OCEAN ENERGY
ERA-NET

JA.3. SME Engagement & Support

Ocean Energy Supply Chain Analysis Summary Report

February 2018

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Table of Contents

Executive Summary

The Ocean Energy European Research Area Network (OCEANERA-NET) is an EU project funded under the 7th Framework Programme and constitutes a collaboration between 15 national and regional funding organisations from 8 EU countries, coordinated by Scottish Enterprise, the regional Economic Development Agency for Lowlands Scotland.

OCEANERA-NET has been set up to facilitate coordination of research in the ocean energy sector across Europe through delivering a series of collaborative programmes including joint transnational calls and other complementary joint activities.

In the frame of Joint Activity 3 (JA.3), the OCEANERA-NET consortium has been delivering a range of activities aimed at engaging and supporting small and medium-sized enterprises (SMEs) with the primary objective of increased knowledge sharing to the benefit of the entire industry, thus accelerating the sector's pace to industrial roll-out. One activity within JA.3 has hence been focused on the analysis of supply chain databases in ocean energy and the compilation of existing information from the countries primarily participating in OCEANERA-NET into a single comprehensive source. The results from this exercise are presented in this summary report.

Supply chains are complex and dynamic networks linking suppliers with customers. In pre-commercial sectors, such as ocean energy, building resilient supply chains to service the emerging market is an important component of that sector's development towards full commercialisation.

Within the OCEANERA-NET member states there are examples of existing and 'mature' supply chain models and lists of companies, as well as some embryonic ones. This may reflect the stage of development of ocean energy technology and the market in those member countries. The sector is still at a stage where it is primarily dominated by technology developers with a tendency to cover several parts of the supply chain as part of their research, technology development and innovation (RTDI) activities. However, with some technologies progressing to demonstration and pre-commercial stages, particularly in tidal energy, the establishment of a resilient supply chain is becoming increasingly topical.

A supply chain model

Analysis of existing supply chains in OCEANERA-NET consortium and other countries would suggest the following categories of activities are integral to an ocean energy supply chain model:

- Site screening, feasibility and planning. Specifically including developers; environmental impact assessment and survey; consultancy services; financial, legal & other business support services.
- Project design & development. Specifically including project design, research & innovation, test and demonstration facilities; training & skills.
- Fabrication. This category includes engineering services, manufacturing and component supply.
- Deployment, installation & commissioning. Sub-activities to include installation project management; port facilities and operations; turbine and foundation installation; subsea cable installation; substations; certification.
- Operations & maintenance and support services. Sub-activities would include those already listed above and support vessels.
- Decommissioning. This may seem premature given the development stage of technology, but should be included in the supply chain model, especially as demonstration phase equipment, facilities and energy converters will need decommissioning and / or re-cycling in the near future.

Individual partner and supply chain details are set out under each country in subsequent chapters of the report. A summary of the regional / national supply chain information accessed is included here.

CANADA **Reports and Directories Accessed:** - Marine Renewables Canada
DENMARK **Reports and Directories Accessed:** - Partnership for Wave Power Roadmaps - State of Green - Wave Power
FRANCE **Reports and Directories Accessed:** - La Rance-BHA-Oct 2009 - ADEME Roadmap for renewable marine energy - Pays de la Loire Map of Skills 2016 **Notes:** Total of 6 sectors and 115 supply chain companies listed.

IRELAND

Reports and Directories Accessed:

- Renewable Energy in Ireland
- Supply Chain for the Ocean Energy Industry in Ireland
- Ireland's Supply Chain Opportunity

Notes:

550 supply chain companies listed.

SPAIN

Reports and Directories Accessed:

- Ocean Energy Systems - Country Report (Spain)
- Vanguard Initiative - Energy concept note
- IDEPA
- Cluster Energia strategic importance of wave power
- Wave Energy Basque Country
- PLOCAN Projects

Notes:

7 sectors and 88 supply chain companies listed.

SWEDEN

Reports and Directories Accessed:

- Ocean Energy Sweden - Swedish developers

UNITED KINGDOM

Reports and Directories Accessed:

- Carbon Trust Marine Energy Summary
- Renewable UK Wave & Tidal Energy
- Scottish Enterprise Offshore Renewables Supply Chain Directory
- Renewable UK Supply Chain Map
- ORE Catapult Marine Energy Gateway
- Renewable UK Wave Tidal Capability in the UK
- Orkney Marine Renewables Supply Chain
- Business Wales Directory
- Sell2Wales
- Tidal Lagoon Power
- Marine Energy Wales
- REGEN-SW Marine Energy & Offshore Wind Directory 2015
- ORE Catapult - Economic Impact Study into the Development of the UK Offshore Renewable Energy Industry to 2020

Notes:

3 sectors, 12 sub-sectors and 1,000 + supply chain companies listed.

Summary of gaps and barriers identified within supply chain directories / reports

Barriers to the construction of an ocean energy supply chain appear to relate firstly to the developmental nature of the market and industry. A Dutch research report identifies the following factors[1]:

- Reliability and performance of devices. Where proven extensive operational records exist, it is based on technologies used in the wind energy sector, thus benefitting the ocean energy sector via know-how and knowledge transfer. Innovative designs and materials are being used to ensure the long-term survivability of devices.
- There is variable design thinking as regards converters and their components. This together with higher costs and unproven status have hindered investor confidence.
- Environmental, administrative and social acceptance issues. This makes for lengthy consent and planning stages, as well as stringent (and costly) monitoring requirements.

Related to this, additional gaps and barriers were identified over the course of this project or mentioned during discussions:

- Continuity of supply chain companies; the challenge is to ensure that today's suppliers to prototype and demonstration projects remain a part of the industrialised supply chain beyond 2020.
- Lack of capability in sub-activities due to the gap between solutions available and what is needed for early commercial arrays.
- Security and certification requirements may bar or put off companies from being part of the supply chain.
- Dismantling and recycling is an activity element omitted from many supply chain models. This thinking is based on the newness of the technologies, although must apply to early stages especially for prototypes and demonstrator converters. Including this element would bring in expertise from other industries, such as oil & gas.

There are also administrative and resource barriers to compiling and putting in place a supply chain database:

- Gaining written permissions from companies to be included in the database, thus complying with data protection regulations.
- Gathering appropriate details, such as email addresses. Often these are in a generic format (e.g. info@) and so getting to the right person in order to get a response is time consuming.
- Incomplete organisational information. Most supply chain databases are self-completed by the organisations wishing to be listed; the amount and quality of information provided can be variable.

[1] Ocean energy development in Europe: Current status and future perspectives 2015 report by Davide Magagna, Andreas Uihlein; European Commission DG JRC, Institute for Energy & Transport, The Netherlands.

- Keeping the information up-to-date. Even where this is 'delegated' to the listed organisations, there is still a requirement to remind and notify them that task needs to be done.

Opportunities

Research of the supply chain reports and directories identified a number of opportunities. These were often listed as a means of mitigating the barriers and gaps in existing supply chains, and include:

- Involving companies with expertise in other energy supply chains, as well as those from other industries, in ocean energy.
- A broader approach, perhaps at the national level, for the compilation of a database. A number of databases mentioned in this report are regional; by combining these into a national or trans-national approach, any skills and capabilities gaps may be minimised.
- Future potential of decommissioning to attract companies from outside the marine energy sector thus fertilising cross-sector knowledge transfer.
- Dissemination and communication, including social media, offers the opportunity to make the supply chain databases more widely known, which in turn may help to attract more companies to the database, links with other databases, and the forging of collaborations.

There is an understandable tendency for individuals to construct their own contacts databases, in addition to any centralised one within an organisation. There is an opportunity to bring personal lists together, de-duplicate them against both each other and the existing public databases, and then add the details into the public databases. However, time and resource need to be allocated to this activity.

