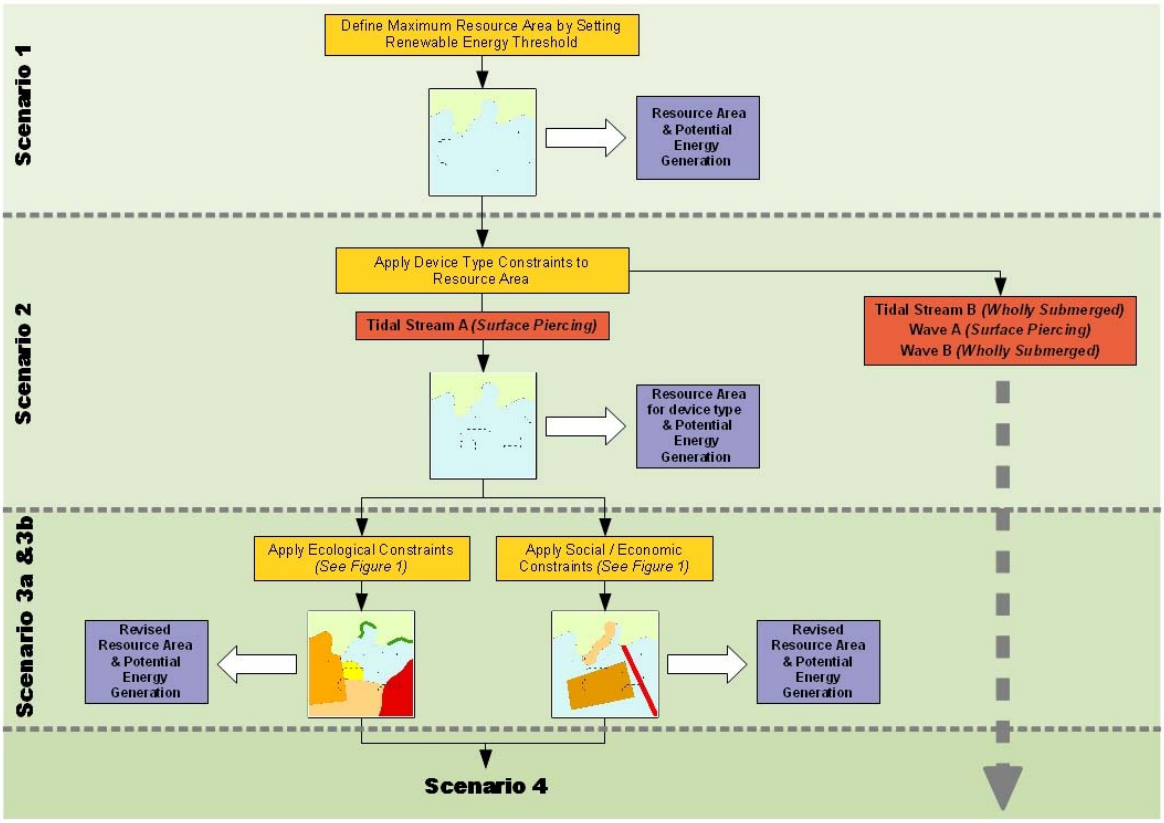

FIGURE 2a

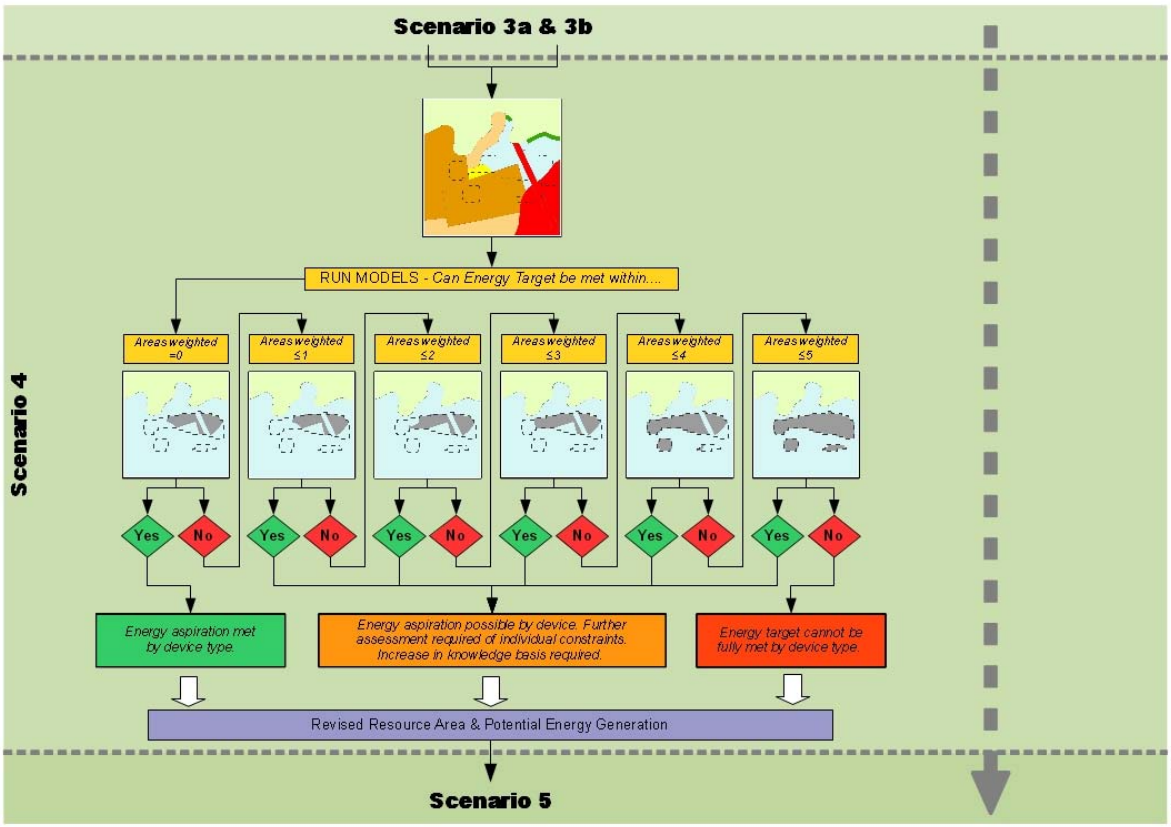

FIGURE 2b

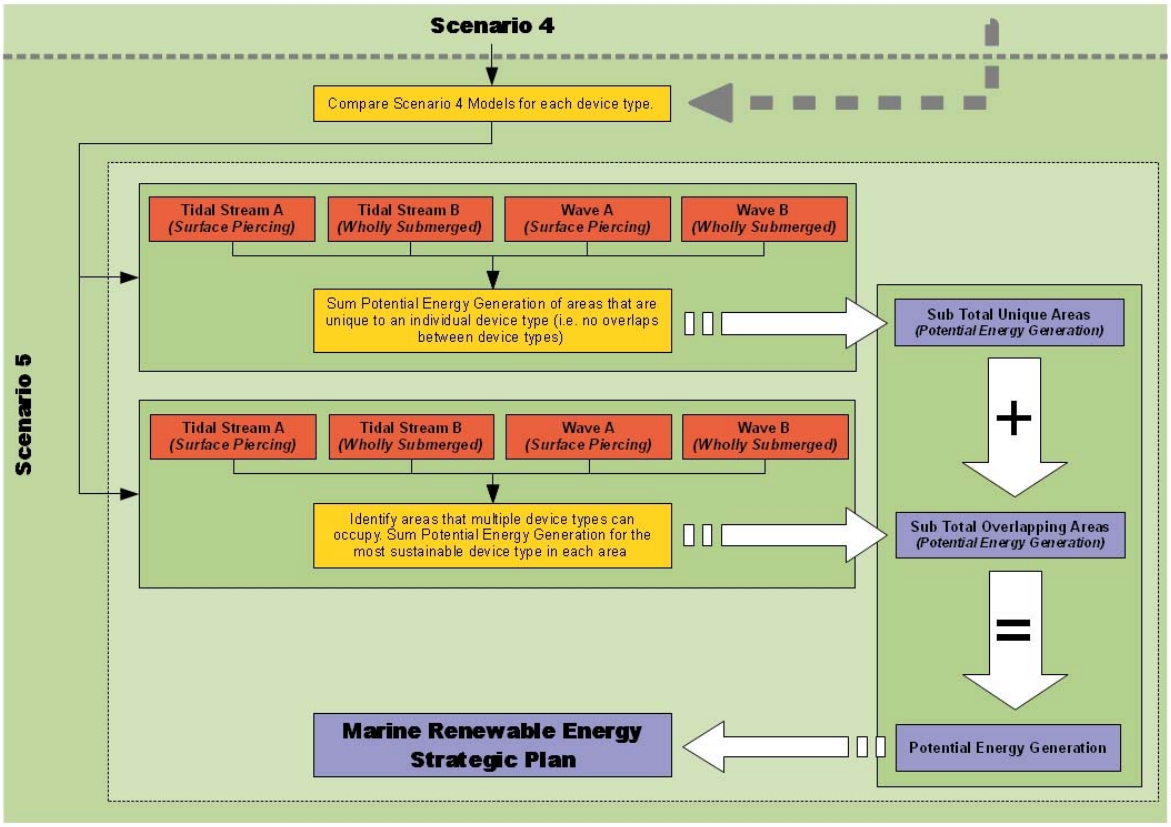

***Figure 2a to 2c Flow diagram of proposed methodology for Scenarios 1 through to* 5**

Stakeholder Participation Questionnaire

The stakeholder participation questions that have been included in the relevant sections of this document are presented below. Completed questionnaires are welcome from all stakeholders, including those choosing to attend workshops. Details of where to return the questionnaire are give in Section 3 and are reproduced below:

MRESF Project Team
RPS Planning and Development
Conrad House
Beaufort Square
Chepstow
Monmouthshire
NP16 5EP
Tel: 01291 621821
Fax: 01291 627827
Email: mresf@rpsgroup.com

Website: http://mresf.rpsgroup.com/

MARINE RENEWABLE ENERGY STRATEGIC FRAMEWORK

STAGE 3 STAKEHOLDER PARTICIPATION QUESTIONNAIRE

Contact Name .....

Company/Organisation Name (if applicable) .....

Address .....

.....

.....

Telephone .....

Email .....

To complete the form digitally, please double click on the appropriate ☐ and insert the ☒ symbol from the selection.

Please note that due to the different interests of Stakeholders, it is possible that some of the questions may not be applicable to all. Please mark such questions as 'not applicable'.

Interest in renewable energy	Developer?	Yes	☐	No	☐
	Stakeholder?	Yes	☐	No	☐
	Regulator/Adviser?	Yes	☐	No	☐
	Research?	Yes	☐	No	☐
	Other?	Yes	☐	No	☐

Please note that due to the different interests of Stakeholders, it is possible that some of the questions may not be applicable to all. Please mark such questions as 'not applicable'.

Data Sources (Section 4.1)

Q.01 In addition to the data listed in the Metadata sheets in *Appendix A*; which are grouped by topic, do you hold data of relevance to the MRESF project? Yes ☐ No ☐

If yes, please provide details (including what it is/availability/licence terms/type).....

.....

.....

.....

Potential Constraints (Section 4.2)

Q.02 Using a scale of low, medium and high, how would you rank the following limitations on marine renewable energy development in Welsh waters?

Practical limitations	Low	☐	Medium	☐	High	☐
Site Specific Issues	Low	☐	Medium	☐	High	☐
Support	Low	☐	Medium	☐	High	☐
Legislative considerations	Low	☐	Medium	☐	High	☐
Existing use	Low	☐	Medium	☐	High	☐
Data requirements	Low	☐	Medium	☐	High	☐

Is there anything else you feel should be included? .....

.....

Grading Constraints (Section 4.3)

Q.03 Do you consider the approach to constraint grades appropriate?

Yes ☐ No ☐

If no, why not?.....

