

1. **INTRODUCTION**

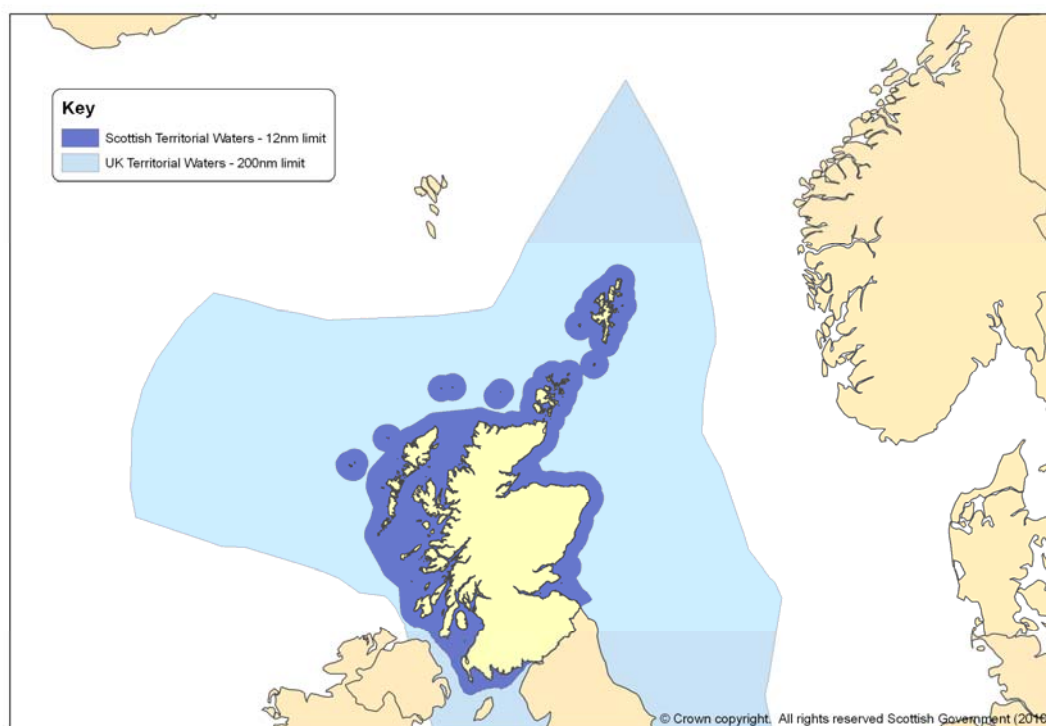
1.1 The Scottish Government has prepared Regional Locational Guidance to facilitate the development of offshore tidal energy Scottish Waters. The Guidance gives consideration to detailed environmental, technical and socio-economic and planning issues in relation to the offshore renewable energy regions of Scotland.

1.1.1 Regional Locational Guidance will be used:

- To provide detailed information in relation to the Areas of Search identified in the 2012 Scoping Report for Tidal Energy Developments in Scottish Waters
- To identify suitable options for inclusion in the sectoral marine planning process.
- To inform key stakeholders and other interested parties of the key regional issues in relation to developing offshore wave energy in Scottish Waters
- To inform the process for determining marine license applications to develop offshore renewable energy in Scottish Waters

1.1.2 This geographical scope of this Regional Locational Guidance covers Scottish Waters (0-200 nautical miles) This includes Scottish Territorial Waters (0-12 nautical miles) and the Scottish Marine Area (12-200 nautical miles) which is executively devolved to Scottish Ministers under the Marine and Coastal Access 2009.

Fig.1 Map of Scottish Marine Area



Offshore Tidal Device Characteristics

1.2.1 Tidal Stream technologies are modular designs which may be sized to match the power demand and conditions in various tidal locations. They may be installed as single devices or as an array of several devices in order to intercept a greater area of the resource. Projects may have the capacity in the range of a few hundred kilowatts for single device installations, to a few hundred megawatts in multiple-device tidal stream power plants.

1.2.2 Similarly to off-shore wave devices, there are currently a number of different tidal devices either deployed or due to be deployed within and around Scotland's waters. Generally, all of the devices are based around turbine technology, the information is as follows:

- **Horizontal Axis Turbines** – these devices work in much the same way as a conventional wind turbine. A turbine is placed in a tidal stream which causes the turbine to rotate about a horizontal axis – similar to a wind turbine;
- **Vertical Axis Turbines** – These devices use the same principle as the horizontal axis turbines, only with a different direction of rotation. A turbine is placed in a tidal stream which causes the turbine to rotate about a vertical axis;
- **Reciprocating Hydrofoils** – These devices have one or more hydrofoils attached to an oscillating arm. The oscillation motion used to produce power is due to the lift created by the tidal stream flowing either side of a wing. The motion can be used to drive a hydraulic system to produce useful power; and
- **Venturi Effect Devices** – These are funnel-like devices which direct the water through a constricted section of a duct, increasing the water velocity and decreasing the pressure. The resultant flow can drive a turbine directly, or the induced pressure differential in the system can drive an air turbine
- **Archimedes Screw** – This is a helical corkscrew shaped device (a helical surface surrounding a central cylindrical shaft). The device draws power from the tidal stream as the water moves up/through the spiral turning the turbine
- **Tidal kite** – the tidal kite is tethered to the sea bed and carries a turbine below the wing. The kite 'flies' in the tidal stream, swooping in a figure-of-eight shape to increase the speed of the water flowing through the turbine

1.2.3 There are also a number of methods to fix the converter to the seabed. The methods for fixing the converters to the seabed are listed below:

- **Seabed Mounted/Gravity Base** – This is physically attached to the seabed or fixed by virtue of its large weight. In some cases, there may be additional fixing to the seabed;
- **Pile Mounted** – this principle is the same, or similar, to that used to mount most large wind turbines, whereby the device is attached to a

pole penetrating the ocean floor. Horizontal axis devices will often be able to yaw about this structure. This may also allow the turbine to be raised about the water level for maintenance;

- **Floating (with 3 sub-divisions)**
- **Flexible mooring** – The device is tethered via a cable/chain to the seabed, allowing considerable freedom of movement. This allows a device to swing as the tidal current direction changes with the tide
- **Rigid mooring** – The device is secured into position using a fixed mooring system, allowing minimal leeway
- **Floating structure** – This allows several turbines to be mounted to a single platform, which can move in relation to changes in sea level
- **Hydrofoil Inducing Downforce** – This device uses a number of hydrofoils mounted on a frame to induce a downforce from the tidal flow. Provided that the ratio of surface areas is such that the downforce generated exceeds the overturning moment, the device will remain in position

Initial Plan Framework

1.3.1 The Initial Plan Framework provides the baseline or start point for the spatial planning of tidal energy in Scottish Waters. The IPF will contain the following categories of planned development:

- Further Areas of Search
- Existing Development Options
- Other developments

Future Development Areas of Search

1.3.2 The development of Locational Guidance was highlighted as required within the 2007 Marine Renewables Strategic Environmental Assessment. Locational Guidance will be used to identify initial plan options which will then be subject to Sustainability Appraisal in order produce draft Plan options. The draft Plan options and the Sustainability Appraisal Reports will then be subject to consultation with statutory authorities and the public. Locational Guidance has been interpreted to consist of 2 distinct stages:

- Scoping Report
- Regional Locational Guidance

- *Scoping Report*

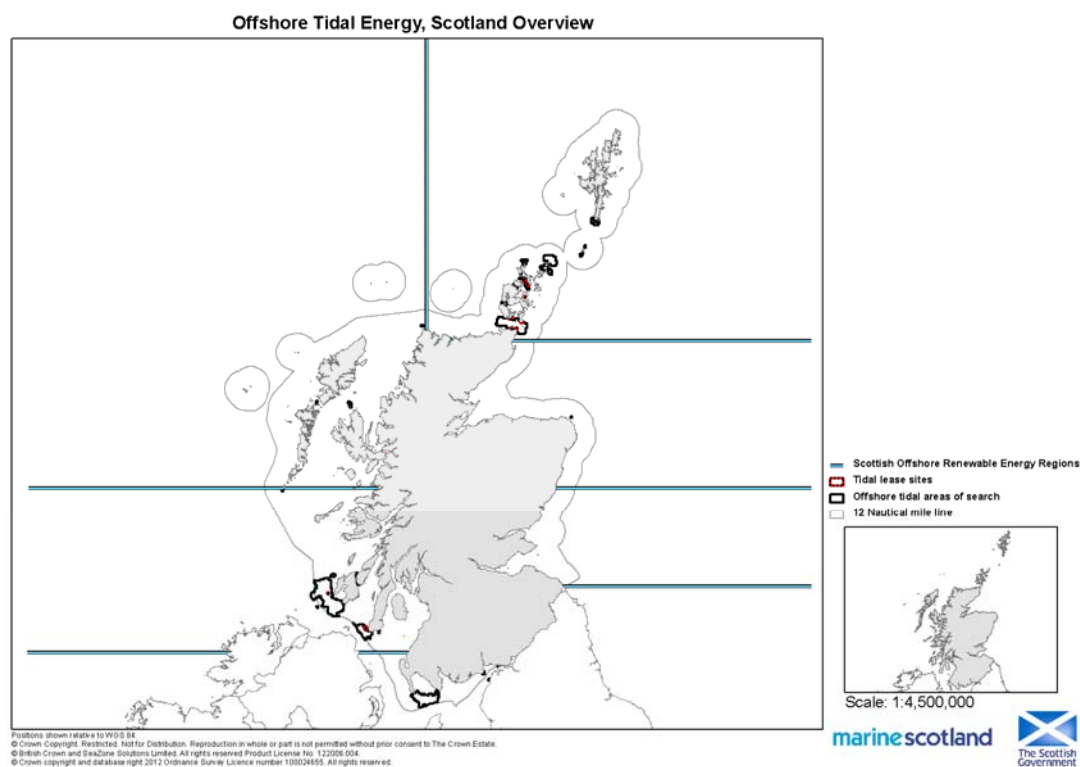
1.3.3 Marine Scotland Science carried out a scoping exercise to identify further areas of search for the development of tidal energy in Scottish Waters, out to the 200 nautical mile limit. The Scottish Government used The Crown Estate's Marine Resource System (MaRS) to help identify areas of resource for wave developments and assess known sectoral and environmental constraints. In July 2012, The Scottish Government published the Scoping

Study for tidal Energy Development in Scottish Waters. Fig.1.1 (below) contains the areas identified within the Report

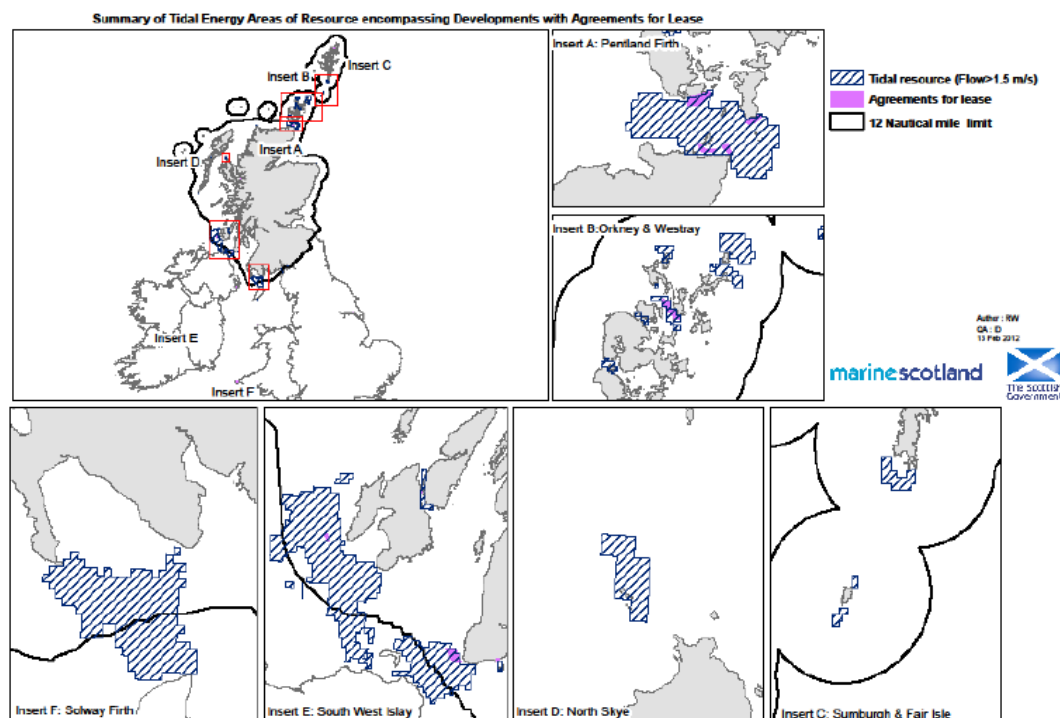
- *Regional Locational Guidance*

1.3.4 Building upon the scoping report, the Scottish Government has considered more detailed environmental, technical and socio-economic issues in relation to the identified areas of opportunity for tidal energy development. The findings of this exercise will be published as Regional Locational Guidance (RLG). RLG can be used to consider a range of practical considerations relevant to Plan options including supply chain, ports and harbours provision, grid provision and connectability, construction and decommissioning requirements to facilitate development and economic growth. The further RLG to be produced will build on the existing Regional Locational Guidance for wave and tidal developments in the Pentland Firth and Orkney Waters¹ and for the Saltire Prize.

Figs.1.1 Areas of Search for Tidal Plan Options



¹ *Ibid*



Pre-Statutory Consultation

- 1.3.5 A pre-consultative programme will be established, involving workshops with relevant sectors and communities in areas adjacent to development options identified in the Draft IPF. The pre-consultation events will be used to highlight the Draft IPF and the SEA, Scoping, Leasing and RLG work which has already been used to populate the Draft Framework and to explain the programme of workstreams planned under the Sustainability Appraisal process. These pre-consultation workshops should allow sectors and communities to feed in specific and local knowledge and issues at the beginning of the process and allow for a better awareness of the Scottish Government's proposals to develop the industry within Scotland's seas.

Initial Plan Framework

- 1.3.6 The next stage in the process is to analyse the issues raised in the non-statutory consultation and apply the information in the Regional Locational Guidance to the Scoping Areas of Search in order to refine these Areas into Plan Options. The Initial Plan Framework (containing the Plan Options) will then be put to Scottish Minister's for approval before for the formal sectoral planning process is commenced.