Authors

This report was compiled by the Knowledge Transfer Network Ltd, third party to OCEANERA-NET consortium partner Innovate UK.

1. Background, Scope and Coverage

1.1 Introduction to the OCEANERA-NET project

OCEANERA-NET is a European Research Area Network funded by the EU through the 7th Framework Programme; the consortium constitutes 15 partners from 8 countries and is coordinated by Scottish Enterprise, the Regional Economic Development Agency for Lowlands Scotland in the UK.

The overall objective of OCEANERA-NET is to create a sustainable network of funding partners to coordinate ocean energy research in Europe, aiming at reducing duplication and benefitting from transnational cooperation to fund Research, Technology Development and Innovation (RTDI) in the sector. OCEANERA-NET has delivered a series of collaborative programmes including joint transnational calls and other complementary joint activities.

In the frame of Joint Activity 3 (JA.3), the OCEANERA-NET consortium has been delivering a range of activities aimed at engaging and supporting small and medium-sized enterprises (SMEs) with the primary objective of increased knowledge sharing to the benefit of the entire industry, thus accelerating the sector's pace to industrial roll-out. One activity within JA.3 has hence been focused on the analysis of supply chain databases in ocean energy

1.2 Importance of Ocean Energy

Ocean energy will play an important role in Europe's energy objectives and will also provide new opportunities to stimulate technological innovation, commercial activity and competitiveness. The European ocean energy sector is a world leader presenting the most advanced technology so far.

For the creation of a new industrial sector related to ocean energy, which will deliver jobs in its regions throughout the local supply chain, investments will be essential. But this supply chain is spread across EU Member States and there is a need for knowledge sharing across industry to reduce duplication in efforts.

Small and medium-sized enterprises (SMEs) account for 99% of private sector companies; they contribute to more than half of the total added value created by businesses in the EU and they are responsible for the majority of new jobs created in Europe. Their capacity for innovation and flexibility in a changing business environment makes them crucial for Europe's success in the global economy in general and in the ocean energy sector in particular.

Through inter-enterprise cooperation, SMEs raise the level of skills with their flexible and innovative nature. Thus, SMEs can generate important benefits in terms of creating a skilled industrial base and industries, and developing a well-prepared sector capable of contributing to GDP through higher value-added activities.

However, strategic, collaborative RTDI activities are heavily dependent on establishing contacts along the supply chains. SMEs often lack the resources for building contacts outside their core activity, thus opportunities may be limited, especially for cross-sector transfer.

Also, new ocean energy business development is a key factor for the success of regional reconversion where conventional heavy industries will have to be phased out or reconstructed (especially in the field of metallurgy and shipbuilding) and in remote, rural areas where the economic base and employment opportunities are limited, and in this field SME's can play a leading role.

1.3 Scope of the work

One of the objectives of the OCEANERA-NET project is to engage industry and promote their participation in collaborative RTDI activities supported through joint calls and other sources of funding (e.g. OCEANERA-NET COFUND in ocean energy), alongside other joint activities. One such joint activity is focused on sharing knowledge on supply chains and facilitating collaboration between companies in future projects with a focus on engaging and supporting SMEs.

An analysis of present supply chains is a specific task under this joint activity, the results of which are presented in this report.

Building on previous work on the supply chain analysis in the energy sector performed by the OCEANERA-NET partners, information was gathered on the ocean energy supply chain at national and regional level and analysed with regards to opportunities, barriers and gaps, paying specific attention to SMEs. The countries analysed include the 8 countries participating in OCEANERA-NET, namely the UK, Ireland, France, Netherlands, Belgium, Portugal, Spain, and Sweden, as well as Denmark and Canada as other key examples with promising activity and supply chains in the ocean sector.

For the purposes of this task and report, "Ocean Energy" consists of Tidal & Current, Wave, Salinity Gradient and Ocean Thermal Energy Conversion (OTEC) technologies. Sometimes the term "Marine Energy" is used, although that term may also include offshore wind energy devices. Where individual countries and organisations use the term "Marine Energy", such as in corporate names, and this equates with "Ocean Energy", that term is used.

Europe is ideally positioned to make use of the natural waves and tidal streams that surround our continent. The potential for ocean energy in Europe is huge: 334GW for wave & tidal power and around 50GW for salinity gradient. OTEC also offers significant technological development and export potential to tropical coastal areas where the temperature difference is greatest.

Europe's ocean energy industry plans to deploy 100GW of capacity by 2050, generating significant economic activity for a pan-European supply chain and 400,000 jobs across Europe. This equates to contributing up to 15 per cent of Europe's electricity demand [2]. Reports on the current status and future prospects for ocean energy in Europe are available [3].

1.4 What is a supply chain?

An ocean energy supply chain is a network of companies and organisations involved in the manufacture, transport and installation of wave and tidal devices, supporting infrastructure, assets for maintenance and renewal purposes, and a range of support, consultancy and business services.

The challenges faced in securing cost efficient, reliable and sustainable supply chains differ according to the maturity of the energy technology and the size of the region's or country's deployment ambition.

2. Methodology

Both desk and field research methodologies were used in this project.

Desk research gathered information on existing supply chain analyses from

- partner countries and national / regional bodies within those countries
- an internet search of supply chain information covering databases and reports

Field research was conducted either by telephone or face-to-face to discuss

- the supply chain information provided by the partner countries and bodies
- the gaps, barriers and opportunities associated with supply chains

A list of organisations / people contacted (via email, telephone and in person) is included at Annex 1.

[2] http://cordis.europa.eu/result/rcn/176823_en.html
[3] http://www.sciencedirect.com/science/article/pii/S2214166915000181

3. Supply Chain Analysis by European Country

3.1 United Kingdom

3.1.1 Context for ocean energy

The UK ocean energy sector could be worth more than £4 billion cumulatively to UK GDP by 2050, so a significant and long term supply chain base is vital as the sector moves towards commercialization [4].

The UK has a number of test sites and commercial exploitation projects for tidal and wave energy. Although in recent years a number of factors have adversely affected development in this area. Most notably:

- slow technology development has led to withdrawal of commercial financing of marine energy projects by companies such as EON in 2013 in the Orkney Islands, and Vattenfall in 2015 off the Shetland Islands. Both companies now concentrate on wind energy.
- uncertainty around financial support (subsidies) from the National Government and caused for example by the Government's reduction in 2015 of renewables subsidies for Solar and recent Contract for Difference competitions which mean that ocean energy has to compete with more mature technologies such as offshore wind, and its independent review, of tidal lagoon energy.

The consequences, either directly or indirectly, have been:

- companies entering into administration, most notably Pelamis
- companies being the subject of acquisition, for example Marine Current Turbines firstly by Siemens and then by Atlantis Resources
- projects being delayed, such as the Swansea Bay Tidal Lagoon.

Renewable UK information [5] indicates:

- 20 Wave project sites in the UK
- 35 Tidal project sites in the UK

These are listed on its website, with details of the site / project leaseholder and project status as a guide to the state of the ocean energy industry in the UK; although, this information is somewhat dated.

3.1.2 The UK 'national structure' supply chain database

The UK has one main renewable energy supply chain database, based on a standard 'national structure' model. It was initially developed by Regen South West (Regen SW), and is available to view at MESCG (Marine Energy Supply Chain Gateway) operated since July

[4] https://www.carbontrust.com/media/168547/tina-marine-energy-summary-report.pdf
[5] http://www.renewableuk.com/page/WaveTidalEnergy

2015 by the Offshore Renewable Energy Catapult (ORE) [6] on behalf of its partners Scottish Enterprise (SE), Highland & Islands Enterprise (HIE), Invest Northern Ireland, Welsh Government, Renewable UK, and Regen SW.

The database consists of organisations operating in both Ocean Energy and Offshore Wind, so there is some overlap.