.....

Data Gaps and Uncertainty (Section 4.4)

Q.04 Have you addressed the issues of data gaps and uncertainty in large scale data sets previously?

Yes ☐ No ☐

and do you view the type of approach to dealing with data gaps and uncertainty as appropriate?

Yes ☐ No ☐

Q.05 When considering data gaps and uncertainty, please highlight the relative importance of the following:

Method of data collection/generation	Low	☐	Medium	☐	High	☐
Consideration of raw data extent	Low	☐	Medium	☐	High	☐
Level of data processing undertaken	Low	☐	Medium	☐	High	☐
Age of data	Low	☐	Medium	☐	High	☐
Detail of data (e.g. fine/broad)	Low	☐	Medium	☐	High	☐

Is there anything else you feel should be included? .....

.....

Q.06 Can you add to or update the list presented in *Appendix B*?

Yes ☐ No ☐

If yes, please give the details here:.....

.....

.....

Potential Generation Capacity (Section 4.5)

Q.07 Is the proposed approach for assessing potential generation capacity appropriate to the project? Yes ☐ No ☐

In particular:

Is the 2m/s minimum tidal stream value appropriate? Yes ☐ No ☐

Is the 10kW/m minimum wave energy value appropriate? Yes ☐ No ☐

Is the minimum farm size of 30MW appropriate given the 5 year lifespan of the MRESF? Yes ☐ No ☐

Is the minimum array area of 2km^2 appropriate given the 5 year lifespan of the MRESF? Yes ☐ No ☐

Is the 30% correction factor suggested appropriate? Yes ☐ No ☐

Is the 25% load factor appropriate? Yes ☐ No ☐

Is the 2% reduction in power generation potential appropriate? Yes ☐ No ☐

If no, please indicate which aspects together with potential alternatives:.....

.....

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Development of the Framework (Section 4.6)

Q.08 Do you consider the chosen scenarios appropriate for testing the sustainability of the Framework?

Scenario 1 'Maximum Energy Generation' Yes ☐ No ☐

Scenario 2 'Maximum Achievability' Yes ☐ No ☐

Scenario 3a 'Least Impacting Ecologically' Yes ☐ No ☐

Scenario 3b 'Least Impacting for Existing Use' Yes ☐ No ☐

Scenario 4 'Most Sustainable for individual device types'

Yes ☐ No ☐

Scenario 5 'Most Sustainable for marine renewables'

Yes ☐ No ☐

If no, please indicate why:.....

.....

.....

.....

Q.09 The Welsh Assembly Government Energy Policy Statement describes sustainable development as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs' (http://wales.gov.uk/docs/desh/policy/100331energystatementen.pdf), given this description, do you view the sustainable approach adopted by the MRESF project to be appropriate?

Yes ☐ No ☐

If no, please indicate why:.....

.....

.....

.....