Existing Options

- 1.3.7 The Initial Plan Framework also contains existing options for the development of tidal energy derived from:
- The Crown Estate Commissioners' Wave and Tidal Lease Bidding Round for the Pentland Firth Strategic Area.

- Marine Scotland's Stage 1 Marine Spatial Plan and Regional Locational Guidance for the Pentland Firth and Orkney Waters.
- Further Leasing Round for wave and tidal energy developments in support of the Saltire Prize Programme.
- The Saltire Prize Scoping Report.
- The Regional Locational Guidance Report in support of the Saltire Prize, identifying 'Areas of Opportunity' for potential Marine Renewable energy development.

Other Developments

1.3.8 In addition to the existing and future developments, the Initial Plan Framework also consider the following other developments:

- All sites at the licensing stage. These sites will be treated as committed development. However, they will also be included in the assessment work to ensure that cumulative and in-combination environmental, economic and social impacts are properly addressed.
- Developments which have an award of 'agreement for lease' from the Crown Estate Commissioners. These include:
 - The Pentland Firth Strategic Area sites.
 - These sites are underpinned by the 2007 Marine Renewables SEA and have also been subject to the Crown Estate Commissioners' Strategic HRA.
 - These sites are now at the marine licence stage and although they will be included within the regional assessment process, they will not be considered as Plan options under investigation.
 - 'The Saltire Prize' sites with agreement for lease.
 - These sites are also at the licensing stage. These sites are 30 MW or less. Although they will be included within the regional assessment process, they will not be considered as Plan options under investigation.

Sustainability Appraisal

1.3.9 The Sustainability Appraisal process for the Sectoral Marine Plan for Tidal Energy in Scottish Waters will comprise:

- Sustainability Appraisal
 - *Strategic Environmental Assessment*
 - *Habitats Regulations Assessment*
 - *Socio-economic Assessment*
- Consultation Analysis

Strategic Environmental Assessment (SEA)

- 1.3.10 The SEA will play a prominent role in the development of the Plan by identifying key environmental receptors, effects and mitigation measures and by providing an early indication of issues to be addressed at the project level.
- 1.3.11 SEA will be applied to test and comment on the existing options for development from a strategic perspective, and as a tool to identify any potential strategic environmental constraints in relation to any future development proposals identified in the Plan-making process. The SEA process will be applicable to strategic and regional level issues. It will not be used to pre-empt project-level environmental assessment. The SEA findings and associated opinions arising from the consultation process will lead to broad recommendations for the Plan as a whole. The findings from the SEA process will also, where appropriate, be used as a starting point for further, more detailed data collection and environmental assessment, either for strategic review at a regional level or for developer project-level assessment.
- 1.3.12 A representative cross-sectoral advisory group made up from Marine Strategy Forum members will be formed to ensure stakeholder involvement in the strategic environmental assessment.

Habitats Regulations Appraisal (HRA)

- 1.3.13 The HRA will be carried out for the existing options and any further options which are identified in the Plan-making process. It will be applied to test the existing and future options for development for significant effects on Natura 2000 sites. The HRA findings and associated opinions arising from the consultation process will lead to alterations of the Plan if it is concluded that a development may result in a significant effect on a Natura 2000 site and that appropriate mitigation measures can not be determined.
- 1.3.14 A representative cross-sectoral advisory group will be formed to ensure stakeholder involvement in the HRA process.

Socio-economic Assessment

- 1.3.15 The Socio-economic Impact Assessment aims to identify the extent to which existing marine activities may be affected by proposals for future plan options for offshore wind energy, and to estimate the potential economic and social consequences arising from their potential interactions. Site-specific or local impacts are not within the scope of the assessment, as these would be more adequately addressed through project-level analyses.
- 1.3.16 A representative cross-sectoral advisory group will be formed to ensure stakeholder involvement in the Socio-Economic Assessment.

Sustainability Appraisal Report

- 1.3.17 The Sustainability Appraisal Report will detail the key findings of the SEA, and Socio-economic Assessment. It will provide an overall assessment of the Draft Plan in relation to achieving sustainable development. The Report will clearly indicate the sections which contain the SEA. To ensure compliance with the Environmental Assessment (Scotland) Act 2005, the Report will be produced in a form that allows the SEA to be read as a stand-alone section.
- 1.3.18 The Sustainability Appraisal Report will be subject to formal consultation with the public and stakeholders for a period of at least 16 weeks and will run concurrently with the consultation on the Draft Plan.

Draft Plan

- 1.3.19 The key findings from the HRA, SEA and Socio-economic Assessment will inform the development of the Draft Plan. The outcomes and key findings of the Locational Guidance will identify the options within the Draft Plan. Plan option categories may be set which take account of likely development timescale order taking into account technology development, installation capability and grid availability and provision.
- 1.3.20 The pre-statutory consultation workshops will ensure consultees are able to engage in discussions to help develop the draft Plan. The Draft Plan will then be subject to minimum formal consultation with the public and stakeholders for a period of 16 weeks.

Statutory Consultation

- 1.3.21 Under the Environmental Assessment (Scotland) Act 2005, there is a requirement to consult on the Draft Plan and the SEA Environmental Report. As the Sectoral Plan is subject to Sustainability Appraisal, the SEA Environmental Report will be subject to consultation as part of the wider Sustainability Appraisal Report. The Statutory Consultation Authorities for the SEA are SNH, the Scottish Environmental Protection Agency (SEPA), Historic Scotland and JNCC (Joint Nature Conservation Committee).
- 1.3.22 Statutory Consultation is also a requirement of HRA (at the appropriate assessment stage). The Statutory Consultation Authority for HRA is Scottish Natural Heritage (SNH). The respective documentation for the HRA and SEA processes will detail the procedures for consultation.
- 1.3.23 The Sustainability Appraisal Report, including the SEA, HRA and Socio-economic assessment will be subject to formal consultation with the public and stakeholders for a period of at least 16 weeks². Where appropriate, extensions will be granted if consultees highlight that they require more time to respond.

² A standard period of 12 weeks is suggested under the Scottish Government's *Consultation: Good Practice Guidance*

Consultation Analysis Report

- 1.3.24 Consultation Analysis aims to ensure that key issues and concerns of the sectors and communities can be taken into account throughout the process. A Consultation Analysis Report will be produced which will detail the consultation responses to the Draft Plan and Sustainability Appraisal Report. The responses will be analysed and summarised and if required, subject to further consultation to ensure an accurate representation of the pre and statutory consultation processes. The key findings outlined in the Consultation Analysis Report will inform the development of the Final Draft Plan.

Repeat Stage if Necessary

- 1.3.25 If significant alterations are made to the Draft Plan as a result of the key findings from statutory consultation, there may be a requirement to undertake further consultation on an amended Draft Plan. This is a requirement of the Environmental Assessment (Scotland) Act 2005.

Final Draft Plan

- 1.3.26 The key findings and recommendations arising from the HRA, SEA, Socio-economic Assessment and Consultation Analysis will inform the development of the Final Draft Plan. The Final Draft Plan will contain the recommended Plan Options for development in relation to tidal energy generation at the strategic level within Scottish Waters.

Scottish Ministers' Approval

- 1.3.27 The Final Draft Plan will be put before Scottish Ministers for adoption. Ministers will decide the actual details of the final Plan and confirm they are content to adopt the Plan.

Adopted Sectoral Plan

- 1.3.28 The Final Draft Plan will contain the adopted Plan Options for development in relation to tidal energy generation at the strategic level within Scottish Waters.

Post-Adoption Statement

- 1.3.29 A Post-Adoption Statement is a requirement of the Environment Assessment (Scotland) Act 2005. The Statement outlines the reasons for choosing the Plan as adopted and details how environmental considerations have been incorporated into the Adopted Plan. It also contains a record of each consultation response and the subsequent actions taken in the plan development process as a result of each response.

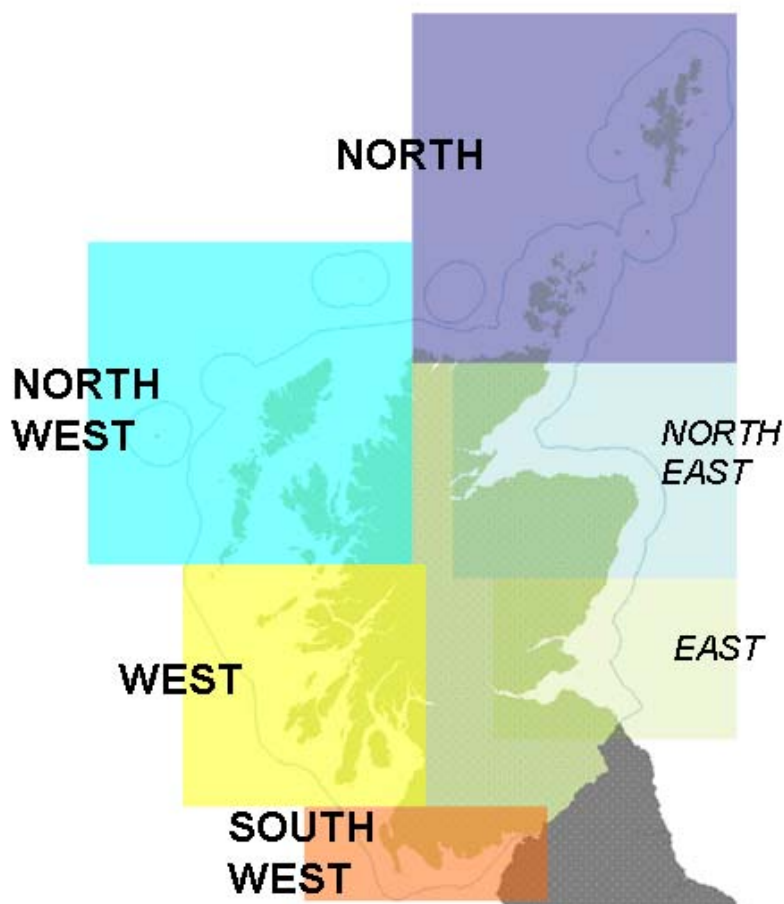
- 1.3.30 The Post-Adoption Statement for the Sectoral Marine Plan for Tidal Energy will also detail how considerations of the findings from the HRA and Socio-economic Assessments have been taken into account in the development of the Plan.

for the Sectoral Marine Plan for Wave Energy will also detail how considerations of the findings from the HRA and Socio-economic Assessments have been taken into account in the development of the Plan.

Regional Locational Guidance Areas

- 1.4.1 The RLG will firstly provide an overview of the Scottish Marine Area.
- 1.4.2 The following sections will focus on regions and areas of search identified on a regional basis within Scottish Waters³. For each topic, where appropriate information is available, there will be:
- An Overview of Information at the SORER level (Scottish Offshore Renewable Energy Region)
 - Information in relation the relevant Areas of Search identified within each Region
- 1.4.3. The Scottish Offshore Renewable Energy Regions (SORERs) are as follows:

Fig.1.3 Scottish Offshore Renewable Energy Regions (SORERs)



- 1.4.3 The East and North East Regions are not included in the following sections as there are no planned developments or future areas of search for tidal energy within these Regions.

³ It should be noted that these regions have no relationship with the Marine Regions being consulted upon under the Marine Planning Legislation

SCOTTISH MARINE AREA – KEY ISSUES

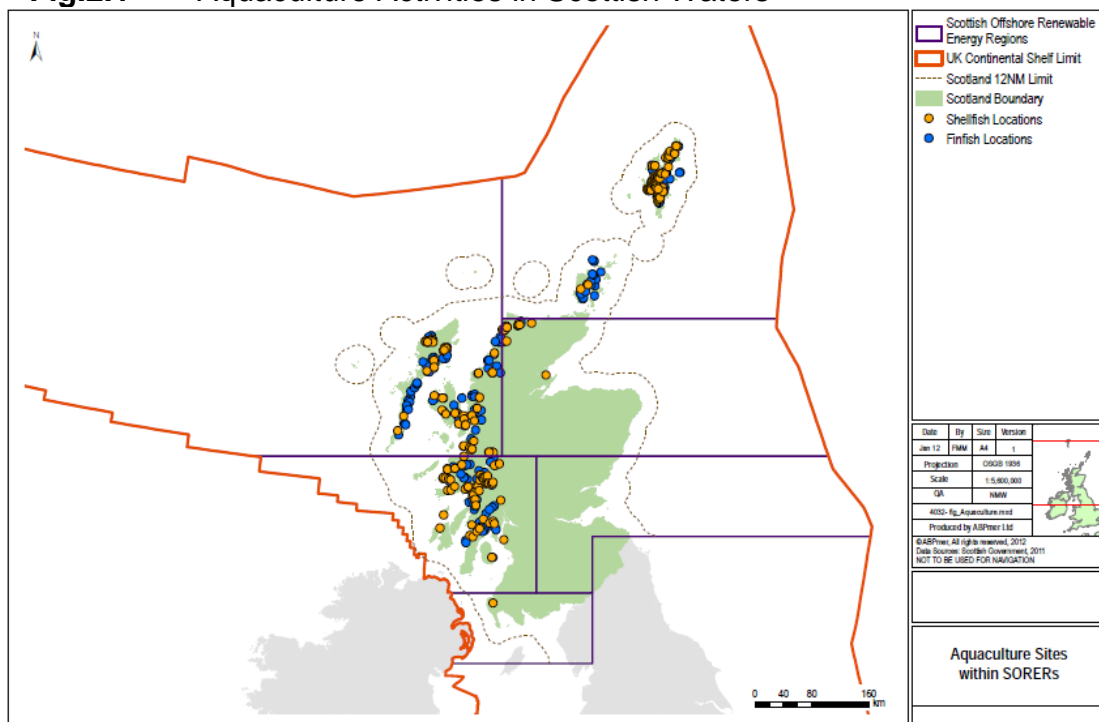
2.1 Resource

- 2.1.1 Tidal stream resource is limited to the locations where sufficiently strong tidal currents occur. These areas are confined to coastal and near shore waters where the large volumes of water involved in tidal fluxes are constrained to pass through firths and sounds (such as the Pentland firth), or round headlands (such as off the south west of Islay).
- 2.1.2 There are currently no areas of Scottish marine waters outside STW where tidal streams are sufficiently fast to generate commercial interest based on current tidal stream technologies.
- 2.1.3 The scoping study report on tidal stream energy (Davies, *et al* , 2012) identified the areas of opportunity and relative levels of constraint for tidal stream energy development. This Regional Locational Guidance (RLG) provides more detailed information on the potential interactions between tidal stream developments and other uses of the sea, emphasising those areas identified in the Scoping Study.
- 2.1.4 In some of the more favourable locations, when the annual mean spring peak flow equals or exceeds 1.5 ms^{-1} the mean annual power density, ie: the amount of energy available at a site that can be converted to power by tidal stream turbines can reach $1.38 \text{ kWatts m}^{-2}$, neap mean annual tidal output can reach $0.76 \text{ kWatts m}^{-2}$ and mean annual spring output $5.48 \text{ kWatts m}^{-2}$.
- 2.1.5 The maximum neap tidal power output can reach up to $6.9 \text{ kWatts m}^{-2}$ at the tidal flows between Eday and Rousay in the Orkney islands. The maximum peak tidal power observed in scottish waters can reach up to $46.3 \text{ kWatts m}^{-2}$ and is generated off the Isle of Stroma in the Pentland Firth.
- 2.1.6 Mean annual peak flow speeds can reach 1.06 ms^{-1} for neap tide and 2.05 ms^{-1} .for spring tide. The maximum mean neap peak flow is 2.38 ms^{-1} and the maximum mean spring peak flow is 4.49 ms^{-1} .
- 2.1.7 In contrast to wind energy tidal stream energy is predictable and consistent, the ebb and flow of sea water amongst land masses is linked to the movements of the moon and the sun and the rotation of the earth, by observing this synchrony, tidal stream activity can be calculated accurately far in advance. It is estimated that the practically achievable resource Scotland could benefit from is 6 Giga Watts (assuming a 33% conversion rate) Carbon Trust Report, 2006.
- 2.1.8 Most of the large tidal resource in Scottish waters is found around Orkney, Islay and the Solway Firth (Ibid) but smaller resources not captured by the 2011 tidal Scoping Study and hence not included in this report exist in various locations and will be examined in future studies.