The model consists of 3 main areas of activity covering the following sub-sectors of activity (numbers in brackets refer to the number of organisations in each subsector):
Technology development based on TRL (28)

- Research & Innovation (52)
- Test and Demo Facilities (15)

Project Developers (17)

- Consultancy services (184)
- Naval Architects (19)

Technology Manufacturing & Integration – consisting of:

- Engineering services (220)
- Manufacturing and component supply (333)
- Ports and operations (66)
- Marine operations, installation and subsea support (165)
- Training & skills (57)
- Financial, Legal & Support services (139)

3.1.3 Other UK supply chain models and databases

All databases, models and reports mentioned in this section are freely and publicly available unless stated.

Renewable UK [7] lists 1,390 organisations in the supply chain for both wind and marine renewables on its website, but does not allocate them to specific activities or subsectors. The site also contains an interactive zoomable map giving the locations of organisations recently active in the industry. Clicking on the circles reveals the company name and website.

The Marine Energy Programme Board (MEPG) set up in 2013 by DECC to make recommendations to HM Government on priorities for the Marine Energy Programme, specifically wave and tidal energy. In a February 2015 report [8] the current supply chain status was set out and split into the following elements:

- Development and project management, including design, ownership and asset management
- Device supply: devices and subsystem components

[6] https://ore.catapult.org.uk/our-knowledge-areas/knowledge-standards/knowledge-standards-projects/marine-energy-supply-chain-gateway-2/
[7] http://www.renewableuk.com/page/SupplyChain
[8] Wave and Tidal Energy in the UK : Capitalising on Capability. Available at: http://c.ymcdn.com/sites/www.renewableuk.com/resource/resmgr/publications/reports/wavetidalukcapability.pdf

- Balance of plant supply: foundation and mooring systems, subsea array and cables, substation electrical systems
- Installation and commissioning covering ports, foundation, device and subsea cable installation
- Vessels and on-board equipment
- Other (covering consultancy and R&D services)

Other information from this report is included on supply chain challenges and opportunities.

Highlands & Islands Enterprise /Orkney Island Council has a supply chain section on its orkneymarinerenewables.com website [9]. This is a local supply chain listing split into developers (2 organisations), marine companies (4), onshore (4), survey work (6), test centres (1) and transport (2) categories. Each entry has a description of activities and services provided, website, telephone number, general email address, and postal address. The 2016 edition of its suppliers directory, available on the same website, is split into the same categories contains more organisations (30 in total) than the supply chain section.

Scottish Enterprise has an Offshore Renewables supply chain model and directory [10], created with Highlands & Islands Enterprise. It has 7 main categories with each category expandable to reveal a more detailed sub-activity. The main categories are:

- Balance of plant
- Development & consenting
- Installation & commissioning
- Operation and maintenance
- Supporting functions
- Turbine
- Wave & tidal. The sub-activities in this category are developing & consenting, tidal device complete, wave & tidal specific component, wave & tidal specific service, and wave device complete. This category lists 120 organisations.

Each sub-activity can be ticked and then searched for organisations, with details including postal address, telephone, website url, and expandable capability sections.
It should be noted that registration into this directory is voluntary and entries are not independently verified.

This supply chain is overseen by Scottish Enterprise's Energy Supply Chain Team, and existing supply chain companies are supported by opportunities and technical solutions workshops, and meet the buyer events.

[9] http://www.orkneymarinerenewables.com/supply-chain
[10] https://www.scottish-enterprise.com/industry-support/renewable-energy/offshore-renewables-supply-chain-directory

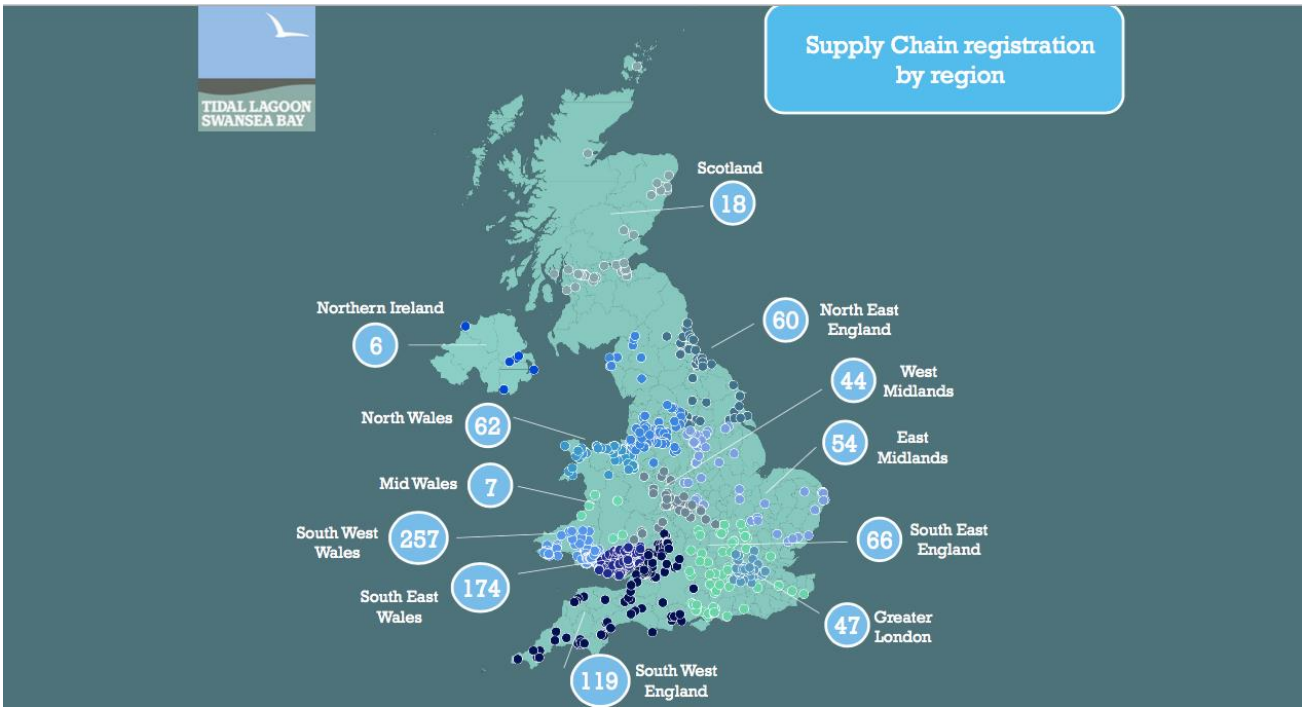
The Welsh Government's Directory of Welsh Businesses [11] is a supply chain directory covering all industries and sectors. To be listed businesses register and create their own entries allocating themselves to sectors (20) and sub-sectors, for example one can search by the 'Energy' sector and then 'Marine' or 'Renewable Energy' sub-sector. One can also search by keyword, region or postcode. There is also a map listings page, which can then be filtered by sector and sub-sector. About 1,910 organisations are listed in the directory.

Sell2Wales [12] a public sector contracts site also has a database of suppliers and buyers registered for all sectors and business on a National Database. However, this can only be searched by buyer, ie public authority.

Tidal Lagoon Power has 6 tidal lagoon projects under various stages of development, of which Swansea is the first and the closest to receiving consent. The proposed Tidal Lagoon Swansea Bay is said to be capable of generating 320MW of power. A number of Welsh Government sponsored studies have been undertaken to determine the manufacturing, assembly and construction labour and skills requirements and gaps for this development, (available on Tidal Lagoon Power's website [13]), which include statements of the various work packages involved.

Although, Tidal Lagoon Power has no public supply chain directory or model its website contains a graphical list of "suppliers and partners". Tidal Lagoon Swansea Bay is constructing an "internal use only" supply chain directory to ensure that 65% of capital expenditure is spent within the UK.