Q.10 Is a 5-year timescale for the MRESF Framework realistic, taking into consideration the need for the Framework to provide certainty to the industry while being adaptive to the status of the industry and to be current in terms of understanding of the environment (human, social and natural) and the level of constraint that the various factors present to development Yes ☐ No ☐

If no, please indicate whether a longer Yes ☐

or shorter timescale would be appropriate Yes ☐

Q.11 Do you view the approach to grading areas for potential development as appropriate?

Yes ☐ No ☐

Stakeholders (Section 4.7)

Q.12 In addition to the list of stakeholders provided in *Appendix C*, are there any other individuals and/or organisations that you feel should be included in the stakeholder participation process? Yes ☐ No ☐

If yes, please provide details (including contact name, email, telephone and address).....

.....

.....

.....

5 What Happens Next?

The overall timetable for the MRESF project aims for submission to Ministers in Autumn 2010. Between now and then, the RPS project team will be undertaking the stakeholder participation process, developing the scenarios and testing the sustainability aspects of meeting the marine renewable energy potential of Welsh waters. On completion of the project, the work will be made publicly available on a project specific website, which is anticipated to include the following:

- Copies of all the project reports (including Stage 1 plus addendums, Stage 2 reporting, stakeholder participation related literature and supporting documents for the Framework developed during Stage 3);
- Details of the metadata associated with the data layers acquired during the project to describe the existing human and natural environment of Welsh waters;
- Dependant on access, interactive mapping layers to enable the viewer to explore but not edit the data layers, various scenarios tested and the resulting grading of potential development areas;
- Details of the bibliography amassed during Stage 1 and subsequent additions; and
- Provision to upload data, reports, project information containing baseline data for Welsh waters and/or information on renewable energy devices, their interactions with the environment and their potential impact.

Details of the website will be made available to all stakeholders when it becomes publicly available.

Appendices

Appendix A

Metadata Held by RPS for Use within the GIS mapping

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Subtidal Benthic Ecology				
Offshore Flora & Fauna	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Subtidal Biotopes (HabMap)	Habitat Mapping For Conservation and Management of the Southern Irish Sea (HabMap)	Habitat Mapping For Conservation and Management of the Southern Irish Sea (HabMap)	Irish Sea	14/04/2010
Geology and Seabed Features				
Bathymetry	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Marine Geology	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Subtidal Geology	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Seabed Landscapes*	Joint Nature Conservation Committee (JNCC)	Joint Nature Conservation Committee (JNCC)	United Kingdom	16/10/2007
Fish Ecology				
Fish Nursery Areas*	Centre for Environment, Fisheries & Aquaculture Science (CEFAS)	Centre for Environment, Fisheries & Aquaculture Science (CEFAS)	Europe	15/10/2007
Fish Spawning Areas*	Centre for Environment, Fisheries & Aquaculture Science (CEFAS)	Centre for Environment, Fisheries & Aquaculture Science (CEFAS)	Europe	15/10/2007
Birds				
Common Scoter Concentrations	CCW / Coastal Assesment, Liason & Monitoring (CALM)	Countryside Council for Wales (CCW)	Wales	16/04/2010
Seabird 2000	CCW / Coastal Assesment, Liason & Monitoring (CALM)	Joint Nature Conservation Committee (JNCC)	Wales	16/04/2010
Seabird Colonies	CCW / Coastal Assesment, Liason & Monitoring (CALM)	Joint Nature Conservation Committee (JNCC)	Wales	16/04/2010

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Wetland Birds	CCW / Coastal Assesment, Liason & Monitoring (CALM)	WeBS Partnership	Wales	16/04/2010
Marine Mammals				
Grey Seals	CCW / Coastal Assesment, Liason & Monitoring (CALM)	Countryside Council for Wales (CCW)	Wales	16/04/2010
Atlas of the Marine Mammals of Wales	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	25/02/2010
Cetacean Atlas	Joint Nature Conservation Committee (JNCC)	Joint Nature Conservation Committee (JNCC)	United Kingdom	12/04/2010
Intertidal Ecology				
Phase 1 Intertidal Biotopes	CCW / Coastal Assesment, Liason & Monitoring (CALM)	Countryside Council for Wales (CCW)	Wales	16/04/2010
Landscape and Seascape				
Landmap - Cultural Landscape	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	05/03/2010
Landmap - Geological Landscape	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	05/03/2010
Landmap - Historic Landscape	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	05/03/2010
Landmap - Landscape Habitats	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	05/03/2010
Landmap - Visual and Sensory	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	05/03/2010
Seascapes	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	04/03/2010
Designated Sites				
Pembroke Island Marine Environmental High Risk Areas	RPS Planning & Development	Department for Transport (DfT)	Pembroke Island	31/10/2008
Local Nature Reserves	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Marine Nature Reserves	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
National Nature Reserves	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Open Country	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	01/04/2010
Public Forests	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	01/04/2010
RAMSAR Sites	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Registered Common Land	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	01/04/2010
Sites of Special Scientific Interest	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Special Areas of Conservation	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Special Protection Areas	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
World Heritage Sites	CADW, Welsh Assembly Government	CADW, Welsh Assembly Government	Wales	02/03/2010
Areas of Outstanding Natural Beauty	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Biogenetic Reserves	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Biospheric Reserves	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Country Parks	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
Heritage Coast	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	17/03/2010
National Parks	National Parks Authorities	National Parks Authorities	Wales	14/04/2010
Bird Reserves	Royal Society for the Protection of Birds (RSPB)	Royal Society for the Protection of Birds (RSPB)	United Kingdom	07/04/2010
Important Bird Areas	Royal Society for the Protection of Birds (RSPB)	Royal Society for the Protection of Birds (RSPB)	Great Britain	07/04/2010

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Shipping				
Shipping Density*	Anatec UK Ltd	Anatec UK Ltd	Wales	03/04/2008
Shipping Routes*	Anatec UK Ltd	Anatec UK Ltd	Wales	03/04/2008
Shipping Clearways	Marine Coastal Agency	Marine Coastal Agency (MCA)	United Kingdom	13/11/2007
IMO Routeing	Maritime Data	International Maritime Organisation (IMO)	United Kingdom	02/03/2010
		Maritime Data		
Ports	Maritime Data	Anatec UK Ltd	United Kingdom	02/03/2010
		Maritime Data		
Marine Transportation Features & Routes	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Navigational Aids	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Aviation				
Aerodromes	RPS Planning & Devlopment	Civil Avaition Authority	United Kingdom	31/08/2007
Civil Air Traffic Zones (CATZ)	RPS Planning & Devlopment	Civil Avaition Authority	United Kingdom	31/08/2007
Radar (20m - 200m)	BWEA Avaition	NATS En Route Plc ("NERL")	United Kingdom	07/04/2010
Archaeology				
Wrecks	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Protected Wrecks*	Wessex Archaeology	Wessex Archaeology	Wales	05/02/2008
Listed Buildings	CADW Inspectorate of Ancient Monuments and Historic Buildings	CADW, Welsh Assembly Government	Wales	02/03/2010