- 2.1.9 This gives an advantage over wind energy and even wave energy as it allows the potential to 'phase' the developments spatially and temporally in order to achieve maximum resource efficiency and continuity.
- 2.1.10 Given the nature of this resource the suitable areas for exploitation are highly defined unlike wind or wave power. Tidal resource data available (Atlas of UK Marine Renewable Energy Resources) shows that the key tidal stream areas are located in:
- the Pentland Firth,
 - Orkney and Westray,
 - Sumburgh and Fair Isle,
 - North Skye,
 - South west Islay
 - the Solway Firth
- 2.1.11 The selection process for these specific areas took place during the Scoping Study for tidal stream energy (Davies *et al*, 2012). Using the ABP mer resource Atlas tidal data, sites displaying a minimum of 1.5 ms^{-1} mean spring peak tidal current were chosen. This figure was used as an approximation of the minimum speed required by currently available generating devices to achieve an economic return.

2.2 Aquaculture

- 2.2.1 The majority of aquaculture production in Scotland is located in the sheltered lochs, bays and sounds of the Western and Northern Isles and West coast. The main species being farmed include the Atlantic salmon, rainbow and brown trout, mussels, scallops and oysters. Previously, more diverse finfish species were cultivated (i.e. halibut, cod, turbot) but these industries have been in decline and are largely absent from Scottish waters. However, trout species are primarily farmed in freshwater habitats, and as such, this industry is not detailed further in this report. Some other species are cultivated in very small quantities (seaweeds, urchins) but these tend to be research and development projects or small scale enterprises targeting niche high value markets that would be easily saturated. There is some speculation at present about the future expansion of the seaweed aquaculture sector into very large farms in offshore waters producing macroalgae for biomass / renewable fuel production, however it is very uncertain whether this will happen.

Fig.2.1 Aquaculture Activities in Scottish Waters

- 2.2.2 Finfish aquaculture farms are based on floating surface structures using floating cages that are usually circular in shape (ranging from 60-120m circumference) with suspended submerged nets. The depth of the submerged nets should be sufficient to allow adequate clearance above the seabed. Cages are often covered with protective netting to prevent bird predation, and moored using a sub-surface mooring grid anchored to the seabed from the intersections and corners of the grid. The depth of water is related to the length of mooring lines, which can be substantial and may require large areas of sea bed to moor cages in position. Most sites are accompanied by feed/accommodation barges to house feed and staff with separate mooring arrangements to seabed anchors.
- 2.2.3 Shellfish farms tend to be smaller in scale and operate around floating longlines or on rafts with submerged rope ‘droppers’ attached. Shellfish stock are grown on these subsurface vertical ropes (mussels and scallops). Oysters (2 species: native flat oyster and Pacific oyster) are generally grown in bags on trestles in the intertidal zone. Shellfish farms are more variable in type and new technologies are frequently being trialled. Examples of these include technologies such as Smart Farms (suspended nets under floating tubes), use of novel dropper arrangements and the styles of oyster containers used on beaches.
- 2.2.4 Both sectors are dependant on ship based transport for site access from their shore bases, and for harvesting and disease treatments (wellboats for salmon and other finfish farming). There is often transportation of equipment and fish stock by vessel between separate sites as well. It will be important

to consider impacts of any development on shipping to service the aquaculture sector.

- 2.2.5 Finfish and shellfish aquaculture is a growing industry and has a turnover worth around £427 million per year to the Scottish economy at farm gate prices in 2009. Contributions to this turnover included Atlantic salmon (£412 million), rainbow and brown trout (£6 million), halibut (£0.5 million), mussels (£7 million) and other shellfish (£1.4 million). Farmed salmon exports are valued at £285 million annually. Aquaculture exports, largely Atlantic salmon, are Scotland's largest food export (Baxter et al, 2011).
- 2.2.6 Scotland produced 154,156 tonnes of salmon in 2010 at 249 sites, belonging to 30 companies and employing 1,064 people (directly involved in salmon farming). Less than 200 tonnes of other finfish species were produced from farms in the same year. Shellfish farms in Scotland produced 7,199 tonnes of mussels in 2010 from 328 sites owned by 164 businesses and employing 399 staff (directly employed on sites). Less than 300 tonnes of other shellfish species were produced in 2010.

Representation of aquaculture data

- 2.2.7 Aquaculture production figures used in this report taken from the Scottish Fish Farm Production Survey 201⁴ and the Scottish Shellfish Farm Production Survey 2011⁵.
- 2.2.8 Shellfish production data is published in accordance with the following regions – Strathclyde, Highland, Orkney, Shetland and Western Isles.
- 2.2.9 Finfish farm production data is published in accordance with the following regions - North West, Orkney, Shetland, South West and Western Isles.
- 2.2.10 Data concerning active and inactive fish and shellfish farm sites was accessed through View Farms on 28th June 2012.

Aviation

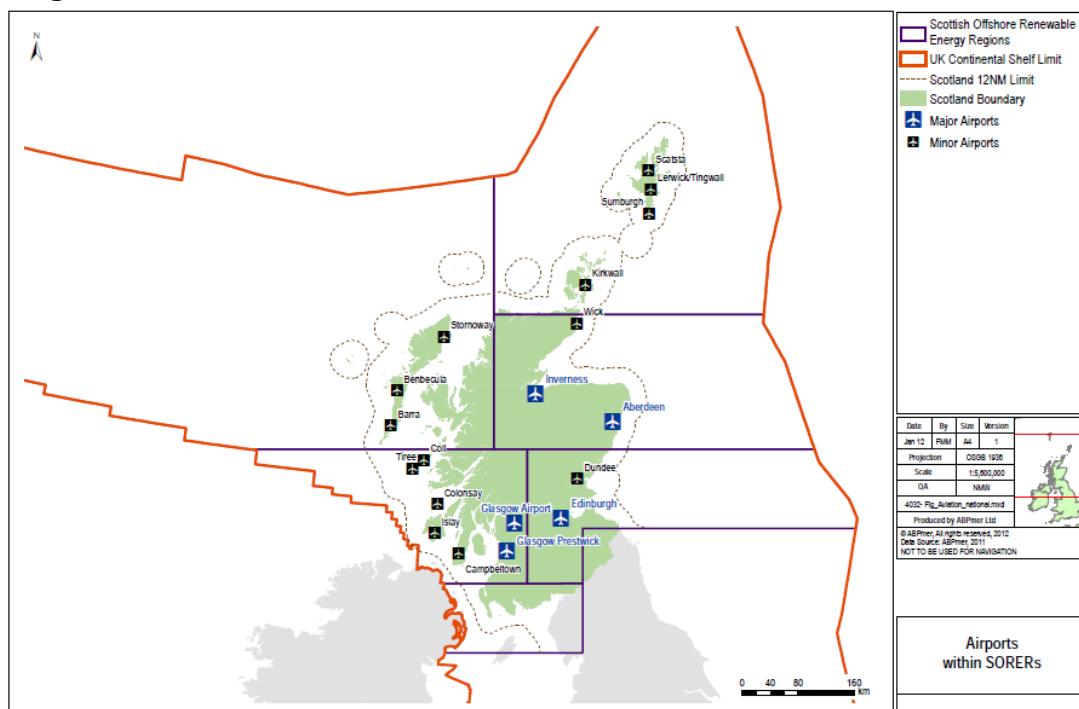
- 2.3.1 Aviation forms a critical component of Scotland's economy by providing both direct access to markets and lifeline services to otherwise inaccessible settlements throughout the mountainous and island terrain.
- 2.3.2 Scotland's five major airports are located in the West (Glasgow and Glasgow Prestwick airports), North East (Inverness and Aberdeen airports) and East (Edinburgh airport). Minor airports are located on the mainland in the East (Dundee airport), North East (Wick airport) and West (Campbeltown airport) and on islands in the North (Scrabster, Lerwick and Sumburgh airports in the Shetlands; Kirkwall airport in the Orkneys), North

⁴ <http://www.scotland.gov.uk/Publications/2011/11/17152846/0>

⁵ <http://www.scotland.gov.uk/Publications/2012/04/7869>

West (Stornoway, Benbecula and Barra airports in the Outer Hebrides) and West (Coll, Colonsay, Tiree and Islay airports). The locations of Scotland's airports is presented in Figure 2.2.

Figure 2.2 Aviation activities in Scotland



2.4 Bathymetry and Seabed

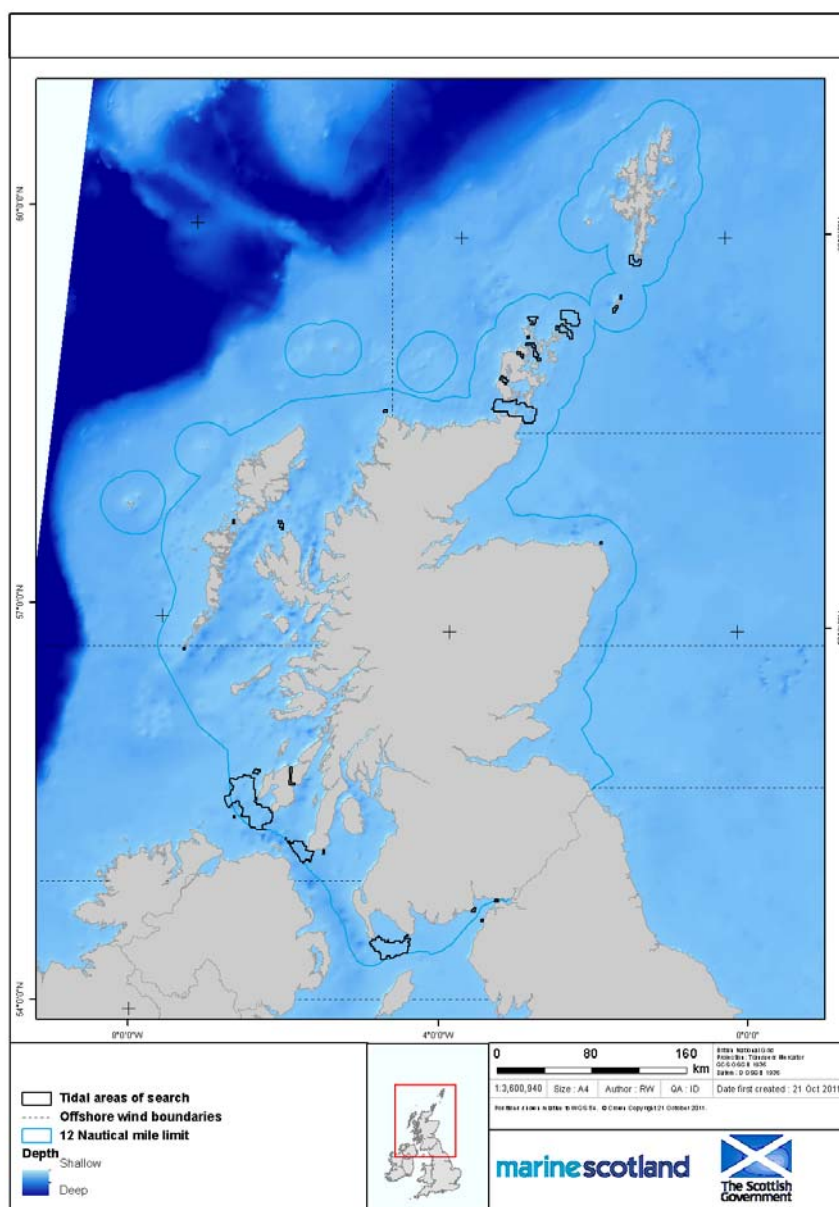
2.4.1 The bathymetry of Scottish waters shows a sharp distinction between the east and west coasts. The east coast bathymetry presents mostly uniform depths and shallow inclines whereas off the west coast the seabed shelves steeply away from the coast such that deep waters occur relatively close to the land. On a closer scale, the picture is more complicated with localised trenches found in waters off the east coast and even plateaux off the west coast. The west coast bathymetry has been deepened by glacial scouring, as demonstrated by sea lochs in the Argyll and Bute area. Hence, the depth range of the Scottish waters off the west coast is highly very variable, with but an estimated average depth could be estimated at of 60 m and with a range of between 10 and 320 m. The east coast presents less small scale variability. The water deepens in an easterly direction towards the North Sea to an average of 100 m. However, deeper sections of up to 200 m exist in the south east Moray Firth, the Devil's Hole and 110 mile Holes. Further north, the average depth also increases and north of the Shetland Isles, the average depth is 110 m inshore of the shelf edge.

2.4.2 The shelf edge or western trench creates a natural bathymetric demarcation that borders Scotland on the west. This trench starts at between 40 and 60 nm to the west of the Hebridean Islands and follows a broadly north-south direction off the west of Scotland, in the west and a northeast-southwest direction further the north. Depths at this point increase rapidly offshore from

around 200 m to more than 2,000 m. Currently, all offshore wind developments and proposals for development are located in the shallower water east of this trench.