[11] https://businesswales.gov.wales/directory-welsh-businesses
[12] https://www.sell2wales.gov.uk/
[13] http://www.tidallagoonpower.com/document-library/



The Supply Chain section of the website states that over 1,000 companies have already registered an interest in supplying services to the project; it gives the opportunity for companies to register separately for the Swansea and Cardiff tidal lagoons. It also points potential suppliers to the Sell2Wales website (noted above), where opportunities for supplying to the project will be advertised.

Marine Energy Pembrokeshire [14], established in 2010, is funded by the Welsh Government, The Crown Estate, Port of Milford Haven and Pembrokeshire County Council. It is a partnership between technology developers, the supply chain, academia and the public sector with the objective of

- Providing support and guidance for the marine energy sector
- Raising awareness of the region's key development opportunities
- Providing an information conduit between industry, public sector agencies and Government
- Promote wider public understanding of the benefits of marine energy.

Although a few developers are mentioned on the website no supply chain directory or database is available.

Regen SW publishes a Marine Energy and Offshore Wind, South West Company Directory containing over 350 companies [15]. The directory has general chapters covering offshore energy resources, technology developers, research capabilities, PRIMaRE, demonstration sites, ports, port operations and land-based support.

[14] http://www.marineenergypembrokeshire.co.uk
[15] https://www.regensw.co.uk/marine-energy-and-offshore-wind-south-west-company-directory-2015

The main categories of the directory (now in its 8th edition) reflect the 'national structure' directory hosted on the ORE website mentioned in section 4.1.2.
The categories are port & port operations; consultancy services; engineering; manufacturing & components; composites; marine operations, installation and subsea support; financial, legal and support services; and training & skills. Each category has a list of sub-activities.

EMEC (The European Marine Energy Centre) which operates the largest marine energy testing sites in Europe has no publicly available supply chain database.

3.1.4 Gaps and barriers in the supply chain

A number of gaps and barriers in the current UK supply chains have been identified:

Cost of generation
A major challenge facing the ocean energy sector is cost. The TINA report (mentioned in footnote 2) analysed the cost structure and estimate that current (2012) costs are of the order of £200- 300/MWh for tidal and £250-400/MWh for wave. It concluded that tidal is currently cheaper than wave but both are still significantly in excess of other more proven technologies. While more up to date estimated costs are slightly lower, concepts for the design, operation and maintenance of whole arrays have not yet been developed, making this estimate a difficult task.

Continuity of supply chain companies
An ORE Catapult report (Economic Impact Study of the offshore renewable energy industry in the UK, March 2014 [16]) concludes that the challenge (for the tidal and wave industry) is to ensure that today's suppliers of and to prototype and demonstration projects remain as part of the industrialised supply chain beyond 2020. As noted earlier a number of major investors (utilities) have withdrawn from the industry, due to the slow progress in proving the technologies, in order to concentrate on more immediate investment returns.

Lack of capability in sub-activities
The MEPB report on wave and tidal energy capability in the UK (footnote 5) noted concern about capability in a number of sub-activities of the supply chain, notably as regards the technologies for wave energy devices and subsystems due to the gap between solutions available and what is needed for early commercial arrays.

Security and certification requirements
A concern was expressed that some companies may find it difficult to get involved in the industry because of security and certification requirements. If correct, this barrier to entry needs substantiating with examples.

[16] https://ore.catapult.org.uk/wp-content/uploads/2016/05/Economic-Impact-Study-into-the-Development-of-the-UK-Offshore-Renewable-Energy-Industry-to-2020.pdf

Not all activity elements included in the models

All UK ocean energy supply chains omit a "dismantling" element, which is included in some others, e.g. France (Loire) and Canada. Whilst a moot point to discuss 'dismantling' when ocean energy technologies are still in the early development stage, it is an activity that needs to be considered, and could bring in expertise and companies involved in offshore oil & gas dismantling projects.

3.1.5 Opportunities

A number of industry reports (included in the footnotes) suggest that the UK is considered to have a high to very high competitive advantage across many categories and sub-activities of the supply chain. However, there are opportunities for companies with expertise in other energy supply chains as well as those from other industries to become involved in ocean energy.

For example, Scottish Enterprise runs an ongoing programme of supply chain support, covering all energy industry sub-sectors and will provide assistance to any company seeking to find out more about its company base and capabilities, see https://www.scottish-enterprise.com/industry-support/renewable-energy.

3.2 Ireland

3.2.1 Context for ocean energy

Ireland is actively committed to harnessing its abundant wave, tidal and offshore wind energy resources while developing an indigenous ocean energy industry in the process. The publication of the Offshore Renewable Energy Development Plan in February 2014 [17], and its implementation through the Offshore Renewable Energy Steering Group, has had the benefit of facilitating a genuinely collaborative environment in this area.

All relevant agencies and Government departments are working together to support this burgeoning sector and offering one single gateway for information and access to the ocean energy industry in Ireland. Ireland has a unique ladder of development and test site infrastructure, which was significantly enhanced in 2015. The importance of supporting technology developers while also investing in academic research has been well-recognised, and the past year has seen tangible progress in both areas with some flagship projects already underway.

[17] http://www.dcenr.gov.ie/energy/en-ie/ Renewable-Energy/Pages/OREDP-Landing-Page.aspx

3.2.2 Supply chain analyses

The Sustainable Energy Authority of Ireland (SEAI) has an in-progress supply chain database on its website [18] for Ireland's marine renewables industry which was conducted following the "Ireland's Sustainable Energy Supply Chain Opportunity" report [19] published in June 2014.

SEAI, working with the Marine Institute, is in the process of getting permission off the featured companies and also developing a new application on which to host the database, which is now available on the Ocean Energy Ireland portal [20]. The database, covering offshore wind as well as wave and tidal energy, provides a companies listing together with their services and capabilities, and is said to contain about 550 organisations.

Companies will be able to register their information on the database. Although SEAI does not verify the information it does quality check the details for accuracy, and whether the company is still active. Each company will be responsible for keeping its own information up-to-date, and SEAI will send approximately annual reminders to the companies to look at their listing and correct it.

The database is also available in an updated ArcGis interactive map format with layers for each of the categories listed below, as well as for marine renewable energy test facilities (8 sites) and Irish Lights' navigation aids.

A newly developed application on the site means that companies can be searched via Energy Type or Business Type. The Energy Types are divided into Wind, Wave and Tidal, while the Business Types are categoried as follows:

- Business Support Services (12)
- Consultancy Services (21)
- Device Developer (8)
- Manufacturing (17)
- Marine Support Services (18)
- Research and Laboratory Services (18)
- Technology Suppliers (25)

3.2.3 Other Irish databases

MAREI (Centre for Marine & Renewable Energy) [21] is the marine and renewable energy research, development and innovation centre supported by Science Foundation Ireland.

[18] http://www.seai.ie/Renewables/Ocean-Energy/Marine-Energy-Companies/
[19] https://www.seai.ie/Publications/Statistics_Publications/Energy_Modelling_Group_Publications/Ireland's-Sustainable-Energy-Supply-Chain-Opportunity.pdf
[20] http://oceanenergyireland.ie/SupplyChain
[21] http://www.marei.ie/sector/marine-renewable-energy-technologies/

It combines the expertise of a wide range of research groups and industry partners, with the shared mission of solving the main scientific, technical and socio-economic challenges across the marine and renewable energy sectors.

MaREI is coordinated by the Environmental Research Institute (ERI) at University College Cork and has 130 researchers working across 6 academic institutions collaborating with over 45 industry partners on 10 projects.

The 45 industry partners are not listed, although there is a data hub tab with 'useful links' to 29 Irish and other country research institutes.

The Marine Renewable Energy (MRE) Technologies focuses on the design and testing of novel wave, tidal and offshore wind energy devices. The research covers aspects such as hydrodynamic and numerical modelling and electrical control, and also expands to areas such as the design of mooring systems and array optimisation for the deployment of multiple devices. Physical testing of prototype devices can be done at our state of the art facilities at LIR-NOTF.