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Historic Landscapes	CADW, Welsh Assembly Government	CADW, Welsh Assembly Government	Wales	02/03/2010
Scheduled Ancient Monuments	CADW, Welsh Assembly Government	CADW, Welsh Assembly Government	Wales	02/03/2010
Recreation and Tourism				
National Cycle Network and Other Routes	Sustrans	Sustrans	Wales	13/04/2010
Visit Britain Attractions*	Visit Britain	Visit Britain	United Kingdom	
Registered Parks and Gardens	CADW, Welsh Assembly Government	CADW, Welsh Assembly Government	Wales	02/03/2010
Access Land	Countryside Council for Wales (CCW)	Countryside Council for Wales (CCW)	Wales	01/04/2010
Water-Related Recreational Activity Areas*	Environment Agency - Wales	Environment Agency - Wales	Wales	01/04/2010
South West Wales Recreational Activities	Pembrokeshire Coastal Forum	Pembrokeshire Coastal Forum	South West Wales	29/03/2010
Boat Cruising Routes*	Royal Yachting Association (RYA)	Royal Yachting Association (RYA)	United Kingdom	31/10/2008
Boat Racing Areas*	Royal Yachting Association (RYA)	Royal Yachting Association (RYA)	United Kingdom	31/10/2008
Marinas*	Royal Yachting Association (RYA)	Royal Yachting Association (RYA)	United Kingdom	31/10/2008
Sailing Areas*	Royal Yachting Association (RYA)	Royal Yachting Association (RYA)	United Kingdom	31/10/2008
UK Atlas of Recreational Boating*	Royal Yachting Association (RYA)	Royal Yachting Association (RYA)	United Kingdom	31/10/2008
Yachting Clubs*	Royal Yachting Association (RYA)	Royal Yachting Association (RYA)	United Kingdom	31/10/2008
Yachting Training Centres*	Royal Yachting Association (RYA)	Royal Yachting Association (RYA)	United Kingdom	31/10/2008
Fisheries				
Fish Values	COWRIE	ABPmer Ltd	United Kingdom	02/03/2010
Fish Values per Gear Code	COWRIE	ABPmer Ltd	United Kingdom	02/03/2010

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Classified Bivalve Mollusc Harvesting Areas	Department for Environment, Food and Rural Affairs (DEFRA)	Department for Environment, Food and Rural Affairs (DEFRA)	England and Wales	31/03/2010
Designated Shellfish Waters*	Environment Agency - Wales	Environment Agency - Wales	Wales	10/06/2008
Shellfish Waters - Designated Sensitive Areas*	Environment Agency - Wales	Environment Agency - Wales	Wales	10/06/2008
Fishing - Days Fished	Maritime Data	DECC SEA	United Kingdom	02/03/2010
		Hartley Anderson Limited		
		Maritime Data		
		Scottish Government Marine Directorate		
Fishing - Landings Density	Maritime Data	DECC SEA	United Kingdom	02/03/2010
		Hartley Anderson Limited		
		Maritime Data		
		Scottish Government Marine Directorate		
Fishing - Port Landings	Maritime Data	Marine Fisheries Agency (MFA)	United Kingdom	02/03/2010
		Maritime Data		
Fishing - Ports and Vessels	Maritime Data	DECC SEA	United Kingdom	02/03/2010
		Hartley Anderson Limited		
		Marine Fisheries Agency (MFA)		
		Maritime Data		
Fishing - Satellite	Maritime Data	Marine Fisheries Agency (MFA)	United Kingdom	02/03/2010
		Maritime Data		

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Marine Obstructions	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Oil and Gas				
Offshore Installations	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
25th Round of Offshore Licensing	Department of Energy and Climate Change (DECC)	UK Deal	United Kingdom	31/02/2010
26th Round of Offshore Licensing	Department of Energy and Climate Change (DECC)	UK Deal	United Kingdom	31/02/2010
Installation Safety Zones	Department of Energy and Climate Change (DECC)	UK Deal	United Kingdom	31/02/2010
Subsurface Installations	Department of Energy and Climate Change (DECC)	UK Deal	United Kingdom	31/02/2010
Surface Installations	Department of Energy and Climate Change (DECC)	UK Deal	United Kingdom	31/02/2010
Wells	Department of Energy and Climate Change (DECC)	UK Deal	United Kingdom	31/02/2010
Cables and Pipelines				
Submarine Cables (Kisca)	Sea Fish Industry Authority	Kisca Kingfisher	Wales	13/04/2010
Pipelines	Department of Energy and Climate Change (DECC)	UK Deal	United Kingdom	31/02/2010
Renewable Energy Resource				
Atlas of UK Marine Renewable Energy Resources - Wave	Department of Trade & Industry	ABPmer Ltd	United Kingdom	15/01/2010
Atlas of UK Marine Renewable Energy Resources - Wind	Met Office	ABPmer Ltd	United Kingdom	15/01/2010
Atlas of UK Marine Renewable Energy Resources - Tide	Proudman Oceanographic Laboratory (POL)	ABPmer Ltd	United Kingdom	15/01/2010
Water Quality				
Sites under IPC (Intergrated Pollution Control)*	Environment Agency - Wales	Environment Agency - Wales	Wales	14/03/2005

TITLE	DISTRIBUTOR	ORIGINATOR	GEOGRAPHIC EXTENT	LAST UPDATE / DOWNLOADED
Sites under IPPC (Intergrated Pollution Provention Control)*	Environment Agency - Wales	Environment Agency - Wales	Wales	14/03/2005
Bathing Waters - Designated Sensitive Areas*	Environment Agency - Wales	Environment Agency - Wales	Wales	10/06/2008
EC Bathing Waters*	Environment Agency - Wales	Environment Agency - Wales	Wales	10/06/2008
Non EC Bathing Waters*	Environment Agency - Wales	Environment Agency - Wales	Wales	10/06/2008
Military				
Explosives Dumping Sites	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Marine Military Practice Areas	SeaZone Solutions Limited	SeaZone Hydrospatial	Wales	04/03/2010
MoD Establishments*	Ministry of Defence	Ministry of Defence	Wales	13/03/2008
Military Air Traffic Zones (MATZ)	RPS Planning & Devlopment	Civil Avaition Authority	United Kingdom	31/08/2007
Electricity Grid				
Electricity Substation Sites	National Grid	National Grid	United Kingdom	12/04/2010
Overhead Power Cables	National Grid	National Grid	United Kingdom	12/04/2010
Shoreline Constructions	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Aggregate Dredging				
Activity and Licence Areas	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Spoil Grounds				
Spoil Grounds	SeaZone Solutions Limited	Seazone Hydrospatial	Wales	04/03/2010
Renewable Energy				
Renewable Energy Interests in Welsh Waters	Various	Various	Wales	16/04/2010

Appendix B

Key Data Gaps and Relevant Work Planned, Proposed and in Progress

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
Physical environment	Resource		Wave data is available for periods between Jan 2005 and August 2009, with interim survey reports on metocean data		MREDS	http://www.mreds.co.uk
			Strategic wave monitoring network		Cefas	www.cefas.co.uk/data/wavenet.aspx
			Wave height studies. Using satellite altimetry to study wave height for optimum location of sites		National Oceanography Centre, Southampton	
	Geology		DiGSBS250 Version 3 (Baseline Products):Sea Bed Sediments		BGS, Hydrographic Office and SeaZone	To purchase when complete
	Change in physical processes	The effect of a change in wave or tidal energy				
				Seabed and shoreline processes and the dynamic response to energy extraction and mixing	PRIMaRE	Unknown
			An Integrated Modelling Framework for Environmental Impact Assessment of Large-Scale Arrays.		SuperGen PhD	Unclear
			Wave devices as coastal defence		University of Edinburgh	Unknown status
			Wave Attenuation Calculations for Various Designs of Wave Devices.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AE_SDP_2009_2011_FINAL.pdf
	Uncertainty on the potential for and significance of a change in vertical mixing					
	If or how energy extraction at the surface or mid column will affect the seabed					
	Uncertainty as to whether there is a critical amount of energy that can be extracted prior to significant change occurring		Energy Extraction from the Florida Current, How Many Turbines is Too Many?		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AE_SDP_2009_2011_FINAL.pdf