2.4.3 Data from the British Geological Society (BGS) has been used to provide information on the sediment types found in the areas this report. This data set describes the type of sediment based on the results of grab samples, collected from the top 100 mm of the seabed, combined with core and dredged samples where available (BGS, 2012). In general, Scottish waters display a wide range of seabed habitats, from scoured rock or coarse sediment to muddy gravel or fine sand. There is a high degree of variability between the coarseness of the substrate, although patches of uniformity were also identified (i.e. the sandy extents in the central North Sea, muddy sand in the north North Sea or rocky outcrops west of Lewis).

Figure 2.3 Bathymetry in Scottish Waters:

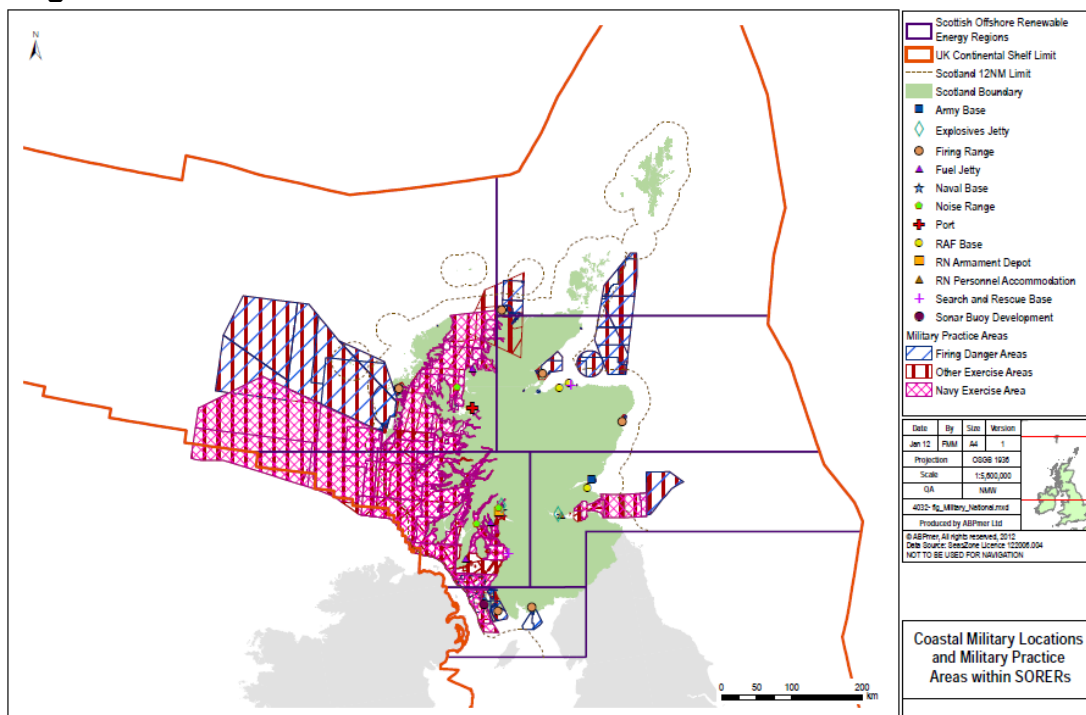


2.5 Cultural Heritage

- 2.5.1 Scotland's coastal and marine environment are rich in cultural heritage. There are many scheduled monuments and listed buildings clustered along the coast, with designated wrecks and military remains sites identified offshore. Key coastal features include a number of Category A listed lighthouses, ecclesiastical remains, military defences, forts and castles. Two of Scotland's World Heritage Sites (St. Kilda and the Heart of Neolithic Orkney) are on the coast, with others (including Hadrian's Wall in England and the Giant's Causeway in Northern Ireland) having the potential to be impacted by offshore development.
- 2.5.2 In addition, the RLG shows that there are many areas close to the coast where offshore archaeological remains are thought to be located, and potentially valued underwater landscapes about which relatively little is known. These areas are potentially vulnerable to offshore energy development, and are likely to trigger requirements for archaeological surveys at the project level.

2.6 Defence

- 2.6.1 The military defence sector makes use of the Scottish coastline for the location of bases and training, and uses the sea for training, testing and evaluation activities. The sector also undertakes the surveillance and monitoring of these waters to detect and respond to potential threats. In this assessment, the military use of the coast and seas by the Royal Navy (submarine bases, jetties and exercise areas), Army (training camps and firing ranges), Royal Air Force (bases, coastal Air Weapon Ranges and Danger Areas) and the Ministry of Defence (MOD) (Defence Testing and Evaluation Ranges to trial weapon systems) (Baxter et al, 2011).
- 2.6.2 Military activities occur in both inshore and offshore waters around Scotland. Principal marine-related defence activities include sea transport by naval vessels and sea training. Activities relating to maritime transport are mainly associated with naval bases and the only naval base in Scotland is Her Majesty's Naval Base (HMNB) Clyde at Faslane in the West Region. Sea training is carried out within defined military practise and exercise (PEXA) training areas. The Navy's Scottish Exercise Areas (SXAs) occur in all SORERs except the North and North East, while firing danger areas and 'other' exercise areas occur in all SORERs. Although the PEXA cover large areas of sea, military exercises cover only a proportion of these areas at any one time and are restricted temporally to a number of weeks per year. The major training exercise each year is the Joint Maritime Course in which Navy, Army and RAF exercises are conducted off the Scottish North West coast and which lasts for two weeks (UKMMAS, 2010).

Figure 2.4 Defence activities in Scottish Waters

2.7 Environment

Coastal and Flood Protection Measures

- 2.7.1 Scottish Natural Heritage (SNH) estimated that 307km of mainland Scotland's coast is comprised of coastal defences (reported in Baxter et al, 2011). Coastal defences are generally located in or adjacent to intertidal areas. All of the coastal and flood defences in Scotland occur within inshore waters in all SORERs except the South West and North SORERs where currently there are no flood or coastal defences.

Designated Sites

- 2.7.2 Scotland has a wide range of habitats and species which are protected under international and national legislation and / or at the local level. The level of protection and therefore sensitivity of different parts of the coast to development varies between regions. The Marine Atlas describes and maps the range of habitats and species. It is estimated that there are around 6,500 species and animals and plants (excluding microbial flora) in Scotland's seas. Of the UK's 350 fish species, it is thought that 250 are found in Scottish Waters.
- 2.7.3 Natura 2000 sites comprise Special Protection Areas (SPA) and Special Areas of Conservation (SAC) designated respectively under two European directives, Directive 79/409/EEC (the Birds Directive) and Council Directive 92/43/EEC (the Habitats Directive).

- 2.7.4 There are 58 SPA with marine / coastal components, and whilst there are no entirely marine SPA in Scotland, scope to introduce such as areas is being explored. Marine SACs have been designated inshore and offshore, to protect coastal lagoons, estuaries, large shallow inlets and bays, mudflats and sandflats, reefs, sandbanks and sea caves, and support bottlenose dolphins, grey and harbour seals. Key features further offshore include Maerl, horse mussel beds, deep water corals or serpulid reefs.
- 2.7.5 Although of Scotland's coastal SPAs support large colonies of seabirds, there is ongoing concern about the continuing decline in the overall seabird population. Marine mammals, including grey and harbour seals and cetaceans (dolphins, porpoises and whales) are also recognised as priority features. Marine plantlife is key to the health of our seas and the species it supports, with Scotland's seas including a wide range of seaweeds, phytoplankton and seagrasses closer to the coast.
- 2.7.6 In addition to Natura 2000 sites, some 56 Sites of Special Scientific Interest (SSSI) in Scotland contain intertidal and seal features of interest. European protected species are wide ranging, covering several different species of seals and cetaceans, birds, plants and fish.
- 2.7.7 Marine Scotland's Nature Conservation Strategy sets out its overall aim to protect and enhance (where appropriate) marine biodiversity and achieve Good Environmental Status under the Marine Strategy Framework Directive (MSFD) by 2020. It takes a three pillared approach: species conservation, site protection, and policies and measures for wider seas. It is intended that this approach forms the basis for planning and decision making across Marine Scotland's activities.
- 2.7.8 The Strategy provides a framework within which an ecologically coherent network of Marine Protected Areas (MPAs), supporting biodiversity and geodiversity, will be identified and designated by 2016. To achieve this, a number of search areas have been identified, where Priority Marine Features can be found. SNH and JNCC are currently providing advice to Marine Scotland on the composition of the network. Consultation on a proposed network of MPAs is expected in 2013.

Landscape Designations – National Overview

- 2.7.9 Scotland has 40 National Scenic Areas (NSAs) covering around 13% of the total land area. NSAs are protected for their high value in aesthetic and landscape terms. Many are found close to the coast in areas including Shetland and Orkney, the Solway coast, Argyll and the Western Isles, Wester Ross, Sutherland and Caithness. Work by SNH exploring the special qualities of NSAs has highlighted the important role which our coasts and the sea play in defining the character of many of these areas.
- 2.7.10 In addition to national level designations, the regional work has shown the importance of local designations in defining the character and sensitivities of coastal landscapes and seascapes. Information on the characteristics of

locally designated areas varies between local authorities, with some areas having long been designated and others emerging from more recent reviews.

- 2.7.11 The European Landscape Convention forms important context for the RLG. This highlights the importance of spaces between designated areas which are not formally recognised and protected, and encourages closer links between people and their landscapes.

Marine Mammals, Basking Sharks, Seals and Seabirds

- 2.7.12 Data has been collected by a range of organisations to various levels of intensity and detail on the distributions of cetaceans, seals, seabirds and basking sharks. As prominent elements of our natural marine heritage, it is important to assess the potential for their interactions with renewable sites through all stages of development. It is not the remit of this report to offer an exhaustive geographic breakdown by species, so more collective methods of displaying these data have been used.

Seabirds at sea

- 2.7.13 Using the European Seabirds at Sea (ESAS, 1984-2004) database as provided by JNCC, Aberdeen, and expression of the relative importance of sea areas to the range of seabird species covered in the database has been developed. The ESAS database analysis full report by Kober, et al 2010 can be downloaded at: <http://www.jncc.gov.uk/page-5622>. The Scottish populations were extracted from the full extent of this data set using the "clip" command in Arc GIS, and the geographical extent of Scottish waters. Two distinct data sub-sets were used: breeding season and winter distributions and these are represented in separate maps.
- 2.7.14 The method involved calculating the proportion of the Scottish population for each species that was reported in each grid square. These values were then scaled by the proportion of birds of each species. The sum of these scaled proportions for all species per grid square was used to create a map of the sensitivity of sea areas in relation to relative abundance by species using a grid scale of 6x6 km. These proportions are shown on the seabird maps in this report. This gives an indication of the relative importance of areas for sea birds and is not driven purely by the total abundance of birds.
- 2.7.15 Many Special Protection Areas (SPA) have been established around Scotland, this report will highlight those that are in the vicinity of offshore wind areas of search and those whose qualifying birds could potentially interact with offshore wind energy sites.

- 2.7.16 SPA selection guidelines⁶:

⁶ taken from "The UK SPA network: its scope and content" <http://jncc.defra.gov.uk/page-2970>

- An area is used regularly by 1% or more of the Great Britain (or in Northern Ireland, the all-Ireland) population of a species listed in Annex I of the Birds Directive (79/409/EEC as amended) in any season;
- An area is used regularly by 1% or more of the biogeographical population of a regularly occurring migratory species (other than those listed in Annex I) in any season;
- An area is used regularly by over 20,000 waterfowl (waterfowl as defined by the Ramsar Convention) or 20,000 seabirds in any season; and
- An area which meets the requirements of one or more of the Stage 2 guidelines in any season, where the application of Stage 1 guidelines 1, 2 or 3 for a species does not identify an adequate suite of most suitable sites for the conservation of that species

2.7.17 Important Bird Areas (IBA) have also been added to the output maps. These areas are small enough to be conserved in their entirety and often already part of a protected-area network. They:

- Hold significant numbers of globally threatened species, or
- Are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species, or
- Have exceptionally large numbers of migratory or congregatory species, as taken from Bird Life International⁷

2.7.18 The Scottish RSPB reserve areas, marine Important Bird Areas (IBA) and Areas of Search (AoS) for inshore waterbird aggregations as investigated by JNCC have been added to the resulting maps.

Cetaceans:

2.7.19 A number of species of cetaceans can be observed all round the Scottish coast and offshore waters. Relatively common species, such as harbour porpoise, white beaked dolphin and minke whale will have greater probability of interaction with offshore renewable energy devices. Rarer but still notable species such as white sided dolphins and killer whales also need to be included in a data presentation describing the distribution of cetaceans.

2.7.20 An integrated map of the importance of sea areas to cetaceans was developed using a similar approach as that used for seabirds at sea. . The data were taken from the cetacean encounter rate data underlying the Atlas of Cetacean Distribution in North-west European Waters (2003). The proportions of the total number of encounters per species per grid square were calculated and summed. The summed scaled data are represented on the maps of cetacean distributions. The resolution of the summed cetacean data is to a quarter of a statistical rectangle (225 nm²). This "gather all" approach precludes the identification of individual species but allows the relative encounter rate for all observed cetaceans in Scottish waters to be overlaid against areas of search and other planned areas.

⁷ <http://www.birdlife.org/action/science/sites/>

Seals:

- 2.7.21 In addition to SACs designated for the protection of harbour and grey seals, other areas of importance to seals were represented using the seal haul out areas developed from the results of the consultation undertaken by Marine Scotland Science in 2011 located at:

<http://www.scotland.gov.uk/Resource/Doc/347210/0115571.pdf> .

- 2.7.22 The draft haul out sites identified for this consultation were derived from data held by Sea Mammal Research Unit (SMRU) after initial consultation with the Natural Environment Research Council (NERC).