Invest in Ireland – IDA Ireland is responsible for inward investment into Ireland. Its website [22] has a Business in Ireland section with sub-sections on

- sectors (11) - business services, financial services, engineering, clean tech, internet, ICT, cloud computing, internet of things, software, bio pharmaceuticals, medical technology.
- activities (4) – advanced manufacturing, global business services, R&D and high growth
- locations (8 regions)
- company listing.

The listings section is of companies that have invested in Ireland, and is searchable by

- Sector – 9 industrial sectors are named, slightly different to the sectors section itself, but including business services, financial services, software, hardware, consumer goods, bio pharmaceuticals, medical technology, clean tech and engineering
- Country of origin
- Location in Ireland – 26 areas.

The database contains just over 800 entries, although 'ocean energy' is included under the "clean tech" sector, which has just 5 entries. Engineering has 98 entries.

[22] http://www.idaireland.com/business-in-ireland/company-listing/

3.2.4 Gaps and barriers in the supply chain

The SEAI / Marine Institute database initially covered only the Irish Republic, but effort has been made to extend it to Northern Ireland.

The main barrier to developing the database is seen as gaining written permissions from companies to be included in the database, thus complying with data protection regulations. One aspect mentioned is email addresses, which are usually generic (eg info@) and so getting to the right person to get a response is time consuming.

A 2012 study undertaken on SEAI's behalf by SLR Consulting [23] concluded that:
"Ireland's considerable experience in the construction, engineering, electronics, environmental services and ICT means that Irish companies are capable of providing specific solutions to the challenges facing the industry."

However, it noted limited capability or transferable skills in concrete foundations, wave energy hull & PTO systems, installation project management, turbine manufacture (mentioned specifically in relation to wind, but probably also applies to wave and tidal), subsea cables and cable installation.

3.2.5 Opportunities

A 2013 discussion paper (The Supply Chain for the Ocean Energy Industry in Ireland) from the Irish Marine Renewables Industry Association indicated that the principal regional market for the Irish supply chain is the UK, and principally Scotland, which was seen (at the time) as the centre of the UK's ocean energy drive and the leading global location for the industry. [24]

Marketing and communications, including social media, offers the opportunity to make the database more widely known, helping to attract more companies to the database, linking with other databases, and forging collaborations between Irish companies and organisations in other countries.

Of particular interest is the ability to attract companies with experience within the offshore oil & gas industry to become involved in marine energy, especially for activities around installation, maintenance, environmental monitoring and decommissioning.

[23] A Study of the Supply Chain Requirements and Irish Company Capability in the Offshore WW&T Energy Sector: http://www.seai.ie/Publications/Renewables_Publications_/Ocean/A_Study_of_the_Supply_Chain_Requirements_and_Irish_Company_Capability_in_the_Offshore_Wind,_Wave_and_Tidal_Energy_Sector.pdf
[24] http://www.mria.ie/documents/1c2e7a4f5d50c7e6d305f1eb5.pdf

The 2012 study, undertaken on SEAI's behalf by SLR Consulting (see footnote 21) concluded that Irish companies had strong capability in project design, R&D, environmental impact assessment, survey & support vessel operations, ancillary equipment, electrical controls, mooring systems, onshore converters /substations, training in offshore technology and ICT solutions.

3.3 Spain

3.3.1 Context for ocean energy

Ocean Energy Systems in its 2015 annual report [25] states that "in Spain, Ocean Energy is progressing with the consolidation of three open sea test sites: BIMEP and the flagship wave power plant at Mutriku with over 1GWh of cumulative produced power so far in the Basque Country and PLOCAN on the Canary Islands. A couple of wave energy technologies under development by Wedge Global and OCEANTEC and several research projects led by TECNALIA complement the Spanish ocean energy landscape."

The report also states that "the Spanish Renewable Energy Plan 2011-2020, approved in 2011, included targets for ocean energy (100 MW of installed power by 2020); however, these targets seem now difficult to achieve due to the lack of supporting policies for ocean energy. One Spanish region has defined specific strategies and targets for ocean energy: the Basque Government approved in 2011 its Energy Strategy for 2020, which included a specific initiative to speed up technology and commercial development of wave energy and set a target of 60MW by 2020."

The Centre for Development of Industrial Technology (CDTI) is a public organization for technology development, supporting companies' R&D projects with loans and other financial aids. It is part of the Ministry of Economy & Competitiveness.

No supply chains were noted on the CDTI website.

A search of the CDTI website gave 'no results' when searching for 'marine energy'. Using the 'ocean energy' search term, there is a reference to a 2012 seminar on Applied R&D in the Renewable Energy Sector used to promote Spanish – Norwegian bi-lateral co-operation, and included a list of Norwegian companies available for meetings during the seminar.

There does not appear to be a single national Spanish supply chain model or database. A number of regional / local marine energy initiatives are taking place, some of which have a supply chain database. Regions with marine energy initiatives are Asturias, Basque, Canary Islands, Cantabria. Details of these and any related supply chain databases are outlined below.

[25] https://report2015.ocean-energy-systems.org/country-reports/spain/

3.3.2 Spanish regional marine energy initiatives and related supply chain analyses

The Asturias supply chain analysis and database includes the oil & gas sectors as well as marine renewables. It contains just 18 companies with contact names, tel numbers and email addresses. It was constructed by FAEN (Fundación Asturiana de la Energía) and IDEPA (Asturias' Economic Development Agency) in November 2014 as part of the Vanguard Initiative [26] .

IDEPA – Astorias' Economic Development Agency – has the aim of enhance the sustainable economic development of the Principality of Asturias throughout the creation and consolidation of diversified, modern and competitive Asturian business network.

The website contains an information section setting out details of the economy, business structure, labour market and industrial sector [27] . It states there are 67,675 enterprises in the Astoria region of which 54.88% have no employees, and 41.57% are micro enterprises, leaving just 3.55% SMEs and large enterprises.

The IDEPA website also contains a company directory searchable by company name, locality, NACE (economic activity) code to three levels. Unfortunately ocean or marine energy is not a level 1 category of activity; so it is difficult to identify organisations involved in this activity.

The Basque Energy Cluster website [28] states that wave power is a strategic aim of the Basque Country, and with implementation of the Biscay Marine Energy Platform (BIMEP) test centre, it sees "the Basque region as an international benchmark in wave power technologies".

BIMEP is co-funded by IDEA (Institute for Diversification and Saving of Energy) an agency of the Spanish Ministry of Energy, and EVE (Ente Vasco de la Energia) the Basque Government's own energy agency charged with laying the foundations of an energy policy grounded on energy efficiency, diversification of energy sources and promotion of renewables.

A recent example deployment at BIMEP is that of the Oceantec Energy Marinas wave converter, designed as part of the EU funded OPERA (Open Sea Wave Operating Experience to Reduce Energy Cost) project.

[26] http://www.s3vanguardinitiative.eu/sites/default/files/contact/image/adma_energy_concept_note_01_09_14.pdf
[27] http://www.idepa.es/sites/web/idepaweb_en/productos/eldato/index.jsp?codigo=8&idioma=true
[28] http://www.clusterenergia.com/Contenidos/Ficha.aspx?IdMenu=0505ed81-f1d3-4919-aeb6-02c56debb9a6&Idioma=en-GB

The Wave Energy Basque Country [29] website contains a 7 category value chain model:

- Design & engineering of wave generation systems (6 organisations listed)
- Generating plants and site study (2)
- Knowledge / R&D agents (5)
- Maintenance & performance analysis (14)
- Manufacturing, consists of 6 sub-activities covering components, systems and equipment (33)
- On-site installation of devices (10)
- Testing & experimentation infrastructures (1)

The site contains a companies location map and search facilities. The search results show for each organisation its postal address, telephone, website link and the categories in which it operates.