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	Cumulative effects	Cumulative effects	An integrated modelling framework for EIA of large-scale arrays.		MREDS PhD studentship	Started 2008
			Need to understand of the potential for arrays to substantially divert high velocity flows and an understanding of the maximum packing density for individual devices.		http://depts.washington.edu/nnmrec/project_array.html	
	Guidance on the methods available for predicting and monitoring change in the physical environment			Review of models to predict effects on sediments and coastal processes	DECC RAG	Unknown if still proposed
Water and sediment quality	Antifoulants		Survey and Evaluation of Potential Environmental Effects from Antifouling Paints, Lubricants, Hydraulic Fluids and other Chemical Products Potentially used at Offshore Facilities.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf
			Newcastle University continuing generic research and Glasgow University through BRIMOM work and Professor Cowling		Newcastle and Glasgow Universities	http://research.ncl.ac.uk/barnacles/Site/Publications.html, www.gla.ac.uk/marinestation/prc_frame.html, www.gla.ac.uk/marinestation/prc_frame.html
	Potential significance of a change in vertical mixing					
	Potential for energy extraction to affect mixing and dilution near outfalls					
	Potential for release of sediment during construction, operation and decommissioning					
	Cumulative effects					
	General water quality		Fate and Effects of Spilled Transformer Oil (Dielectric Fluids) on the Marine Environment.		MMS and Louisiana State University	http://www.mms.gov/tarprojects/636.htm

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
Visual and Landscape	Site specific work on wave and tidal devices					
	Cumulative effects	Cumulative effects				
	General visual impact		Evaluation of Visual Impacts on Historic Properties.		MMS	http://www.mms.gov/offshore/RenewableEnergy/PDFs/Visual_Impacts_on_Historic_Properties.pdf
	Lighting		Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf
	Visual Impact Exclusion Zone			Wind energy research looking at the effectiveness of visual limits used in Round 2	Unclear	Unknown if still proposed
Marine mammals	Analysis of sightings/survey density would be beneficial in placing distribution information into context (including hotspots)		Land based visual monitoring of wildlife around the EMEC wave test facility in Orkney. Support for land-based observations (inc project design and data analysis) at Billia Croo test facility.		EMEC	Started 2008, funds required March 2010 to continue (SNH)
			Analysis of seal telemetry and count data for the Pentland Firth and Orkney.		Awarded by SNH in March 2010 to SMRU Ltd.	Due for completion June 2010
				Abundance and distribution of basking sharks and cetaceans in the Pentland Firth and Orkney Waters.	Offered by SNH March 2010	Due for completion June 2010
	Better understanding of the use of high current areas by marine mammals					
	Noise	Site specific noise monitoring data required including public reporting. To include construction, operation and decommissioning				

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
			Underwater acoustic interactions between emerging tidal-energy technologies and vulnerable vertebrates.		SNH	PhD in progress. SNH / SEPA funded PhD with SAMS. Commenced Q2, 2008/09. Expected completion Q2, 2011/12.
			Acoustic output from devices: acoustic characterisation and monitoring.		SAMS	Work being undertaken at EMEC
			The impacts of acoustic and electromagnetic noise from marine energy conversion devices on the behaviour of organisms		MREDS PhD studentship	Started 2008
			Underwater noise monitoring at the RITE tidal turbines		Verdant Power	http://verdantpower.com/what-initiative/
			Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf
			Passive acoustic buoy system for monitoring offshore sites		Funded by Scottish Government, undertaken by SAMS	2009-2010
			RAVE – hydro sound alpha ventus: Research and testing of a layered bubble curtain in the testfield alpha ventus		Institut für Statik und Dynamik (ISD), Uni Hannover, Menck GmbH, Kaltenkirchen	http://rave.iset.uni-kassel.de/rave/pages/raveHydrosound
			RAVE Project - Measurement of the operational underwater noise emission of wind turbines of the alpha ventus offshore wind farm		FH Flensburg - University of Applied Sciences	Unknown
			What impact will noise during the construction and operational phases have on marine mammals and fish?		RAVE - Research at Alpha Ventus (German windfarm)	http://rave.iset.uni-kassel.de/rave/pages/raveEcology
			Evaluation of the Soundscape and Potential Impacts of Noise to Marine Mammals and Turtles from Offshore Wind Facilities.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
			Survey connecting the monitoring activities at Horns Rev II OWF and the FINO 3 platform with regard to responses of harbour porpoises to pile driving activities.		BioConsult SH (Institut für Technische und Angewandte Physik (ITAP))	Unknown
	Potential exclusion/disturbance issues		How do marine mammals and passage migrants react to the wind farm and will there be habitat losses?		RAVE - Research at Alpha Ventus (German windfarm)	http://rave.iset.uni-kassel.de/rave/pages/raveEcology
				Marine mammal responses to an offshore wind energy development	DECC RAG	Proposal
				Marine mammal displacement modelling	DECC RAG	Proposal
				Use of HD imagery surveys for offshore wind farm planning	DECC RAG	Proposal
	Collision risk	Potential collision risk (wave and tidal stream)				
			MRESF project work		RPS	2010
			Monitoring at Race Rocks tidal turbine		Project team	No data yet available
			The consequences of close range interactions between marine vertebrates and tidal-stream turbines.		MREDS PhD studentship	Started 2008
			Harbour porpoise collision risk. Estimates of collision risk of harbour porpoises and marine renewable devices at sites of high tidal stream energy.		Scottish Executive	Commenced 2009
			Broad-scale spatial interactions between marine renewable energy devices and vertebrates at risk of collision.		MREDS PhD studentship	Started 2009
			Environmental Impact Assessment: WP6 of EquiMar project. Estimating collision risk of fish, birds and marine mammals with submerged devices		EquiMar (University of Edinburgh)	2008-2011
	Potential for devices to attract mammals and methods of deterrent.		Testing the effectiveness of seal scarers in deterring harbour porpoises. T		BioConsult SH (Institut für Technische und Angewandte Physik (ITAP) & SMRU Ltd)	Unknown
			The use of acoustic devices to warn marine mammals of tidal renewable energy devices		Scottish Government	Announced 2009