Basking Sharks:

- 2.7.23 Data representing the distribution of basking sharks (*Cetorhinus maximus*) was obtained from surveys performed by the Marine Conservation Society. Areas of high numbers of sightings of basking sharks per unit of search effort (SPUE) were used to show the “hotspots” in the observed distribution of this species. These are mainly located off the west coast of Scotland, specifically the area south west of Tiree, south of Barra and Canna Island.
- 2.7.24 Collated sightings data from 1970 to 2010 corroborate this pattern. A small number of sightings have been recorded in the east coast throughout the years in the existing datasets but not sufficient to warrant further analysis. . The higher numbers of basking shark in the west of Scotland can be explained by the relatively high abundance of zooplankton, their favoured prey items, particularly associated with oceanographic fronts which are more prevalent in the west coast of Scotland (Speedie, 2009)

2.8 Fishing

- 2.8.1 Fishing is an important economic activity in Scottish waters and has strong socio-cultural elements in maintaining the vigour and coherence of coastal communities.
- 2.8.2 The location of fishing activities is dependent on the species being targeted. Mackerel is fished in the North Sea from September-December and in the West coast from January-March. Herring is caught in the North sea, around Fair Isle, and Cape Wrath in the summer months. Nephrops fishing is very tightly linked with the areas of muddy seabed favoured by this species. The most actively fished grounds are in the Fladens, Moray Firth, Firth of Forth and the Long Forties in the East. In the west coast, this fishery is active from the North Minch down to the Clyde.
- 2.8.3 Around £500 million worth of fish was landed in 2011 (Scottish Government, fishing statistics) with mackerel and nephrops leading in monetary value (£163 million and £83 million respectively). Whitefish landings accounted for £152 million for the same period, with a decrease in landings for some of the

major species offset by an increase in their sale price. Herring saw a rise in value landed of 46% in 2011 due to increased prices.

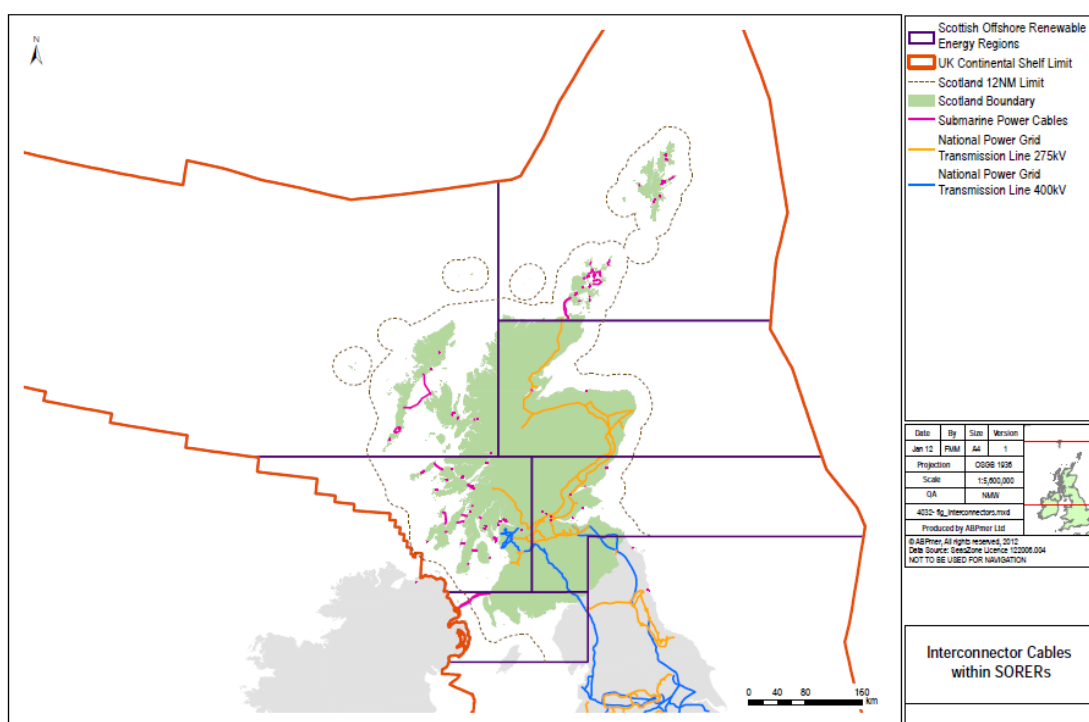
- 2.8.4 Shellfish landings in total added up to £164 million with king scallops (*Pecten maximus*), squid (predominantly *Loligo spp.*) and queen scallops (*Aquipecten opercularis*) some of the other valuable species landed.
- 2.8.5 A variety of sizes of vessel participate in the Scottish fishing industry, from the 70 m pelagic trawlers to the under 10 m inshore creelers. Vessels larger than 15 m in length are obliged to carry a Vessel Monitoring System (VMS) that allows fishery compliance offices to monitor their activity. Vessels smaller than 15 m do not yet have to carry these devices however from October 2012 VMS is planned to be extended down to vessels of 12m. In this report under 15 m vessel activity has been represented using other methods. The value of landings by larger vessels is approximately ten times that of the smaller inshore vessels (MSS, Marine atlas). However, monetary value and the cultural significance of fishing are not necessarily synonymous.
- 2.8.6 Estimates which consider the direct employment in the fisheries sector and indirect economic activity produced as a result of the demand for goods and services by the fisheries sector (for example, supplies such as ice, nets, boxes, fuel and maintenance and chandlery supplies to fishing vessels, packaging and electricity for the processing industry) provide an indication of the overall importance of the fishing sector to the economy as a whole. Fisheries related employment is highly concentrated into relatively few areas, and for these areas the fisheries sector is considerably more important than for Scotland as a whole.
- 2.8.7 In 2007, it was estimated that the total effect on employment (taking account of 'knock-on' or indirect expenditure effects through the economy) of the fish catching industry alone in Scotland was 10,472 full-time equivalent (FTE) jobs. This activity represented £303m (or 0.4%) GDP (i.e. the value of the country's income generated mostly in terms of profits and wages) (BPA, 2008). The number of fishermen employed on Scottish based vessels was 5,218 in 2010. Of these, 4,257 were regular, 909 were part-time and 52 were crofters. Fraserburgh has the highest number of fishermen in employment at 789 fishermen, followed by Ayr with 559 and Shetland with 448. The largest number of part-time fishermen is found on vessels administered by Shetland (217).
- 2.8.8 The processing and preserving of fish and fish products in Scotland provided a value of £255 million and a turnover of £898 million in 2007 (Baxter et al., 2011). In 2010 the number of people employed in fish processing and retail activities in Scotland was 7,217, of which 6,385 were full time and 846 were in part-time positions.

Representation of fishery data

- 2.8.9 Sensitive areas for commercial fish have been mapped using the extent of the spawning and nursery areas calculated from survey data, species specific and local knowledge of fish life history, as reported by Coull et al., 1998. This report has been extensively used by the oil and gas industry and is now used by the renewables industry to assist them with assessment of the relative importance of location and time of year for potential interactions with spawning and juvenile fish. Commercial species covered by the underlying information include: mackerel, herring, cod, haddock, whiting, saithe, plaice, lemon sole, sole, norway pout, blue whiting, sandeels, sprat and one species of shellfish, nephrops.
- 2.8.10 The maps used in this RLG represent counts of the numbers of overlapping layers of spawning and nursery grounds in each grid square. The data is expressed in this way to offer a cumulative level of likelihood of interaction. It is recognised that fishery sensitivities should be considered on an individual basis as some will present a higher sensitivity than others to different interactions. And this representation is merely indicative of the number of species active in any month in any one spatial extent.
- 2.8.11 This data are currently being reviewed and the resulting outputs were not ready to be included in this report.

2.9 Infrastructure and Grid Provision

- 2.9.1 Scotland's transmission grid is mainly made up of 400 kV and 275 kV lines which join the major nuclear and coal fired power stations in the central belt with the Peterhead plant in North East Scotland (Scottish Council for Development and Industry, 2008). The Scottish grid is connected to the English grid with four transmission lines which form two double circuits; on the East, the circuit operates at 400 kV, whilst on the West, part of the circuit operates at 400 kV and the remainder runs at 275 kV (ibid). Connection between Scotland and Northern Ireland is via the 500 MW Moyle Interconnector which joins Ballantrae with Ballylumford (Scottish Council for Development and Industry, 2008).
- 2.9.2 There are 900km of submarine power cables in Scottish waters (Baxter et al, 2011) predominately created to connect island communities to the mainland national grid infrastructure (UKMMAS, 2010). This is reflected in Figure 2.4 which shows subsea grid infrastructure connections in inshore waters between areas of mainland Scotland and between the mainland and islands in all SORERs except the North East SORER. Note, subsea power cables to/from developments (e.g. Oil and Gas platforms) are not shown in Figure 2.5.

Fig.2.5 Interconnector cables around Scotland

- 2.9.3 The electricity transmission system (the grid) in Scotland has become increasingly constrained due to the increasing volume of renewable energy projects connecting to it in recent years.
- 2.9.4 In the north of Scotland, the grid was designed and built to deliver electricity to people's homes (and to utilise the hydro stations built in the 50s and 60s) – not to connect the vast amounts of renewable energy which are now being generated.
- 2.9.5 In the Central Belt and southern Scotland, Scottish Power's network is not quite as congested, but the interconnectors over the border to England are now a significant pinch point in the system and require reinforcement.
- 2.9.6 In the north of Scotland, the transmission system operator is SHETL (Scottish Hydro Electric Transmission Limited), and in the Central Belt and south it is Scottish Power Transmission Limited. National Grid is the GB transmission system operator.
- 2.9.7 SHEPD (Scottish Hydro Electric Power Distribution, SSE's distribution arm) is experiencing similar problems. In many areas, it can now only offer connections of less than 50 kW. Although this seems like an arbitrary figure, this is due to the fact it is the cut-off point, beyond which SHEPD must refer connection applications to National Grid for assessment of reinforcement that the generation may cause for the transmission system (and this generates a fee of £25K for the prospective generator – although SHETL has cut this to £2K as it knows there is no capacity). At root, then, this is also a transmission congestion problem.

Figure 2.6 Offshore Renewable Energy and Grid Upgrades

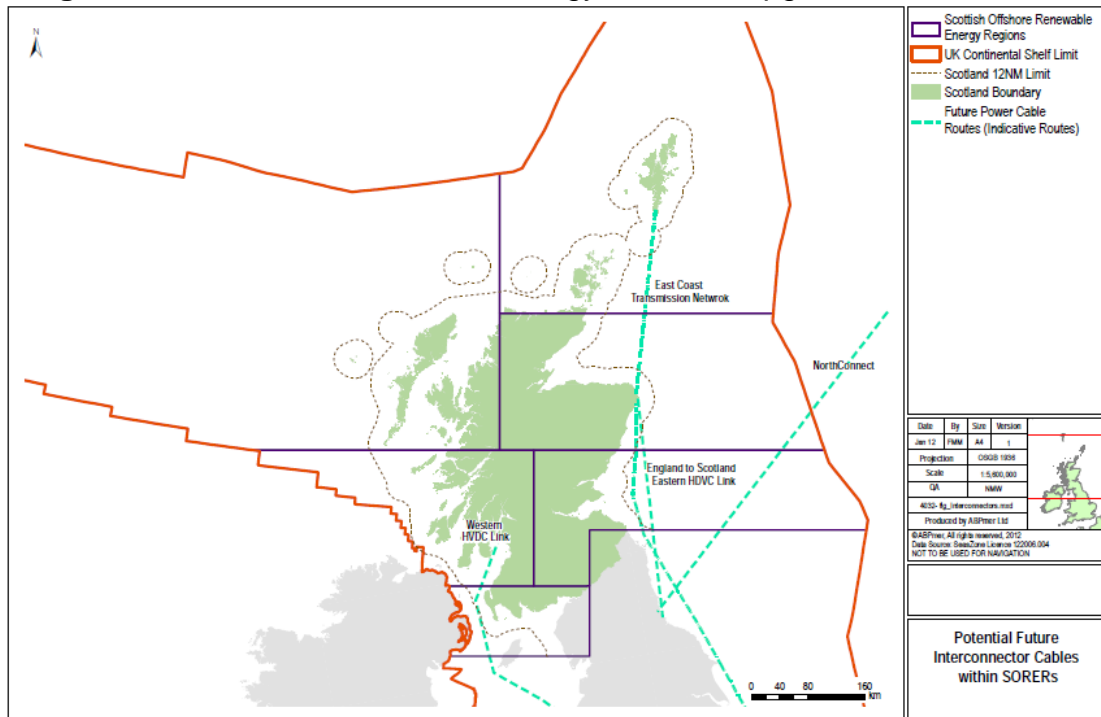


Table 2.1 Summary of key projects in plans and environmental assessment to date

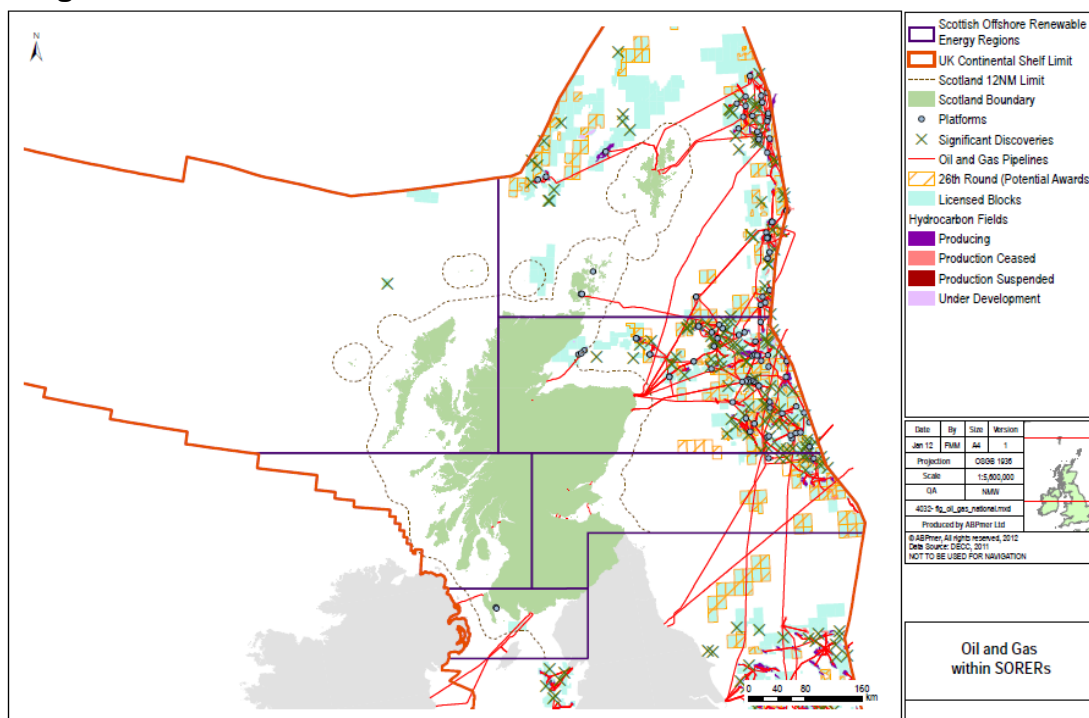
Project	National Development	ENSG refresh	EGPS	DECC	Project level
Orkney – Caithness connection	Part (upgrade)	Yes	Yes	No	Yes – EA
New Caithness / Moray / Shetland Link	Part (Shetland component)	Yes	Yes	No	Part
<i>Connection to Lintmill</i>	No	No	No	Yes	Presume ongoing – round 3
<i>Connection to Blackhillock</i>	No	No	No	Yes	Presume ongoing – round 3
<i>Connection to Peterhead</i>	No	No	No	Yes	Presume ongoing – round 3
Peterhead to Hawthorn Pit (East Bootstrap)	No	Yes	Yes	No	No?
<i>Onshore connection to Torness / Cockenzie / Branxton</i>	No	No	No	Yes	Presume ongoing – round 3
<i>Onshore connection to Tealing / Arbroath</i>	No	No	No	Yes	Presume ongoing – round 3
Torness to Lackenby Head HVDC cable	No	Yes	Yes	Yes	No?
ISLES project	No	No	Yes	No	Initial – further required
SPT link Hunterston to North Wales (western bootstrap)	No	Yes	Yes	No	Yes
South West Scotland Transmission Line	Yes	Yes	Yes	No	Yes
Kintyre to Hunterston	Candidate	Yes	Yes	No	Yes (EA)
Western Isles to Beaully HVDC link	Yes	Yes	Yes	No	Yes (EA)

2.10 Oil and Gas

2.10.1 There is extensive infrastructure associated with Oil and Gas developments in Scotland, including seabed and platform mounted production facilities and networks of pipelines bringing Oil and Gas ashore for processing (Baxter et al, 2011). Pipelines associated with Oil and Gas in Scotland are estimated to

be 12,800km in length although the majority of pipelines exist outwith the 12 nm limit (i.e. offshore) around the coast. Virtually all hydrocarbon fields, platforms, pipelines and infrastructure occur within the North, North East and East SORERs in the North Sea, with the exception of some licensed blocks in the North West and South West SORERs, and three interconnector pipelines within the South West SORER which take gas across the Irish Sea. There is currently no gas storage activity in Scottish Waters (Baxter et al, 2011).

