The UK Offshore Wind Supply Chain:

A Review of Opportunities and Barriers

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Matthew Chinn

Reporting to

Matthew Hancock, Minister of State for Business, Enterprise and Energy

And

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As co-chairs of the

Offshore Wind Industry Council

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Personal introduction by Matthew Chinn

When I was asked to lead this review I really had to think hard about whether there was already enough published on this topic and what more I could add, but it seemed to me that my experience could be useful in looking at supply chain development in a wider context. I know how complex and difficult supply chain decisions can be in a large multinational organisation with competing demands for capital.

The UK offshore wind sector needs a thriving supply base to secure its future and to complete the economic circle of benefits for UK society as a whole. More than that, local content can drive cost reduction, key to making offshore wind power truly competitive and sustainable in the longer term.

While the UK currently has the largest offshore wind market in the world, and this is expected to continue for at least the next decade, OWIC now needs to take an active lead to establish a sustainable UK supply chain and drive down costs. We need to act quickly if we are to grasp this opportunity, not just for UK projects but to prepare for a future broader market in goods and expertise.

Finally I would like offer my sincere thanks to all those involved in conducting this review in the limited time available, but I would particularly like to thank all those interviewees who gave freely of their time and proved to be both open and constructive in offering their evidence and views to the review team and to me personally. Thank you all.

Matthew Chinn

Siemens

Executive Summary

Offshore wind has a very substantial role to play in decarbonising the UK's power sector over the coming years. The UK has a vital yet extremely challenging target to reduce greenhouse gas emissions by 80% by 2050 compared to 1990 levels, and it is clear that several different low-carbon electricity generation technologies will be needed to deliver this commitment. As part of this transition, the UK is forging ahead with ambitious levels of offshore wind deployment: the UK already has the biggest offshore wind market in the world. This is expected to grow to over 10GW by 2020, and to be a growing part of the energy mix in the 2020s as the UK decarbonises its economy and works to deliver the newly agreed ambitious EU greenhouse gas reduction targets for 2030.

This independent review set out to examine the scale of the opportunity for the UK supply chain from offshore wind deployment, to understand the supply chain's current capability and readiness to compete, and to explore key barriers. The aim was to make recommendations to industry and Government about a handful of actions that could make a big difference in the near term, and help industry and Government deliver the twin goals of cost reduction and UK jobs and investment.

Evidence was gathered from across the offshore wind industry, with 29 interviews completed and 13 questionnaires submitted and analysed. In the interests of neutrality, the scope excluded those parts of the supply chain where Siemens has a key interest: wind turbine manufacture, substation equipment and wind turbine maintenance.

What is very clear in the findings is that parts of the UK supply chain have already experienced success: there is a great story to tell on operation and maintenance, array cables and substation manufacture in particular. The first challenge now is to make sure these successful sectors stand ready to meet the demands of the market and maintain their position, through innovation and scaling up to deliver on larger contracts. The second challenge is to seize the opportunities on offer for sectors which, to date, have mainly been supplied from overseas: towers, foundations and export cables.

Offshore wind industry sub-sector	Potential size of opportunity for the UK supply chain	UK supply chain current readiness to compete
Towers	High	Low
Substation structures	High	High
Foundations	High	Medium
Cables – inter array – export	Medium High	High Low
Operation & maintenance	High	High

The evidence revealed a number of barriers which need to be overcome if a strong and sustainable supply chain is to grow in the UK. Different companies within the supply chain

described different challenges, often related to the location, size and type of company rather than the product. However, the main barriers that industry raised cut across all sectors:

- The need for clearer visibility and volume in the order pipeline and market;
- The difficulties facing new entrants without a track record in offshore wind;
- The challenges posed by the way risk is dealt with through the supply chain;
- The need for industry to move towards a culture which better enables collaboration and the efficiencies which follow;
- The need for a clearer support landscape.

A series of recommendations are presented, addressing the different barriers. These focus primarily on:

- The need for clarity on the long term market, including a 2030 emissions target for the power sector;
- Consistent messaging from Government;
- Governments, developers and the supply chain working together to help new market entrants;
- Actions on commercial issues, including bonding.

This report goes to the Offshore Wind Industry Council (OWIC). It contains recommendations for action for both industry and Government, with an expectation that these ideas - which have come from the industry itself - will be driven forward through the Council. Much of what was reported to the review team has been said before in recent reports or working groups, showing that action is clearly needed. OWIC needs to act promptly and decisively to drive forward actions that will make a tangible difference to opportunities for the supply chain in the UK. Working collaboratively to deliver this programme and learning lessons from other industrial sectors will help the offshore wind sector in the UK achieve industry-wide efficiencies, cost-reduction and support sustainable jobs and investment. However, this is a long-term industry involving substantial financial investments and, if the UK supply chain is to have a chance of succeeding in gap areas, the Government has to show its long-term commitment to supporting the market and do so consistently.

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Introduction

In May 2014, Michael Fallon, then Minister of State for Business, Enterprise and Energy, and Benj Sykes of Dong Energy, in their capacity as co-chairs of the Offshore Wind Industry Council, invited Matthew Chinn to review the current state of the UK offshore wind supply chain. The objective of the review was to understand what more could be done to support the development of the UK supply chain, in order to capture maximum economic benefit from the UK's position as the world leader in offshore wind development.

Specifically, it was agreed that the independent review would:

a) Consider the scale of the opportunity for the UK supply chain covering, for instance, foundations, sub stations and cables, although excluding turbines;
b) Examine the UK supply chain's capability, capacity and readiness to compete, and identify key barriers;
c) Recommend actions for industry – via the Offshore Wind Programme Board and the Offshore Wind Industry Council – to enable UK firms to access new opportunities;
d) Consider how best to use the support that the Government provides to the supply chain through the Offshore Wind Investment Organisation.