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	Monitoring Methods		Guidance on Survey and Monitoring in Relation to Marine (Wave and Tide) Renewables Deployments in Scotland.		SNH funded. Awarded to Haskoning 2009.	Due for completion July 2010
				Development and establishment of a marine mammal stranding scheme in Orkney and Pentland Firth.	SNH Currently in negotiation with SAC Inverness. SoR to be drafted, Q1, 10/11.	
	Cumulative effects	Cumulative effects				
			Effects of wind turbines on harbour porpoises behaviour and population dynamics under different environmental conditions.		NERI Dept. of Arctic Environment	Unknown
Seabirds, Wildfowl and Waders	Baseline data		Welsh aerial surveys (BERR RAG)			
				Analysing existing GPS and conventional satellite-tracking data for four key migratory bird species: svalbard barnacle geese, greenland barnacle geese, light-bellied brent geese and greenland white-fronted geese	DECC RAG	Proposal
			Land based visual monitoring of wildlife around the EMEC wave test facility in Orkney. Support for land-based observations (inc project design and data analysis) at Billia Croo test facility.		EMEC	Started 2008, funds required March 2010 to continue (SNH)
				Compilation of species reports	DECC RAG	Proposal
				Population Viability Analysis (PVA) for selected seabird species	DECC RAG	Proposal
			An inventory of bird survey data of relevance to marine renewable energy and other offshore industries		DECC RAG	2010
			Use of coastal waters by breeding terns (COWRIE)			
				Understanding whooper swan migration patterns and potential interactions with wind farms	DECC RAG	Proposal
			Surveys of marine birds in and around marine areas proposed for wave and tidal energy developments off the west coast of Scotland (excluding Orkney & Pentland Firth).		SNH awarded Q3, 09/10 to RPS.	Due for completion May 2010
			The determination of foraging range and diving depths by diving seabirds, especially in the Orkney and Pentland Firth wave and tidal resource areas.		SNH awarded Q3, 09/10 to RPS.	Due for completion May 2010

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
			Field Surveys to Determine Abundance, Distribution and Flight Patterns of Waterbirds, Seabirds, and Seaducks in the Nearshore Atlantic		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf
	Underwater bird behaviour including use of the water column, seasonal variations, dive depth and dive profile	Greater understanding of underwater bird behaviour	Research undertaken for the MRESF project		RPS	2010
			Review of techniques to detect seabird presence and movement below the sea surface and determine potential application in the vicinity of tidal turbines..		SNH awarded Q3, 09/10 to RPS.	Due for completion May 2010
	The potential for birds to be attracted to wave and tidal devices by lights or for roosting.					
	Collision Risk	Collision risk	Assessment methodology for determining collision impacts of marine renewable energy devices (excluding offshore wind farms) on marine birds		SNH awarded Q3, 09/10 to RPS.	Due for completion July 2010
			Environmental Impact Assessment: WP6 of EquiMar project. Estimating collision risk of fish, birds and marine mammals with submerged devices		EquiMar (University of Edinburgh)	2008-2011
			Potential ecological impacts of a small scale tidal device at the Isle of May SAC.		University of Aberdeen	PhD started end 2008. SNH information indicates extended to March 2013
				Identifying a range of options to prevent avian collision with wind turbines and modelling collision risk against a range of mitigation options, using a UK based case study.	Defra sponsored	Calls for expressions of interest by 18 December 2009
			Will there be evasive movements of birds or bird collisions with turbines?		RAVE - Research at Alpha Ventus (German windfarm)	http://rave.iset.uni-kassel.de/rave/pages/raveEcology
			Are Flying Wildlife Attracted to (or Do they Avoid) Wind Turbines?		Board of Trustees of the University of Illinois (Champaign, IL)	Unknown

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	Monitoring and/or assessing bird interaction and potential exclusion			Investigation of responses of birds in flight to an offshore wind farm	DECC RAG	Proposal
				Measuring the interaction between marine features of a Special Protection Area [Bass Rock gannets] with proposed offshore windfarm development zones through telemetry	DECC RAG	Proposal
				Analysis of ESAS data to investigate potential foraging behaviour-offshore wind farm overlap	DECC RAG	Proposal
				Potential effects on guillemots of displacement from offshore wind farm footprints.	DECC RAG	Proposal
				Developing analytical techniques for visual data collection associated with offshore wind farm development	DECC RAG	Proposal
	Cumulative effects	Cumulative effects	Cumulative effects of planned offshore wind farm development on divers.		MMS	2010-2011
			Assessment methodology for determining cumulative impacts of marine renewable energy devices (excluding offshore wind farms) on marine birds		SNH awarded Q3, 09/10 to RPS.	Due for completion June 2010
	Monitoring Methods		Guidance on Survey and Monitoring in Relation to Marine (Wave and Tide) Renewables Deployments in Scotland.		SNH funded. Awarded to Haskoning 2009.	Due for completion July 2010
Fish ecology	Baseline data		GIS mapping of basking sharks in Welsh waters		On behalf of CCW	Unknown
			Seabed communities in strong tidal streams		EMEC	Unknown
			Anticipated updates to fish spawning and nursery ground maps			Unknown
	Definition of important areas for wider range of species (not solely commercial stocks)			Abundance and distribution of basking sharks and cetaceans in the Pentland Firth and Orkney Waters.	Offered by SNH March 2010	Due for completion June 2010

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	Noise	Site specific noise monitoring data required including public reporting. To include construction, operation and decommissioning.	Literature review of the effects of electro-magnetic fields and noise arising from Marine Renewable Energy infrastructure on Atlantic Salmon, sea trout and European eel.		SNH awarded to Cranfield University February 2010	Due for completion April 2010
			The impacts of acoustic and electromagnetic noise from marine energy conversion devices on the behaviour of organisms		MREDS PhD studentship	Started 2008
			RITE tidal turbine project in New York to determine in-situ risk of fish strike and noise monitoring		RITE	No data yet available
			Acoustic output from devices: acoustic characterisation and monitoring.		SAMS	Unknown
			Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS.		MMS	2009
			RAVE Project - Measurement of the operational underwater noise emission of wind turbines of the alpha ventus offshore wind farm		FH Flensburg - University of Applied Sciences	Unknown
			Effects of Pile Driving Sounds on Auditory and Non-Auditory Tissues of Fish		MMS	http://www.mms.gov/offshore/RenewableEnergy/PDFs/Effects_of_Pile_Driving_on_Fish.pdf
			Underwater acoustic interactions between emerging tidal-energy technologies and vulnerable vertebrates.		SNH	PhD in progress. SNH / SEPA funded PhD with SAMS. Commenced Q2, 2008/09. Expected completion Q2, 2011/12.
	Mitigation		RAVE – hydro sound alpha ventus: Research and testing of a layered bubble curtain in the testfield alpha ventus		Institut für Statik und Dynamik (ISD), Uni Hannover, Menck GmbH, Kaltenkirchen	http://rave.iset.uni-kassel.de/rave/pages/raveHydrosound
	How do site conditions effect noise generation (e.g. piling) and transmission.					

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	Artificial reef effect		Behavioural analyses of pelagic and benthic mobile organisms around energy devices		MREDS PhD studentship	Started 2008
			Offshore renewable energy structures as artificial islands: implications for dispersal, population connectivity, and biogeography of coastal species.		SuperGen PhD	Unclear
			The impacts of offshore power production: mitigation through habitat provision.		SuperGen PhD	Unclear
			The performance of invasive marine species on off-shore artificial structures.		SuperGen PhD	Unclear
			Work at the Race Rocks tidal turbine on artificial reefs		Nothing available at present	
			Potential Artificial Reef Effects of Offshore Wind Facilities. Objectives: evaluate the potential artificial reef effects from the development of OWFs along the Atlantic Coast.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AE_SDP_2009_2011_FINAL.pdf
			Will there be changes in benthic communities and fish fauna that are attributable to the artificial hard substrate used?		RAVE - Research at Alpha Ventus (German windfarm)	http://rave.iset.uni-kassel.de/rave/pages/raveEcology
	Collision risk	Collision risk	Environmental Impact Assessment: WP6 of EquiMar project. Estimating collision risk of fish, birds and marine mammals with submerged devices		EquiMar (University of Edinburgh)	2008-2011
			MRESF project work		RPS	2010
			RITE tidal turbine project in New York to determine in-situ risk of fish strike and noise monitoring		RITE	No data yet available
	Potential for devices to attract fish and methods of deterrent.		Non-physical fish deterrents		Herriot-Watt University	Unknown
	Potential damage to feeding, spawning and nursery areas (particularly from cable routes, anchoring and mooring).					