Fig.2.7 Oil and Gas activities in Scottish Waters



2.10.2 The industry is a major employer. It was estimated that in 2010, the Oil and Gas industry provided employment for about 440,000 people across the UK, of which 32,000 were directly employed by Oil and Gas companies and major contractors. Exploration and extraction of oils and gas from the UKCS accounted for the majority of these jobs, providing around 340,000 jobs in 2010, plus 207,000 employed in the wider supply chain and 100,000 in jobs induced by the economic activities of employees. An additional 100,000 jobs were estimated to be supported by the Oil and Gas supply chain's growing export business, bringing the total employment provided by the sector to about 440,000 jobs in 2010 (Oil and Gas UK, 2011). About 45% of the 340,000 UKCS related jobs (i.e. about 153,000) are located in Scotland not only in major cities such as Aberdeen, but across the whole of Scotland including the remoter areas of the country (Oil and Gas UK, 2011).

2.11 Planning Issues

- 2.11.1 National, city-region and local development plans aim to strike an appropriate balance between supporting sustainable economic growth, and protecting and enhancing quality of life and the environment.
- 2.11.2 Informal consultation on the RLG scoping document highlighted a number of local authorities where planning policies are driven by a commitment to economic development. In particular, there is support for realising the opportunities arising for ports and harbours identified in the National Renewables Infrastructure Plan, and it is expected that Enterprise Areas will also feature in future revisions of existing and emerging Strategic and Local Development Plans.
- 2.11.3 Some local authorities have prepared Supplementary Planning Guidance, providing spatial frameworks for onshore wind energy development, usually focusing on larger scale proposals (>20 MW). To date, this local guidance has focused mainly on terrestrial activities and its impacts, but in some cases consideration has been given to the implications of coastal or inshore development proposals. In many cases, the spatial guidance has been developed through the use of constraints mapping to highlight areas of varying levels of sensitivity to this type of development. Scottish Ministers recently wrote to all local authorities to ask them to ensure they have in place up to date spatial frameworks, and to increase the weight afforded to the guidance by incorporating it into formal development plans for each area.
- 2.11.4 The National Planning Framework sits at the top of Scotland's hierarchy of development plans. The second National Planning Framework (NPF2) was published in June 2009, and work will start on NPF3 in September 2012, with a view to adoption in 2014. The Scottish Government published a NPF Monitoring Report earlier in 2012, which identified key changes and trends since NPF2 was published. It highlighted the significant opportunities arising from plans for offshore wind, wave and tidal energy and emerging grid infrastructure improvements. It is anticipated that NPF3 will seek to ensure planning supports sustainable economic growth by facilitating onshore economic development, supply chain and distribution opportunities.
- 2.11.5 Synergies and conflicts between on and offshore wind energy developments and their impacts, cumulative effects assessment and linking marine licensing and onshore planning policies and decisions are likely to remain key challenges for both on and offshore planning regimes.

2.12 Ports and Harbours

- 2.12.1 Ports provide the modal interchange points by which goods and people are transported from land to sea. Harbours are by definition, safe havens for vessels to reside and are often commensurate with ports areas. Within Scottish waters, the ports and harbours sector supports the largest fishing

industry in the UK, provides facilities for a significant offshore Oil and Gas industry, as well as maintaining ferry links to island communities and providing the recreational sector with support services.

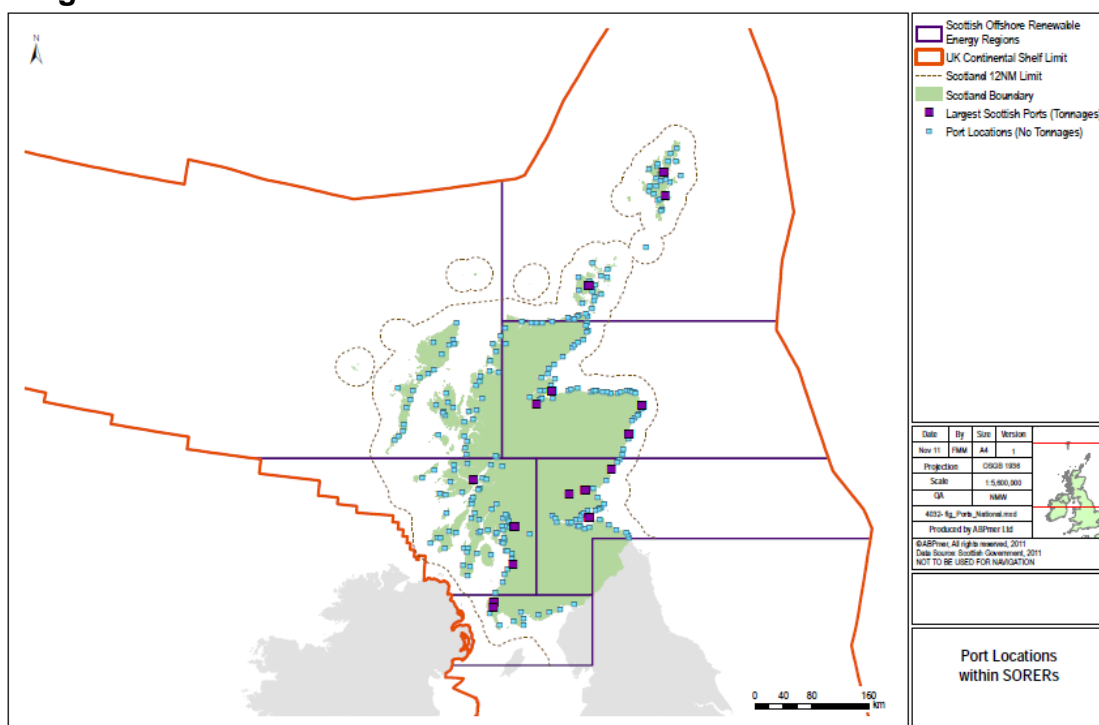
2.12.1 There are three types of port ownership in Scotland: Trust, Municipal and Private. All ports operate on a commercial basis, independently from Government. Duties and responsibilities are conferred by legislation tailored to each Port, with port operations administered by Statutory Harbour Authorities (SHA). There are 15 Scottish ports are classified by the Department for Transport (DfT) under the EC Maritime Statistics Directive as a major port, generally because they handled at least 1 million tonnes of cargo per year. These are namely:

- Aberdeen;
- Ayr;
- Cairnryan;
- Clyde (Ports Group);
- Cromarty Firth;
- Forth (Ports Group);
- Glensanda;
- Inverness;
- Lerwick;
- Montrose;
- Orkney;
- Perth;
- Peterhead;
- Stranraer; and
- Sullom Voe.

2.12.8 There are around 270 ports and harbours in Scottish waters, ranging from very small piers and landing stages, to those with major facilities. They include:

- Large Oil and Gas terminals, e.g. Hound Point (Firth of Forth), Sullom Voe (Shetland), Flotta (Scapa Flow, Orkney);
- Large quarry product port - Glensanda;
- Large fishing ports, e.g. Peterhead, Fraserburgh;
- Smaller fishing ports, e.g. Buckie, Mallaig;
- Oil supply ports, e.g. Aberdeen, Cromarty Firth;
- Multi-purpose ports, e.g. Leith, Clyde;
- Large container ports - Grangemouth;
- Major ferry ports serving Ireland and Europe - Cairnryan, Stranraer and Rosyth – as well as lifeline ferry services within Scotland;
- Marine Works serving as pier heads for ferry services to Scotland's islands and for working boats associated with fish farm installations; and
- Marina facilities, e.g. Fairlie, Craobh Haven, Port Edgar.

2.12.9 Fig.2.8 (below) contains an overview of the Ports and Harbours around Scotland.

Fig.2.8 Ports and Harbours around Scotland

National Renewables Infrastructure Plan

2.12.10 Published in July 2010 by Scottish Enterprise (SE) and Highlands and Islands Enterprise (HIE) National Renewables Infrastructure Plan (N-RIP) Stage 2 identified the potential investment requirements in three broad geographic manufacturing clusters – Forth/Tay, Moray Firth and West Coast and a subsea operations and maintenance cluster – Aberdeen/Peterhead.

2.12.11 The Stage 2 report highlighted that there were two main elements to progressing the readiness of these locations for use:

- Suitability for use – Ensuring that the potential use of the site for this industry is appropriate, bearing in mind the need to ensure sustainable development and that the environmental impacts of the development are considered and taken on board in the planning and design phase of the development. This requires each site to progress through the range of appropriate consenting processes; and
- Asset owners making the investment required in site infrastructure to make them ready for use.

2.12.12 Following the publication of the Stage 2 report both SE and HIE have been engaged in a range of discussions with the site owners regarding the development of the sites for offshore renewables use.

2.13 Recreation

Recreational Angling

- 2.13.1 Sea angling is carried out along most of the Scottish coastline mostly within 6 nm. The Scottish Sea Angling Conservation Network (SSACN) highest densities of anglers are found in the more heavily populated areas of coast around Glasgow, Clyde, Edinburgh and Fife (Baxter et al. 2011). Sea angling launch points are also heavily concentrated along the Argyll Coast and Islands, Solway Firth, Firth of Clyde, Firth of Tay, North Coast, and East Grampian Coast (Land Use Consultants, 2007).
- 2.13.2 Radford et al (2009) estimated a total expenditure of £141 million on sea angling in 2008. Sea angling in Scotland also supported 3,148 FTE jobs in 2008, representing an income of £69.67million (Radford et al., 2009).

Recreational Boating

- 2.13.3 The UK Atlas of Recreational Boating (RYA, 2005) and data from the Royal Yachting Association (RYA) indicates that recreational boating within Scotland is concentrated in the Clyde and along the West Coast, the Moray Firth, Solway Firth and the Firths of Tay and Forth which are the traditional cruising grounds for recreational sailors and power boaters. However, recent developments along the East Coast, and within the Orkney and Shetland Isles, have increased the potential for cruising routes between the Caledonian Canal and the Shetlands with well placed facilities and stopping points en route. The RYA's Position Statement on offshore energy developments (RYA, 2009), which encompasses the whole of the UK, notes that most of the general day sailing and racing areas are close to the shore.
- 2.13.4 Indicative estimates of the number of people participating in sailing and power/motor boating activities in Scotland can be taken from the British Marine Federation (BMF) Water sports and Leisure Participation Survey 2009 (BMF et al., 2009). This report estimated that in 2009, 57,047 people participated in sailboat activities and/or yacht cruising, 12,486 participated in sailboat and/or yacht racing and that 49,015 engaged in motor boating/cruising or canal boating.
- 2.13.5 The Scottish Coast, and particularly the West coast, is identified as being one of the World's premier destinations for sailing. Recreational boating and marine and sailing tourism contribute about £300 million to the Scottish economy. Overall, the sector is expected to grow in the long term (UKMMAS, 2010). An assessment of the current economic impact of sailing in Scotland was undertaken by Scottish Enterprise (2010) and indicated that there is a total berthing / mooring capacity available across Scotland for 12,500 vessels. It stated that the value of the market could increase from its current value of £101 million to £145 million after 10 years. The same report also provided a breakdown of the economic value of sailing and the number of berths in different regions of Scotland and these results are described in each of the relevant regional sections below.

2.13.6 In Scotland, the BMF estimates that in 2009/10, the total turnover of the leisure, super yacht and small commercial marine industry was £92.7million (BMF, 2010). Of this, the 'value added contribution' which is the principal measure of national economic benefit was £29.2million. This study focuses more on business values (such as boat building, specialised equipment manufacture, sales, training, consumer services, insurance services and finance) than the Scottish Enterprise (2010) study which is more focused on expenditure related values of boat owners and visiting tourists. The industry in Scotland supported around 1,579 FTE jobs. However, it should be noted that a proportion of this revenue comes from inland activities. UKMMAS (2010) estimated that 62% of the total value in 2006/07 related to the marine environment. Using the same proportion, the indicative total value related to the marine environment in 2009/10 was £57.5million.

Water Sports

2.13.7 The main marine water sports undertaken in Scotland are recreational angling, surfing, windsurfing, sea kayaking, small sail boat activities (such as dinghy sailing) and scuba diving (BMF et al., 2009; Marine Scotland, 2011a).