PLOCAN (the Oceanic Platform of the Canary Islands) is a marine scientific and technology platform, originally co-funded from ERDF (European Regional Development Fund) and now financed and managed 50% from each of the Canary Islands and Spanish National Governments. Electricity generation is by wave and offshore wind technologies.

However, according to the website [30] the only wave energy project is an Oceanera-net project "supporting research activities in the field of Ocean Energy", a project that is due to end on 30/11/2017. This brings together 16 partners from 9 member states under the co-ordination of SEN (UK).

The website contains a list of participating and interested companies, but these relate to all projects being carried out on the PLOCAN platform. 'Clicking' on the companies should link through to the websites. There is no supply chain categorization of the companies.

3.3.3 Gaps and barriers in the supply chain

No information available

3.3.4 Opportunities

No information available

[29] http://www.waveenergybasquecountry.com/en/
[30] http://www.plocan.eu/index.php/en/projects

3.4 Portugal

3.4.1 Context for ocean energy

The National Ocean Strategy (NOS) 2013-2020 is the public policy instrument in Portugal for the sustainable development of the economic sectors related to the ocean, including the energy sector. The three key pillars of the maritime economy are: Knowledge, Spatial Planning, and Promotion of National Interests.

In 2008 a site for wave energy development – offshore S. Pedro de Moel, between Figueira da Foz and Nazaré, an area of 320 km2 - was designated by the Portuguese State. It is a demarcated maritime space in water depths between 30 and 90 m. In 2010, ENONDAS (a subsidiary of the Portuguese Grid Transmission System Operator) received from the Portuguese State a public concession for this site for 45 years. Enondas has adopted the trading name of Ocean Plug. In 2015, there has not been much progress regarding the development of the infrastructure for the pilot zone.

The FCT (The Foundation for Science & Technology) is the national public agency for science, technology and innovation and the funding of activities in various sectors including ocean energy.

3.4.2 Supply chain analyses

No supply chain model or directory of companies involved in Portugal's ocean energy sector was identified.

3.4.3 Gaps and barriers in the supply chain

No information available

3.4.4 Opportunities

No information available

3.5 Netherlands & Belgium

3.5.1 Context for ocean energy

In the Netherlands, both the Government and commercial parties have been studying the potential of ocean energy since the 1980s. Business and other organisations have joined forces in a trade association called the EWA (Netherlands Energy from Water Agency).

Pilots have been carried out in Dutch waters to test various ocean energy technologies.

In the second half of 2014, the Dutch Ministries of Economic Affairs and of Infrastructure & the Environment commissioned a study into the export potential of Dutch companies involved with energy from water (short term potential, up until 2023), and the potential contribution this technology could make to the Netherlands' energy transition over the long term (2035). The results formed the basis for talks on potential follow-up activities between the two ministries and the sector.

The Dutch Marine Energy Centre (DMEC) was launched in June 2016 with the aim to promote marine energy and accelerate the commercialization of marine renewable energy technologies. It seeks to create a knowledge platform for SMEs active in the technologies for energy from waves, tides and salinity gradients, thereby facilitating collaborations between stakeholders involved in the Dutch marine energy sector.

The Netherlands is interested in Salinity Gradient energy technology, two pilot projects exist.

The RVO (Netherlands Enterprise Agency) is part of the Ministry of Economic Affairs. Its remit is to encourage entrepreneurs in sustainable, agrarian, innovative and international business. It helps with grants, finding business partners, know-how and compliance with laws and regulations. A search of the website for 'marine' or 'ocean energy' returned no results.

Belgium has very limited resources, compared to France and the United Kingdom. Tidal currents coming from the Atlantic Ocean lose speed once they have crossed the Dover Strait. Similarly, wave energy is reduced in the North Sea. Hence, no specific targets have been set and only a few projects are ongoing. The Flansea pilot, off the coast of Ostend and launched in 2013, is the first Belgian wave converter especially conceived for low amplitude waves, with energy density between 5 and 10 kW/m.

The VLAIO (Flanders Innovation & Entrepreneurship Agency) is a Government agency charged with implementing the economic innovation and enterprise policy in Flanders. Businesses get start-up and growth help, and it provides information on permits, finance and investment in innovation and ecological technologies.

The VLAIO represents EEN (Enterprise Europe Network) in Flanders; it was formed in 2015 from a merger between Flanders Enterprise and IWT – the Government agency for innovation and science. It represents the EEN (Enterprise Europe Network) in Flanders region; as such it may have a broad database of businesses, but no specific supply chain information for ocean energy.

3.5.2 Supply chain analyses

No supply chain model or directory is thought to exist for public access in either the Netherlands or Belgium.

The DMEC's (Dutch Marine Energy Centre's) website contains a list of 16 partners (original project initiators) which include Tidal Testing Centre (TTC) Antea Group, Deltares, Energy Research Centre Netherlands (ECN), Netherlands Institute for Sea Research, Erasmus University Rotterdam, Netherlands Water partnership, TNO, Fishflow Innovations, Imares, Red Stack, Ronamic Rotary Equipment, Teamwork Technology, Tocardo, PWC and Synergos Communicatie. DMEC's website also contains a list of projects and test centres.

The Belgium Flansea pilot is a research project of Ghent University with the following partners: DEME Blue Energy, Port of Oostende, Electrawinds, Cloostermans, Spiromatic and Contec, with support from IWT.

3.5.3 Gaps and barriers in the supply chain

No details known

3.5.4 Opportunities

No details known

3.6 France

3.6.1 Context for ocean energy

France was an early entry into the ocean energy market with the building (in the early 1960s) by EDF of the tidal power plant across La Rance, Brittany. It has an installed capacity of 240MWh (24 x 10MWh power sets) and annual output of 600 GWh. Now 50 years old, a 40 year review of the project by British Hydro, concludes it to be technically and environmentally successful [31].

ADEME – The French Environment & Energy Management Agency – exists to implement public policy relating to the environment, energy and sustainable development. It provides expertise and advice to businesses, local authorities and communities, government bodies and the public at large, and helps finance projects, from research to implementation, in its areas of action. In 2010 ADEME was a major contributor to (and publisher of) a roadmap for renewable marine energy [32].

[31] http://www.british-hydro.org/downloads/La%20Rance-BHA-Oct%202009.pdf
[32] http://www.ademe.fr/en/roadmap-for-renewable-marine-energy

There is no mention on ADEME's website of marine energy supply chains or lists of organisations involved in the sector.

Ocean energy development in France appears to be on a regional basis with clusters around West Normandy, The Loire and other areas.

3.6.2 Supply chain analyses

The Loire is a business cluster with 20 main organisations (actors) operating in marine renewable energy, although many other organisations, public and private, also participate in this area.