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	EMF		Study of the Effects of Electromagnetic Fields from Undersea Transmission Lines on Marine Wildlife To Assist in Evaluating Impacts of Renewable Energy Projects on Outer Continental Shelf		MMS	Commissioned 2009
			Literature review of the effects of electro-magnetic fields and noise arising from Marine Renewable Energy infrastructure on Atlantic Salmon, sea trout and European eel.		SNH awarded to Cranfield University February 2010	Due for completion April 2010
	No standard method for determining baseline, monitoring change or determining the effectiveness of mitigation (if possible to define).		Guidance on Survey and Monitoring in Relation to Marine (Wave and Tide) Renewables Deployments in Scotland.		SNH funded. Awarded to Haskoning 2009.	Due for completion July 2010
	Cumulative effects	Cumulative effects				
Plankton	The need for more detailed understanding of the existing baseline is dependant on an improved understanding of potential impact		Work on water column processes and pelagic dynamics		MREDS	Unknown
Benthic ecology	Limited baseline information for Cardigan Bay, around Anglesey and in the Severn Estuary		Extension of HapMap work to include subtidal areas in the Dee and Severn Estuary		CCW	Unknown
	Limited sampling data to inform and characterise benthic habitats offshore in deeper areas where potential projects may be sited					
	Benthic communities in strong tidal streams		Seabed communities in strong tidal streams		EMEC	Unknown
	Sabellaria spp.			Investigation of the genetic diversity of Sabellaria	DECC RAG	

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
				Investigation of the longevity/stability of Sabellaria spinulosa reef features	DECC RAG	Inactive; awaiting further information on aggregate industry studies and outcomes of forthcoming "Sabellaria summit"
	The effect of a reduction in energy, what degree of change is significant and how capable/reliable are the methods available for predicting such change and its significance.		Relating Incident Wave and Current Characteristics to the Morphology of the Kelp Laminaria digitata.		SuperGen PhD	Unclear
			Exploring Links Between Wave Regime Changes and Biotic Assemblages.		SuperGen PhD	Unclear
			A critical unknown for large-scale operation of in-stream turbines are estuary-scale environmental effects.		http://depts.washington.edu/nnmrec/project_env.html	Unknown
			Analysis and assessment of marine habitats and species surveyed by Marine Scotland (Science) in regions of potential wave or tidal power resource.		SNH awarded Q3, 08/09 and Q3 09/10.	Unclear
			Marine Energy Converters: Will They Affect Inshore Ecosystems?		Queens University Belfast Marine Laboratory	Unclear
	The effect of methods of installation other than monopiles, such as gravity base, anchors and moorings.					
	What is the geographic extent of change in physical processes and the relevance for the benthos					
	How do devices that extract energy at the surface or mid depth affect the seabed (stability, depositional characteristics etc)					
	Cumulative effects	Cumulative effects				
	Artificial reef effect		Will there be changes in benthic communities and fish fauna that are attributable to the artificial hard substrate used?		RAVE - Research at Alpha Ventus (German windfarm)	http://rave.iset.uni-kassel.de/rave/pages/raveEcology

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
Designated sites	Uncertainty around the potential for new marine/offshore sites		Possible SACs in Welsh waters (Anglesey reef and Modiolus Beds. Possible seaward extensions of SPAs (query off Pembroke and Lleyn)		JNCC	http://www.jncc.gov.uk/PDF/comm_08P14a.pdf, http://www.jncc.gov.uk/default.aspx?page=4740, http://www.jncc.gov.uk/images/Recommended_extensions.jpg
	General impacts		Potential ecological impacts of a small scale tidal device at the Isle of May Special Area for Conservation (SAC)		SNH	PhD in progress
Shipping	Clarification on shipping clearways (or subsequent successors), their locations and implications for development	Clarity on shipping clearways required				
	Availability of baseline data			Potential for MCA shipping data to be more widely available	MCA?	Stage 1 consultee contacted
	Potential collision risk with devices that are on the surface or subsurface.	Collision risk		Surface collision risk between wave and tidal devices and vessels	MREDS	Unknown
	Potential collision risk with devices that break free.					
	Potential increase in carbon emissions due to vessel diversions					
	Cumulative effects	Cumulative effects				
Tourism and Recreation	Baseline knowledge		Ongoing work on a GIS database of recreational activities in Pembrokeshire		Pembrokeshire Coastal Forum	Interim report available (http://www.pembrokeshirecoastalforum.org.uk/images/stories/SWW%20Recreation%20Audit%20Interim%20Report%202009%20f.pdf).

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
			Synthesis of Existing Information on Recreation and Tourism.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf
	Understanding of exclusion areas that may be required around wave and tidal devices.					
	Understanding of the justification for exclusion zones proposed together with how these could be tailored for different recreational activities.					
	Public perception, particularly regarding visual impacts.	Public perception				
	Noise during construction, operation and decommissioning.					
	Assessment of benefits from different devices and for different activities.					
	Cumulative effects will become increasingly important as developments increase in size and number					
	Cumulative effects	Cumulative effects				
Archaeology	Marked gap in the data within the Cardigan Bay area, which includes a known natural hazard in the form of St Patricks Causeway					
	Lack of data for offshore areas					
	More comprehensive information on recorded losses (and their significance)					

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	Marine geophysical data to attempt to identify currently unknown wrecks					
	Geophysical data to resolve potential submerged landscape features and/or deposits					
	Survey methods		Update and Digitization of Archaeological Baseline Studies Data for the Atlantic Planning Areas.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf
Commercial fisheries	Baseline		Collation of Welsh fisheries data		South Wales Sea Fisheries Committee	On hold
			Further development of marine pressure datalayers and ensuring the socio-economic data and datalayers are developed for use in the planning of marine protected area networks - MB0106.		Defra sponsored, undertaken by Cefas	2008-2010
	The need for exclusion zones around wave and tidal devices and what it may entail.	Potential impact of exclusion zones				
	Potential benefits to fish stocks from fishery exclusion zones		Potential Wave Hub impacts and exclusion zone benefits plus general changes in fish ecology		PRIMaRE	Dependant on Wavehub
			Effect of the Horns Rev 1 offshore wind farm on fish communities.		Orbicon; DTU Aqua (Naturfocus; DHI)	Initiated, reportng December 2010
	Sensitivity of different fishing activities to displacement (including transit routes and fishing grounds).	Sensitivity of different fishing activities to displacement				
				Investigating fishery responses to the construction of an offshore wind farm	DECC RAG	Proposal
			The Economic Impact of OCS Wind Development on Commercial Fishing.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	Potential cumulative effects from exclusion zones (positive and negative)		Marine biomass culture in association with offshore renewables. Proof of-concept study to demonstrate the feasibility and implications of large-scale macroalgae culture in association with offshore renewables e.g. wind farms		SAMS	Funded by NERC 2009
	Cumulative effects	Cumulative effects				
Military Use	Potential conflict with existing use		MRESF project work		RPS	2010
	Potential effect of device deployment	Potential effect of wave and tidal devices				
			MRESF project work		RPS	2011
			RAVE – sonar transponders: Investigation of sonar transponders for offshore wind energy converters and technical integration to an overall concept (re submarines)		Institut für Statik und Dynamik (ISD), Uni Hannover, THALES Instruments GmbH, Institut für technische und angewandte Physik GmbH (itap), Deutsches Windenergie-Institut GmbH (DEWI), BioConsult SH	http://rave.iset.uni-kassel.de/rave/pages/raveSonarTransponders
			Ongoing research programmes to evaluate radar infill, radar processing software and stealth turbine technologies		MoD	Unknown
	Cumulative effects will become increasingly important as developments increase in size and number	Cumulative effects				
			MRESF project work		RPS	2012
Grid Infrastructure	The gap does not relate to data but rather to capacity in required locations					
Cables and pipelines	Certainty in baseline data, particularly accuracy of the location of redundant cables and pipelines					
	Potential for energy extraction to affect mixing and dilution in the vicinity of long sea					