2.13.8 Indicative estimates of the number of people participating in water sports activities in Scotland have been taken from the BMF Water sports and Leisure Participation Survey 2009 (BMF et al., 2009). This report estimated that 52,869 adults (>16 years) participated in surfing, 23,952 adults participated in windsurfing, 12,443 in scuba diving, 37,416 participated in canoeing and 23,937 in small sail boat activities. Radford et al (2009) estimated that 125,188 adults and 23,445 children went sea angling in Scotland in 2008.

2.13.9 Separately, Surfers Against Sewage (SAS, 2010) conducted an initial study into the number of recreational water users in Scotland in 2010 and estimated that there were approximately 300,000 recreational water users (this number included surfers, windsurfers, and kayakers amongst a range of other activities) using the coastal waters of Scotland. A summary of the distribution of different water sports, highlighting key areas activities in Scotland is described below.

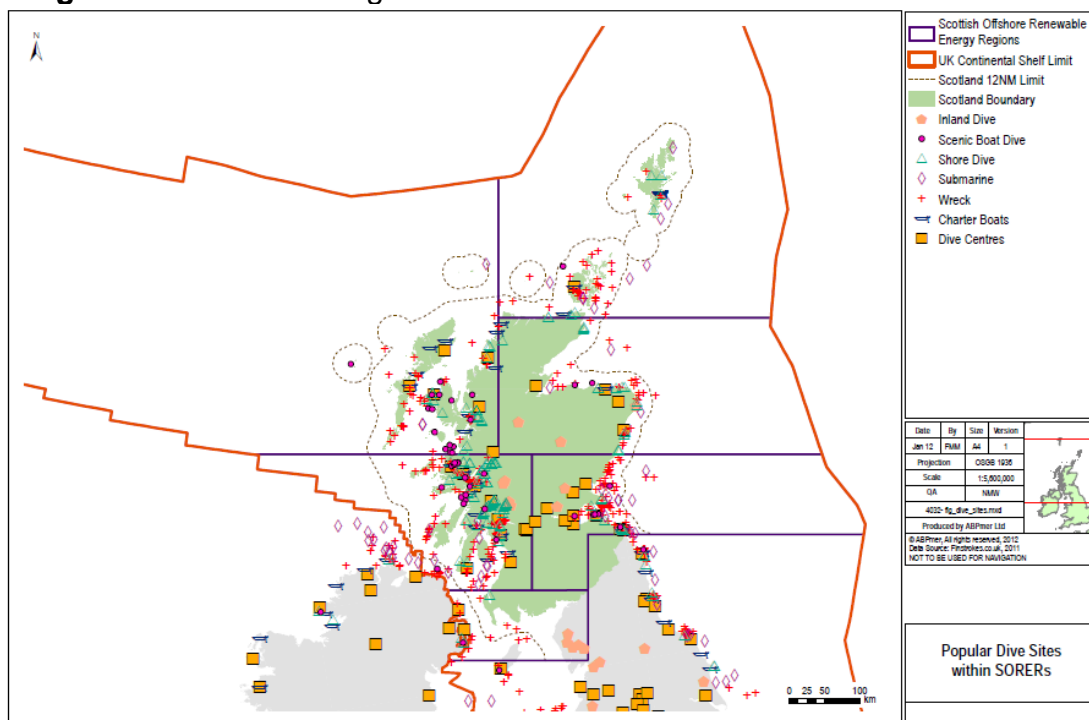
2.13.10 A survey looking into marine and coastal recreation in Scotland commissioned by SNH found that overall, around 87% of all recorded visits to the coast were day trips. Above average proportions of short-breaks or weekend visits were made by sea and shoreline anglers, and divers and snorkelers (Land Use Consultants, 2007).

Scuba Diving

2.13.11 The most popular locations for scuba diving around Scotland are Scapa Flow, Orkney (considered to be one of the best wreck diving areas in the world) and the Voluntary Marine Reserve of St Abbs and Eyemouth off the Berwickshire coastline. The islands of the inner Hebrides, the Firth of Forth

and coast to the Scottish border, all of the East coast from North of Dundee to the Dornoch Firth are also popular diving destinations (Land Use Consultants, 2007; Baxter et al, 2011; Scottish Executive, 2007; UKMMAS, 2010).

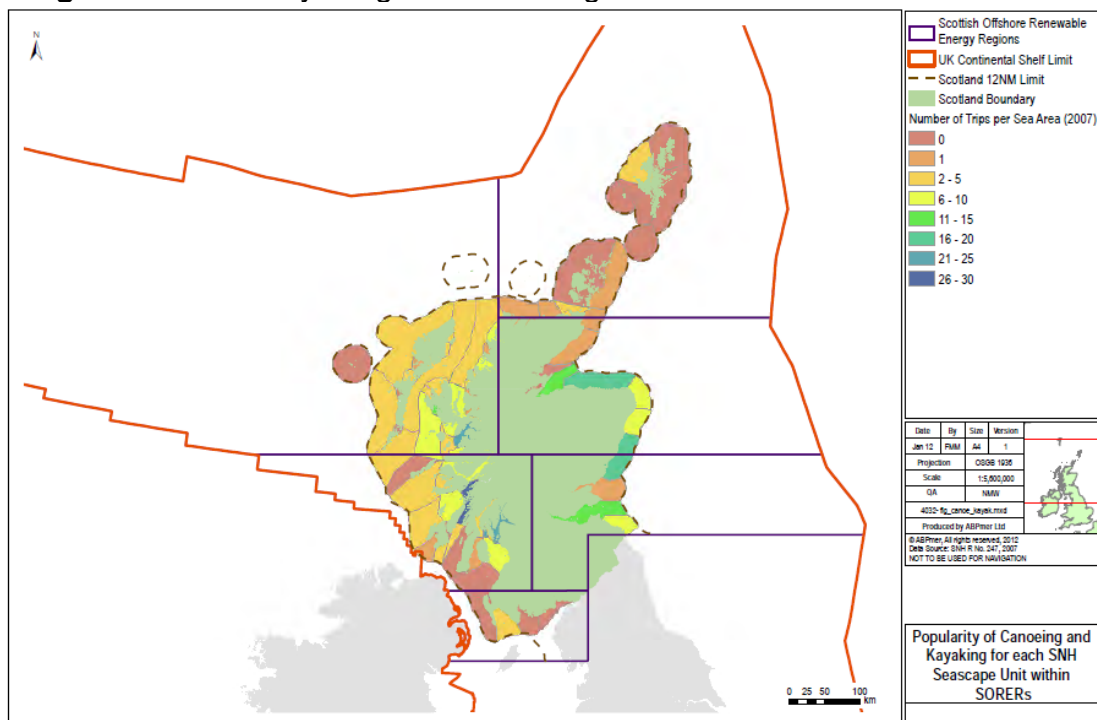
Figure 2.7 Scuba Diving sites around Scotland



Sea Kayaking

2.13.12 The majority of sea kayaking is undertaken close inshore, exploring interesting aspects of the coast such as sea caves, inlets and wildlife. Safety issues and a lack of interesting features in general prevent kayaking further offshore. However, open crossings (between two points such as a headland and an offshore island), often through strong tidal currents are regularly undertaken by more experienced sea kayakers. Unlike other water sports activities which are often undertaken in relatively discrete areas (such as a surf spot or diving site), sea kayaking has the potential to be undertaken along much of the Scottish coast and is only constrained by the availability of suitable launching spots such as beaches or slipways. Popular kayaking areas include the Inner Hebrides, East Grampian Coast, Firth of Clyde and Firth of Forth (Land Use Consultants, 2007). The Scottish Canoeing Association undertook an online survey of sea kayakers in 2011. The survey had a total of 392 respondents. The survey found that the most popular areas for sea kayaking in Scotland was Arisaig, Knoydart, Sound of Sleat, Argyll Islands, Oban to Fort William and the Clyde.

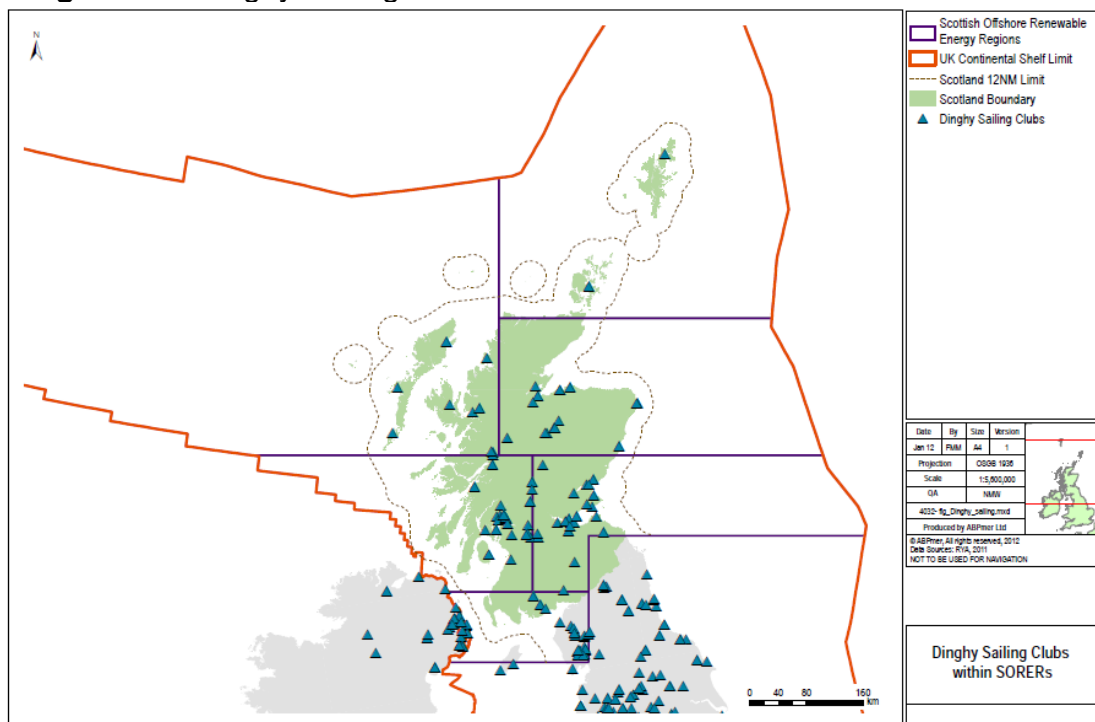
Figure 2.8 Sea Kayaking and Canoeing areas around Scotland



2.13.13 Informed opinion suggests that sea kayaking, particularly on the West coast, and surf kayaking could be worth an estimated £0.5 million per annum'. This statement was based on a study carried out by British Waterways and reported in Bryden et al. (2010), in which average paddlers in the Great Glen (2,500 per annum) spent approx £97 per day locally on overnight visits, or approximately £730K per annum.

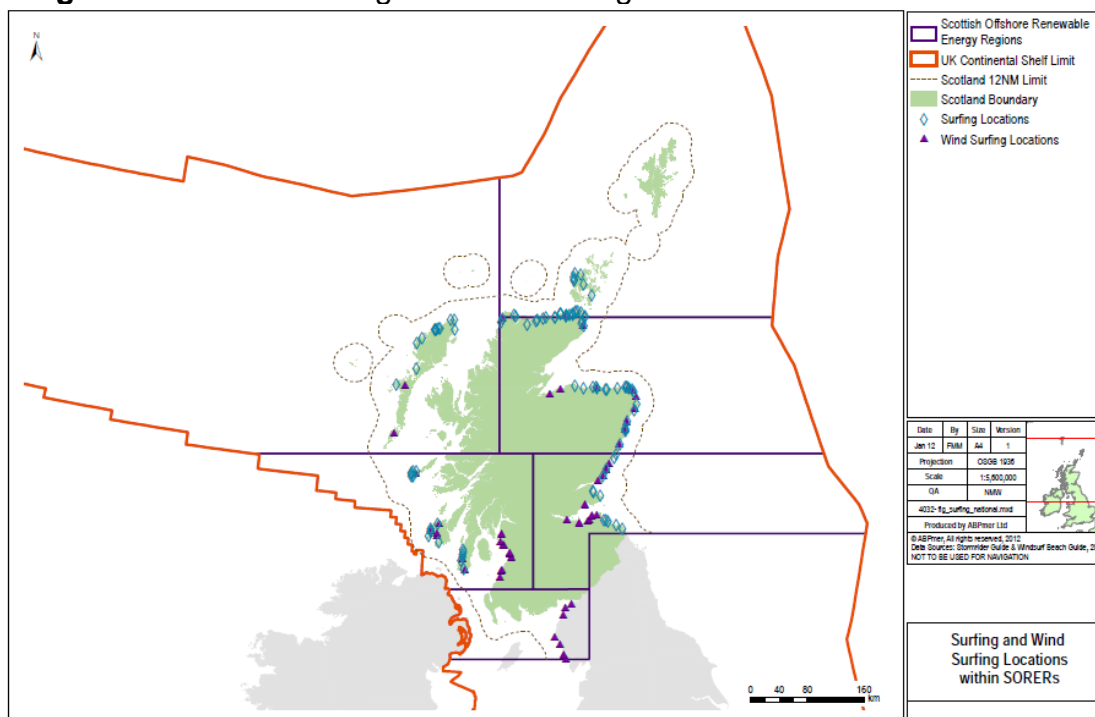
Small Boat Activity

2.13.14 Small sail boat activity is defined as dinghies, day boat or other small keelboats, usually taken out of water at the end of use. Small sail boat activity is widespread along the Scottish coast but the Firth of Clyde and Firth of Forth are noted as a particularly good place to learn to sail in dinghies (Land Use Consultants, 2007).

Figure 2.9 Dinghy Sailing Clubs around Scotland

Surfing and Windsurfing

2.13.15 A variety of different types of water craft are used to surf waves including surfboards, bodyboards, windsurfing boards and kayaks (SAS, 2009). Many surfers are willing to travel large distances to undertake surfing at good quality spots (Lazorow, 2009). Therefore, high quality waves located in remote areas could bring economic benefits to a rural area through travel, accommodation and subsistence expenditure of visiting surfers. Surfing is focused around the far North coast of Scotland (particularly around Thurso), the North coast from Buckie to Fraserburgh and locations down the East coast including Fife, and from North Berwick to the border. Other locations include the Kintyre peninsula, Islay, Tiree, the Western Isles (particularly the West coast of Lewis) and the North coast of Orkney (Baxter et al., 2011; Land Use Consultants, 2007).