The Loire regional agency has a dedicated marine renewal website with a downloadable Directory of Skills [33] for the offshore wind and marine energy. This Directory under the sponsorship of Neopolia, a Loire business network cluster [34], is a "non-exhaustive inventory of the skills and knowhow present in the Loire region" and contains 115 companies and R&D stakeholders across 6 main activities and their sub-activities:

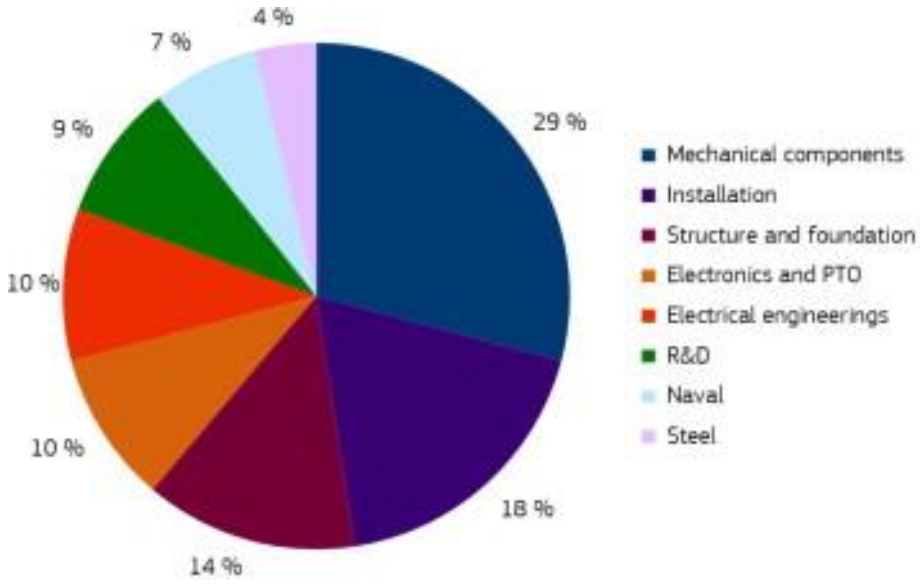
- Studies – preliminary, geotechnical, socio-industrial, measurement and environmental impact
- Components and sub-assemblies for MRE equipment – composites, metal construction, surface treatment & coatings, mechanical and electromechanical, castings, HVAC, power electronics, instrumentation, hydraulics, high & low voltage electricity
- Installation & logistics – infrastructure civils, seabed operations, onshore assembly, foundations, offshore installation, electrical connection, transport
- Operations & maintenance – safety monitoring, operations & maintenance, support vessels
- Related services – Q&A and certification, HR & training, insurance, financial, waste treatment
- Dismantling

For each company there is chart based on the activities / sub-activities showing their specialisms, and descriptions of activities, qualifications and contact details.

West Normandy Marine Energy (WNME) has no supply chain database or model on its website. For information on companies in the area contact should be made with the Technical Committee facilitator (see contact list in the Appendix). The website does contain a list of 20 partnering organisations.

[33] http://www.mre-paysdelaloire.com/wp-content/uploads/Directory_skills_mre_UK_2016.pdf.pdf
[34] Neopolia has about 200 organisations in the cluster, the directory contains those who responded to a questionnaire ahead of publication date.

ResearchGate has published a review of Ocean Energy in Europe [35] which includes an analysis of France's supply chain.



The total number of companies is not stated for each activity category included in the analysis, which excludes critical activities inter alia 'operations and maintenance'.

3.6.3 Gaps and barriers in the supply chain

The Loire directory consists of under 60% of the organisations in the Neopolia cluster. Thus, completeness, gaining response to requests to be included in the directory, is an issue.

Ouest Normandie Energies Marines see a number of barriers to producing a supply chain include:

- Tier 1 contractors have own suppliers, so some opportunities are limited
- Cost is an important consideration, local supply chain companies may not always be the cheapest / best value suppliers – or may be located in other countries (not necessarily Europe)
- Capabilities and skills are not always readily transferable – a company may be excellent in what it does, but for ocean energy these may need to be slightly different and the supply chain may not be able to accommodate that required change in skill; for example a need for references and capability statements directly relevant to ocean energy

3.6.4 Opportunities

No information available

35 https://www.researchgate.net/publication/310840826_Renewable_energy_and_biodiversity_Implications_for_transitioning_to_a_Green_Economy#pag:8:mrect:(471.63,740.24,14.38,6.20)

3.7 Sweden

3.7.1 Context for ocean energy

The Swedish Energy Agency is responsible for facilitating a sustainable energy system in Sweden. It funds research, technology development and demonstration. In 2015 it started a four year ocean energy programme with a budget of 53 MSEK (€5.7 million). In the first call 7 projects were funded.

Ocean Energy Sweden is a business network consisting of Swedish companies developing products and systems in the area of ocean energy. The network will grow to include suppliers, universities, research institutions, test centres and others. It therefore has the potential, to set up and coordinate common projects.

The main purpose of this Ocean Energy Sweden network is increased interaction and cooperation between companies in the sector, ultimately aiming for cost efficient products, systems and commercial projects. Focus will be on networking, joint development projects and commercial activities.

Other central (Swedish Research Council and the Swedish Governmental Agency for Innovations systems) and regional authorities fund and help businesses develop technologies.

3.7.2 Supply chain analyses

The ocean energy sector in Sweden is described as fragmented, and being relatively new the main involvement is from technology companies, energy companies, research agencies, public organisations and interest groups.

While there are some key players and cooperative networks around specific projects, notably by developers located of the West Coast of the Gotaland region, no supply chain model or directory of companies in the supply chain exists.

The main Swedish developers are listed on the Ocean Energy Sweden website [36] and include Gaiatellus, Wavetube, Minesto, Ocean Harvesting, Seabase, Waves4power, and Corpower. The website also lists research organisations such as Chalmers University of Technology, Uppsala University, KTH Royal Institute of Technology, Blekinge Institute of Technology and RISE (Research Institutes of Sweden). RISE was created at the end of 2016 from SP Group (SP Technical Research Institute), Swedish ICT and Innventia.

[36] https://oceanenergy-sweden.se/swedishdevelopers/

*"We have done a mapping of the sector in Sweden, however I would say that it is more a identification of different stakeholders than a supply chain analysis so I would not say that it is sufficient." (*SP Technical Research Institute Sweden).

3.7.3 Gaps and barriers in the supply chain

A 2014 report by The Swedish Energy Agency contains a chapter on marine energy and an analysis of the needs and barriers of the marine energy sector. This report is only available in Swedish [37]. The report analyses five Technology Innovation Systems (TIS) centred on offshore wind, marine energy, and system weaknesses that hamper the area's further development, which can be addressed by the system's stakeholders and what motivates specific political commitments.

3.7.4 Opportunities

The same report is said to constitute a basis for formulating measures to achieve increased innovation, technology transfer and industrialization in the TIS areas of technology.

Another opportunity for supply chain development is as test technologies approach commercialization. An example is Minesto's commercial launch of its Deep Green device off Anglesey, due in Autumn 2017, utilizing both UK and Swedish component manufacturers and sub-contractors.

3.8 Denmark

3.8.1 Context for ocean energy

Denmark has long been at the forefront of wind energy development with companies such as Vestas Wind Systems and Dong Energy. Its development in the field of marine energy, specifically wave, has been slower.

In 2015, the Partnership for Wave Power published [38]a set of roadmaps for the development of wave power, which aim at Danish and international commercial success on the wave power sector by 2030. The roadmap work has been funded by the Danish Energy Agency, which is responsible for administering energy and supply.

The roadmap is a series of roadmaps each covers a different range of activities:

- Project steering
- Mooring systems
- PTO systems

[37] Teknologiska innovationssystem inom energiområdet.pdf
[38] http://vbn.aau.dk/ws/files/215360990/Partnership_for_Wave_Power_Roadmaps.pdf . The Partnership includes 9 wave energy developers.

- Power transmission from floating WEC to seabed
- Materials & components
- Dissemination

National energy development programmes such as EUPD, Energinet.dk and the Danish Strategic Research Council are able to fund development of wave energy, as well as other sources.

DanWEC test site is being developed with Greenlab funding. Two wave rider buoys have been launched and a seabed survey has been carried out over an area in the sea south-west of Hanstholm harbour. This area has been accepted by authorities for test purposes, and at the moment the wave energy system Wave Piston has a permit to test in this area and deployed their anchoring system during the summer of 2015.

The Danish wave energy sector is involved in co-operative projects funded by the EU as well as international collaborations.

3.8.2 Supply chain analyses

The Partnership for Wave Power report mentioned above includes a list of current Danish wave energy systems being undertaken by the Partnership developers. Each of the 11 project concepts is described in detail and includes website urls.

No supply chain modal or listing by activities has been found, although State of Green, [39] an official website for information about “green” issues in Denmark is a useful resource. It has tabs for sectors, solutions, profiles, news and events.