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	outfalls					
	Cumulative effects	Cumulative effects				
Renewable Energy	Cumulative effects	Cumulative effects				
Marine Aggregate Extraction	Lack of information on aggregate wharves and routes travelled between wharf and dredging site					
	Potential for cumulative effects on transit routes and aggregate grounds (concerns primarily relate to navigation issues but also to resource sterilisation)	Cumulative effects				
Oil and Gas	Baseline data		New licensing round			https://www.og.decc.gov.uk/upstream/licensing/26_rnd/index.htm for Welsh waters
	Cumulative effects	Cumulative effects				
Licensed disposal sites	Cumulative effects	Cumulative effects				
Airspace and radar	The need for additional baseline data is dependant on the potential for impact from wave and tidal devices					
	Clarification that wave and tidal devices are unlikely to present an issue for radar	Radar				
	Cumulative effects	Cumulative effects				
CO2 sequestration	Further work to identify potential targets for further evaluation will necessitate the acquisition of existing seismic and well data					

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
	and geophysical work done to date					
	Only when an area of possible sequestration has been identified would it be recommended to acquire new data, if needed, because of the high cost of data acquisition					
	The source of the volumes of CO2 identified for sequestration (as this will probably have implications for the location of sequestration sites)					
General Impacts	Construction		Comparative review of foundations for offshore wind turbines: engineering and environmental considerations		DECC RAG	Commenced December 2009, reporting due March 2010
	Impact assessment methodology		UKERC Energy and Environment theme Phase 2. To develop tools for assessing the environmental impact of energy exploitation/carbon abatement in the marine environment and to optimise opportunities for improved sustainability (including integration of socio-economic valuation of ecosystem goods and services into technology evaluation)		UKERC funded, PML doing	Commenced 2009
			The Provision Of Guidance To Inform The Simplification Of Marine Renewable Energy Development Application Procedures (Including Guidance On EIA/AA)		Scottish Government Research Programme supported by SNH. Awarded Q4 08/09. EMEC / Xodus Aurora.	
	Current understanding		Review of environmental impacts of offshore renewables. Review of the current understanding of the environmental impacts of offshore wind and tidal energy		Rolls Royce funded, PML doing	Commenced 2008

Topic Heading	Data Gap	Stage 1 Priority Datagap?	Research Underway	Research Planned / Proposed	By?	Availability
			Review of potential impacts of wave and tidal renewable energy developments on Scotland's marine environment.		Scottish Government Research Programme supported by SNH. Awarded, Q2, 09/10 to Aquatera	
	Data acquisition		ReDAPT: Reliable Data Acquisition Platform for Tidal.		Rolls Royce (PML, Tidal Generation Ltd, Garrad Hassan, University of Edinburgh, EDF Energy, E.ON, EMEC)	Commenced 2008 (4 year project)
	Monitoring and mitigation		Environmental risk management for the Strangford Lough Turbine.		SMRU, Queens University Belfast	2008-2013
			Strategic Review of Offshore Wind Farm Monitoring Data Associated with FEPA Licence Conditions - ME1117.		Defra funded done by Cefas	2010
			Development of Marine Monitoring Guidelines and Protocols for Wave and Tidal Power Schemes in Scotland		SNH	Unknown
			Alternative Energy and Space-Use Conflicts and Related Mitigation.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf
	Socio-economic aspects of renewable energy development		Alternative Energy Capacity Inventory in Coastal Alaska.		MMS	2010-2012
			Worldwide Synthesis and Analysis of Existing Information Regarding Social and Economic Effects of Alternative Energy Uses on the OCS and Workshop.		MMS	www.mms.gov/offshore/RenewableEnergy/Assets/PDFs/AESDP_2009_2011_FINAL.pdf

Appendix C

Stakeholder List

Developers

Organisations	
AMEC Wind Energy	Open Hydro
Aquamarine Power	Pelmais Wave Power
Atlantis Resource Corporation	Peterbrotherbood and Tidal Hydraulic Generators
AWS Ocean Energy Ltd	Pulse Generation
C-Wave	Renewable Technology Ventures
RES	RWE npower Renewables
Clean Current	Scira Offshore Energy Ltd
Dong Energy	Scotrenewables Ltd
Eclipse Energy	Scottish Power
Tidal Energy Ltd	SSE Renewables
Elsam A/S	Swan Turbines
Embley Energy	Tidal Generation Ltd
EMEC	Triton
Eon	Warwick Energy Ltd
Lunar Energy	Waveberg
Marine Current Turbine	Wave Dragon
Neptune Renewable Energy Ltd	Wavegen
Ocean Power Technology	

Data Sources and Regulators

Organisations	
University of Aberdeen	DECC
DECC Offshore Bird Surveys	DECC RAG
DECC SEA Team	DECC (OREEF, FLOW and NOREL)
Bridgend County Borough Council	British Marine Federation

Organisations	
Campaign for the Protection of Rural Wales	Carbon Trust
Cardigan Bay Marine Wildlife Group	Cefas
Countryside Council for Wales	COWRIE
Cranfield University	Crown Estate
Defra	Department for Transport
DETINI	University of Edinburgh
Environment Agency	Friends of the Earth
Geodata	Glasgow University
Greenpeace	Health and Safety Executive
ICES	JNCC
Lancaster University	Marine Conservation Society
Low Carbon Research Institute	Marine Management Organisation
Marine Data and Information Partnership	Maritime Coastguard Agency
Marine Institute, Sustainable Energy	Natural England
National Trust	North Western and North Wales Sea Fisheries Committee
North Highland College	Peninsula Research Institute for Marine Renewable Energy
Pembrokeshire Coastal Forum	Renewable UK
REA	Robert Gordon University
RenewableUK Cymru	Royal Yachting Association
RSPB	Sea Mammal Research Unit
Scottish Association Marine Science	Shark Trust
Severn Estuary Partnership	South West Regional Development Agency
South Wales Sea Fishery Committee	University of Southampton
Sports Council for Wales	Sustainable Development Commission
Surfers Against Sewage	Trinity House
Swansea University	WCLink
Wave Energy – Denmark	Welsh Local Government Association
Welsh Coastal Maritime Partnership	Welsh Surfing Federation

Organisations	
Welsh Federation of Fishermens Associations	
Whale and Dolphin Conservation Society	The Wildlife Trust West and South Wales
The Wildlife Trust North Wales	WWF

Stakeholders

ABP	Civil Aviation Authority
BHP Billiton	Gloucester Harbour Trustees
BMAPA	MoD
BPA	Oil and Gas UK
Chamber of Shipping	UKCPC
Civil Aviation Authority	UKMPG
Swangrove Estate	