Figure 2.10 Surfing and Windsurfing locations around Scotland

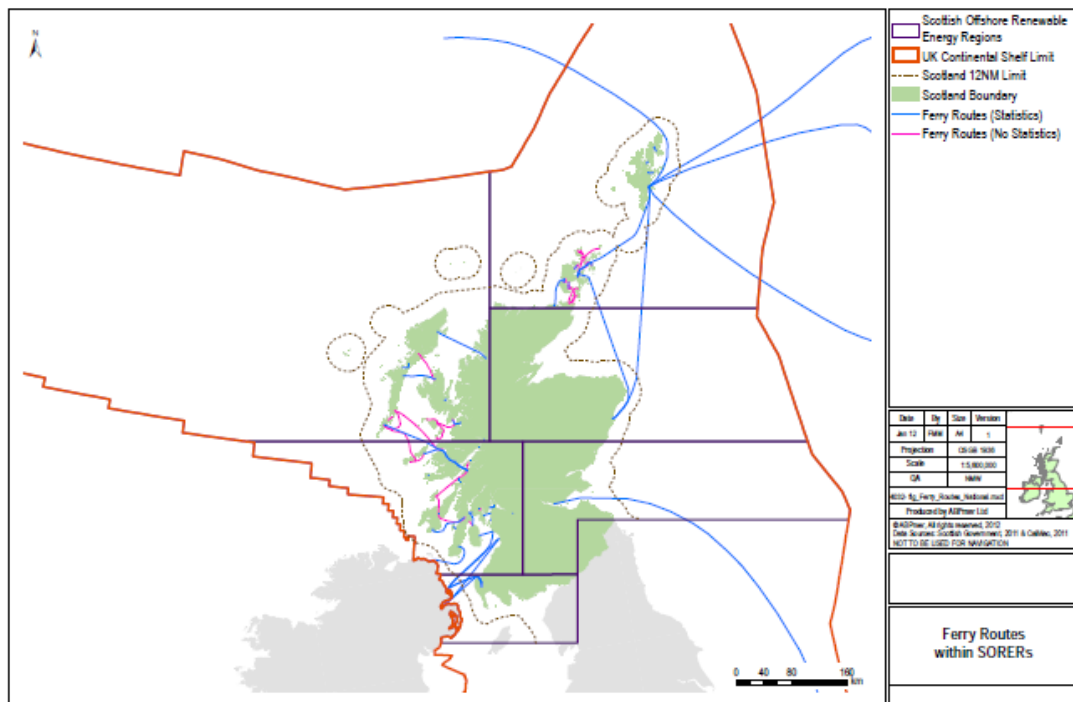
2.13.16 There is limited data concerning the expenditure and employment levels of surfing-related tourism (SAS, 2009). At a UK level the economic value of the surf industry was estimated at £200 million in 2007 (UKMMAS 2010). The total number of people participating in surfing in the UK in 2009 was estimated 645,827 (BMF et al., 2009). If it is assumed that the Scottish value is pro rata to the estimated number of individuals engaging in surfing activity in Scotland, this would give a Scottish value of around £16.4 million per annum.

2.14 Shipping

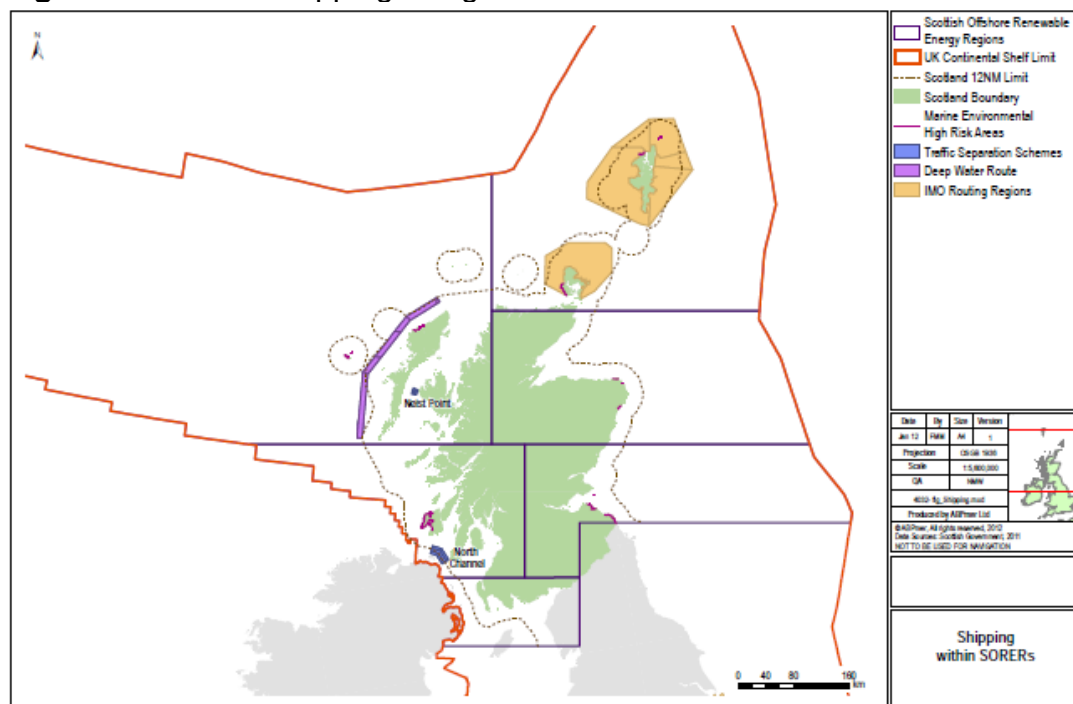
2.14.1 Shipping, and navigation in general, represents a major existing use of the sea, and interactions with potential renewables developments need to be considered in marine spatial planning and licensing in Scottish waters. Be it ferry routes, cargo vessels or oil and gas industry transport, the opportunity for interactions between offshore developments and shipping is high.

2.14.2 Ferries connect Scotland with other countries and also provide essential transport links with many Scottish islands. The North-west and West coast, for instance, depend closely on day to day ferry transport to move products from farming, fishing and other industries to the mainland, and to support other key activities such as tourism and recreation.

Fig.2.13 Ferry routes around Scotland



- 2.14.3 Busy harbours like Aberdeen, Peterhead and Lerwick see up to 3,500 vessel movements linked with the oil and gas industry per year (P&J 09/2011). Ports in the Clyde and Leith provide berths for vessels that collectively ship up to 2 million tonnes of freight each year.
- 2.14.4 Vessels of more than 350 tonnes carry an Automatic identification System (AIS, class A). Using this data, the shipping density in Scottish Waters can be plotted.
- 2.14.5 The International Marine Organisation (IMO) has implemented various routings around Scottish waters with purposes ranging from traffic separation, areas to be avoided (ATBAs), precautionary areas and deep water demarcation sites. Four ATBAs exist around Orkney, Fair Isle and Shetland. These ATBAs offer an opportunity for development, or at least a relief from shipping as a constraint to implementation of renewable devices.

Figure 2.14 Shipping designations around Scotland

- 2.14.6 Shipping provides for the transport of freight and passengers both within Scottish waters and internationally. Commercial shipping routes can be split into two distinct types: transiting vessels passing through Scottish Waters and vessels with either their origin or destination port within Scotland. The movement of vessels is monitored and recorded by the Maritime and Coastguard Agency (MCA) and individual port authorities.
- 2.14.7 In 2008, a total of 67.4Mt of freight was recorded as being lifted by water transport in Scotland. Of this, 23.3Mt was coastwise traffic to other ports in the United Kingdom (including Scotland), 1.8Mt of one port traffic to offshore installations, and 42.4Mt of exports from the major Scottish ports (Baxter et al, 2011).
- 2.14.8 Oxford Economics (2011) reports for the Chamber of Shipping have estimated that from a turnover of £9.5bn, the shipping industry contributes about £4.7bn GVA to the UK. The UK Major Ports Group suggests that ports contribute around £7.7bn to UK GDP. Neither source of information presents a breakdown for Scottish Shipping or Ports (Baxter et al, 2011). It can be assumed that ships transiting through Scottish Waters, but not making port calls provides no economic value to Scotland. Indirect value may be obtained from transitory shipping through jobs related to safety of shipping in Scottish waters and commodity transportation originating in Scotland, but shipped through other UK ports.
- 2.14.9 In 2009, the number of jobs for sea and coastal water transport supporting activities was estimated at 4,700 and the equivalent GVA was £432 million. These values cannot be disaggregated to individual sea areas (Baxter et al, 2011).

2.15 Social Considerations

- 2.15.1 Coastal communities (living within 5km of the coast) account for an estimated 41% of Scotland's total population. The regional analysis shows that the characteristics of coastal communities vary between different parts of the country.
- 2.15.2 Different parts of the coast experience different types of pressures, with some areas being sparsely populated by fragmented communities, and others including more densely populated city-regions. According to the Scottish Planning Policy (201) more than two thirds (68%) of the coastal population live on the 'developed coast'; with 14% living on the undeveloped coast and 18% on the 'isolated coast'.
- 2.15.3 Most parts of the coast have ageing populations, and all regions are expected to experience an increase in the average age of the population over the coming years. Fuel poverty is an issue across coastal communities in most of the regions, with only small decreases in recent years within some groups of the population. The Scottish Government is, however, committed to reducing this issue in the medium to long term. Health indicators (based on people's perception of health) are expected to remain largely static or to improve in the coming years.
- 2.15.4 The Scottish Index of Multiple Deprivation (SIMD) highlights where coastal communities have varying levels of access to employment, education, skills and training, health and access to services. Views on quality of life (perception that neighbourhood is a good place to live) also vary between coastal communities, with some regions showing positive trends (i.e. North, Northeast and West), whilst others (such as the East and Northwest) are experiencing a decline in this indicator.
- 2.15.5 The profile of key employment sectors also varies between regions, and whilst most depend primarily on the service economy, other activities including agriculture, forestry and fishing accounts for a slightly greater share of jobs in more remote, rural regions than it does in communities closer to more 'urban' and accessible parts of the coast.

2.16 Supply Chain

- 2.16.1 The supply chain for offshore wind energy covers all the jobs associated with manufacturing, transporting and installing renewable devices, as well as related tasks such as maintenance, surveying, and operations.
- 2.16.2 Development of a fixed offshore wind supply chain is still in the early stages of development but there is existing capacity in the Scottish supply chain for offshore wind. The main strengths of this supply chain are:

- Offshore engineering with expertise in construction, operations and maintenance;
- Project management and training (due to the offshore Oil and Gas sector);
- Design and development services including consultancy, engineering and project development services;
- Research and development expertise in the private sector, academia and public sector funded programmes;
- Existing port facilities with North Sea access and surrounding offshore service networks; and
- Fabrication and manufacturing of components.

2.16.3 The National Renewables Infrastructure Plan (NRIP) has identified a list of priority sites which could be developed to support offshore wind. These include:

- Leith – integrated manufacturing;
- Dundee – distributed manufacturing and operation/maintenance;
- Nigg (note that this site has already been used to support the Beatrice Demonstration Project) – integrated manufacturing;
- Energy Park Fife at Methil (some supply chain investment has already occurred here) – further manufacturing;
- Aberdeen – distributed manufacturing and operation/maintenance;
- Hunterston – integrated manufacturing;
- Arnish – distributed manufacturing;
- Campbeltown/Machrihanish (some supply chain investment has already occurred here) – further manufacturing and operation/maintenance;
- Ardersier – integrated manufacturing;
- Peterhead – distributed manufacturing and operation/maintenance; and
- Kishorn – distributed manufacturing.

2.16.4 Sections 3-8 provide an overview of the supply chain activities relating to the development of offshore wind energy which are currently taking place at the regional level.

2.17 Tourism

2.17.1 Marine and coastal tourism can be defined as any recreational activity that makes use of the marine environment and intertidal coastal zones (Benfield and McConnell, 2007). This can include a range of activities such as walking along the sea-front to sea-side based horse riding. Both non-motorised (walking/picnicking) and motorised (boat-based tourism such as wildlife viewing) activities are also considered here. Benefits derived from the wild landscape may also be considered under tourism, and McMorran et al (2006) state that the most appropriate valuations of the natural landscape come from tourist expenditure. Tourist activities are also considered to influence other industries, including accommodation, travel, food and beverage, etc.

2.17.2 Considering coastal activities in particular, Baxter et al (2011) highlights some of the areas within Scotland which provide for marine related recreation:

- The Firth of Clyde and the West Coast are renowned for sailing, with opportunities for day sailing, racing and cruising. The presence of facilities including marinas, boatyards and moorings helps increase the attractiveness of the area for this type of activity;
- Recreational sea angling occurs all around the Scottish coast, although Dumfries and Galloway, the West coast in Argyll and the Northeast coast are hotspots;
- Diving occurs in many areas including the Orkneys, sea lochs off the West coast and the Sound of Mull, Argyll, the Moray Firth and Northwest Scotland. Investment has recently tried to enhance diver numbers in the Southeast (e.g. around St Abbs Head);
- Surfing often occurs on the South East coast, although more extreme conditions are found on the Western and Northern coasts, with Thurso hosting the O'Neill Highland Open. Tiree on the West holds the Tiree Wave Classic and also provides a venue for events by the Professional Windsurfing Association;
- Canoeing and kayaking occur in coastal areas where access is available; and
- Wildlife watching is popular, with significant increases in cetacean watching in the
- Moray Firth documented in the past two decades. Coastal bird watching is also popular (e.g. at the Scottish Sea Bird Centre at North Berwick).

2.17.3 Marine and coastal wildlife tourism defined by a recent Scottish Government study as (Scottish Government, 2010f):

- Marine – studying or viewing marine mammals from a boat; and
- Coastal – studying/viewing/enjoying wildlife on the coast, which includes viewing birds from a boat and watching marine mammals from land.

2.17.4 Both of these types of tourism may be affected by offshore renewable energy generation. For example, increasing numbers of boats for service activities for energy generation structures may impact the space available for tourist related craft.

2.17.5 The popularity of wildlife tourism in Scotland is probably partially influenced by the number of designated Marine SACs. There are 36 sites in total covering intertidal waters, reefs, coastline and seal breeding areas. Indeed, in a survey carried out by IFAW (2009), Scotland had the largest proportion of Europe's cetacean watchers with 27%. This equated to 3% of the global number of cetacean watchers, with 223,941 tourists taking part. Marine and coastal wildlife tourism in Scotland (including cetacean related tourism) has

a combined total expenditure of £160 million and total income of £92 million, with peak activity occurring in May and June (Scottish Government, 2010).

- 2.17.6 Cetacean related tourism in particular saw huge growth in the last decade, and a 2008 survey found that the number of whale watchers had almost doubled since 1998, with an average growth rate of 8.5% in the last 10 years (IFAW, 2009).