Marine (specifically wave) energy is included under the ‘solar and other renewables’ energy sector tab. This sector as a whole contains 160 solutions and 130 profiled companies. Further searching within sector by area of interest (wave power) delivers a total of 41 organisations, categorised into public sector, business, institutions and organisations. These can be viewed as tiles, a list or on a map. The full profile of each organization is revealed by clicking on ‘+’.

3.8.3 Gaps and barriers in the supply chain

No information available

3.8.4 Opportunities

To use the expertise and supply chains from wind and other renewable energy industries in the marine energy area.

[39] https://stateofgreen.com/en/sectors/solar-other-renewables/wave-power. “State of Green” is a public-private partnership of the Danish Government, Confederation of Danish Industry, Danish Energy Association, Danish Wind Industry Association and Danish Agriculture and Food Council.

4. Countries outside Europe

4.1 Canada

4.1.1 Context for ocean energy

After a hesitant start in the early 2000's, the Ocean Renewables Energy Group (OREG) was formed in 2004 to represent the sector and push for marine energy in British Columbia.

In 2012 OREG rebranded as Marine Renewables Canada, and registered the association as a Canadian non-profit society. This change coincided with the movement towards implementation of the Canadian Marine Renewable Energy Technology Roadmap, and signified the growth of the industry. Marine Renewables Canada works to aid in the realisation of Canada's ocean energy resources, technologies, and project capabilities.

The Canadian marine renewable energy sector progressed steadily in 2015. The province of Nova Scotia passed sector-specific legislation, the Fundy Ocean Research Centre for Energy (FORCE) announced the development of a 5th berth at the in-stream tidal demonstration site, new monitoring instruments for accurate tidal current and turbulence measurements were developed, and international collaborative R&D projects between Canada and the United Kingdom were announced.

4.1.2 Supply chain analyses

Marine Renewables Canada aligns industry, academia and government to ensure that Canada is a leader in providing ocean energy solutions to a world market. It has a supply chain model and database on its website [40].

294 member organisations are listed in the database, mainly located in Newfoundland (St John's) and Nova Scotia. The supply chain model consists of 7 main categories (stages of the project lifecycle) and 17 sub-activities, many of which are included within more than 1 category of the model:

- Site screening & feasibility (209 member organisations).
- Planning (165)
- Project design & development (165)
- Fabrication (213)
- Deployment, installation & commissioning (199)
- Operations & maintenance (174)
- Decommissioning (174).

The organizational profile consists of a short paragraph about the organization, the services it provides, the markets it serves, postal address and a website link.

[40] https://supplychain.marinerenewables.ca

4.1.3 Gaps and barriers in the supply chain

No information available

4.1.4 Opportunities

No information available

Annex 1: List of organisations and people contacted

Organisation	Staff Member	Staff Position
Regen SW	Johnny Gowdy	Commercial Director
Innovate UK	David Hytch	Lead Technologist - Offshore Renewables
ORE Catapult	Simon Cheeseman	
Marine Energy Wales	David Jones	Project Director
Marine Institute (SEAI)	Gillian Gannon	
Scottish Enterprise	Suzy O'Hare	Senior Executive Energy Supply Chain
Pays de la Loire	Charlotte Sugliani	Econ Dev, Marine Renewable Energy
Ouest Normandie Energies Marine	Emmanuel Pottier	Technical Committee Industry & Sub-contracting
LHEEA	Thomas Soulard	Project Manager, SEM-REV Sea Tests Site
SP Technical Research Institute Sweden	Pierre Ingmarsson	
EMEC	Oliver Wragg	Commercial Director

Annex 2: Ocean Energy Sites

1. United Kingdom

Name	Location	Operator	Type	Funding	Website
Ballycastle	Fair Head / Torr Head – Co Antrim	Tidal Ventures	T		Tidal Ventures
Brims Tidal Array	Orkney	Brims Tidal Array Dev / SSE Renewables	T		SSE
Brough Head	Orkney	Brough Head Wave Farm	W	Public	Gov.Scot
Cardiff Tidal Lagoon	Cardiff	Tidal lagoon	T		Tidal Lagoon Power
EMEC	Orkney Isles (4 sites)	EMEC	W, T	Public	EMEC
Fab Test Fred Olsen	Falmouth	Falmouth HC	W		FABTEST
Harris Demo Zone	Isle of Harris	EMEC	W	Public	EMEC
Holyhead Deep	Anglesey	Minesto	T	Mix	Minesto
Kyle Rhea	Isle of Skye	MCT - Seagen	T	Private	Atlantis Resources
Lashy Sound	Orkney	ScotReneables Tidal Power	T		Scot Renewables
Meygen Pentland Firth	Pentland Firth	Meygen	T		Atlantis Resources
Morlais	Anglesey	Menter Mon Cyf	T		Morlais Energy
Mull of Galloway	Dumfries & Galloway	MCT - Seagen	T	Private	Atlantis Resources
Mull of Kintyre	Mull of Kintyre	Argyll Tidal / Nautricity	T		Nautricity
Ness of Duncansby	Orkney	Scottish Power Renewables	T		Scottish Power Renewables
North Yell	Shetland	Nova Innovations	T		Nova Innovation
Pendeen Array	Cornwall	Pendeen Consortium	W		
Portland Bill Tidal Site	Portland Bill	Marine Current Turbines	T		Atlantis Resources
Ramsey Sound	Pembrokeshire	Tidal Energy	T		Tidal Energy Ltd
S Pembroke Demo Zone	Pembroke	Wave Hub	W		Wave Hub
Sanda Sund	Kintyre	Oceanflow Development	T		Ocean Flow Energy

Strangford Loch	N Ireland	MCT / Sea Generation	T		Atlantis Resources
Swansea Tidal Lagoon	Swansea	Tidal Lagoon	T		Tidal Lagoon Power
Wave Hub	Cornwall (6 sites)	Wave Hub	W		Wave Hub
West Islay	Orkney	DP Energy	T	Mix	DP Energy
Westray South	Orkney	DP Energy	T	Mix	DP Energy

2. Other European

Name	Location	Operator	Type	Funding	Website
Marine & Renewable Energy Test Site	Galway Bay	SmartBay Ireland, Marine Institute, SEAI	W & T	MIx	Smart Bay
Lir NOTF National Ocean Test Facility	UCC (Cork)	University College Cork	W	Mix	lir-notf
Atlantic Marine Energy Test Site	County Mayo (Annagh Head)	SEAI	W	Public	SEAI
Biscay Marine Energy Platform (BIMEP)	Armintza, Biscay	EVE and IDAE	W & T	Public	BIMEP
Mutrika Wave Energy Plant	Mutrika, Biscay	EVE	W	Public	EVE
Plocan	Canary Islands	Govt	W	Public	PLOCAN
Danish Wave Energy Centre Nissum Bredning	Denmark	DANWEC	W	Mix	DANWEC
Danish Wave Energy Centre - Hanstholm	Denmark	DANWEC	W	Mix	DANWEC
Ostend (Flansea)	Belgium				DEME Group
Den Oever -	Scheldt - Holland	Tocardo	T	Private	Tocardo
Grevelingen barrier	Holland		T		
LabSchale sites	Holland			Mix	
Agucadura	S Pedro de Moel Portugal	ENONDAS	W	Public	REN

Pico OWC Plant	Island of Pico, Azores	WavEC – operational	W	Private – non-profit partners	Pico-OWC
Peniche	Portugal	Waveroller (AW Energy)	W	Private	AW-Energy
SEM-REV, Le Croisic	Nantes, Loire, France		W	Public	SEM-REV
Lysekil	Sweden	Uppsala University	W	Public	wave-power/lysekil
Soderfors, Dalalven River	Sweden	Uppsala University	W	Public	Soderfors
Runde Island (REC)	Norway		W		Runde Centre.no/en