A significant volume of work – both governmental and industry led – has already been completed in this area, but many of the recommended actions have either not been taken up or are still in progress. With the industry having recently reached a new milestone – the first Contracts for Difference allocation round – a number of long standing issues have been brought into clearer focus. This report looks at what is needed next, given what we know now, rather than how we got here. The sector can grow in the UK through both investment from existing UK firms and inward investment from non-UK firms. The recommendations from this review need to be actioned over the short term, and they focus on the provision of practical support for the future development of the UK offshore wind supply chain.

This is a global market, with a strong presence in the seas of northern Europe, and there will be benefits from European countries working together to reduce the cost of deployment and to maximise the benefits for European companies.

The UK has the greatest natural wind resource of all these countries and brings significant skills from traditional electrical engineering, as well as offshore oil and gas. With both this history, and the natural geographical advantage of excellent wind resource, the UK should be well placed to capitalise on this opportunity. However, the offshore wind industry and its supply chain started in Denmark and Germany, and so far these countries have reaped the greatest industrial benefits, including extensive supply chains for onshore production. The

growth of offshore wind and the demanding requirements for the port-side facilities needed, create an extensive new opportunity.

By default there is a natural tendency to a competitive approach between countries. This is not serving our countries well as it segments markets, discourages sharing of key lessons and leaves weaker companies unable to invest to reduce the cost of offshore wind energy. In the long run, locking in first mover advantage for a single country will be a hollow victory, as without the scale of an international market and the skills of an international workforce, offshore wind will not deliver the cost reductions required.

It is time to recognise that, in the interests of separate countries and companies, the cost reduction that is needed will only come through greater cooperation.

To keep driving the sector forward and improve the UK's share of supply chains and associated economic benefits both Government and industry are going to have to work to deliver on a number of areas. This independent report contains a number of recommendations for both Government and industry and it is hoped both sides will deliver on these, while recognising the need to work within EU internal market rules. A full list of recommendations is given in Annex A.

Matthew Chinn was invited to lead the review, as his - then - position as Managing Director of Siemens Energy Sector in the UK meant he was well placed to provide insight on the UK market, looking across the sector as a whole. To avoid bias and potential conflicts where Siemens has direct involvement in the supply chain, the scope of the study was restricted to exclude Siemens' main area of direct interest. The scope therefore excluded wind turbine manufacture, substation equipment, and wind turbine maintenance. The review team took evidence from other turbine manufacturers to ensure their perspective of the wider supply chain and industry was also taken into account. Indeed it is worth noting that although turbines and blades are out of scope of this review, there are opportunities for the UK in these areas, and others would be better placed to assess these opportunities in a more neutral way for OWIC. The focus has been on top tier companies, but it is recognised that there are many and varied opportunities across the full supply chain.

Methodology

The UK offshore wind supply chain has rightly received significant attention over recent years, as the UK's global dominance in offshore wind has continued to strengthen. The Offshore Wind Cost Reduction Taskforce[1], the 2013 Industrial Strategy[2] and the Offshore Wind Investment Organisation (OWIO) have all identified key actions to ensure the UK can capture maximum economic benefit – both through investments bringing growth and jobs to the UK and through further cost reduction in offshore wind. Likewise, there have been numerous assessments of the capability and capacity of the UK supply chain.[3,4] Recognising this, the literature was reviewed, taking in key recent documents and plans, across both government and industry, to understand in detail what work was already underway and to identify any possible gaps. The findings of the literature review are set out in Annex B.

The next step in the review process was to test the emerging conclusions from the literature review with industry members. It was important to benefit from the views of both members of the supply chain and offshore wind developers - existing and potential - along with key industry bodies and governmental organisations. Given the limited timescale for the review, face to face interviews were supplemented with written input from additional interviewees. All those who provided input to the review work in offshore wind and are senior figures within their organisation. The literature review had identified the wide-ranging set of issues being raised in this field, and so to provide a more focused line of inquiry, a core set of interview questions was developed. Examples of the types of questions used in the face to face interviews and in the written questionnaires are in Annex C. The full list of interviewees can be found at Annex D. Interviews were conducted by the review team and all responses, whether face to face or written submission, were treated confidentially unless respondents indicated they should be treated otherwise.

In total, 29 interviews were completed and 13 written submissions received, with a number of further discussions with government and industry organisations. This provided a significant body of evidence that was analysed and discussed by the review team in workshops. During these, emerging conclusions and recommendations were drawn out for inclusion in this review.

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[1] Offshore Wind Reduction Taskforce, July 2012 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66776/5584-offshore-wind-cost-reduction-task-force-report.pdf

[2] Offshore wind industrial strategy: business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action

[3] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities

[4] Wind Energy in the UK – State of the Industry Report 2013 - http://www.renewableuk.com/en/publications/reports.cfm/state-of-the-industry-report-2012-13

The emerging conclusions were then tested at a meeting of OWIC's Offshore Wind Programme Board on 8 October 2014, with representation across the supply chain, industry, DECC, BIS, The Crown Estate and the Scottish Government. This enabled the recommendations to be further refined to ensure they would deliver implementable, short-term actions that would provide genuine practical support to develop the offshore wind supply chain in the UK.

Key findings

The UK Success in offshore wind

UK investment in offshore wind is increasing economic opportunities for UK businesses. The perceived wisdom that all of the investment in the offshore sector is ultimately going overseas needs to be forcefully challenged.

Recent supply chain analysis shows that 43% of the lifetime cost of a UK wind farm is spent in the UK[5]; this translates into real jobs. Manufacturing related to the turbines themselves remains largely at this point in Germany and Denmark, but the resources required to project manage and install projects has grown extensively in the UK.

Early wind farm installations used predominately overseas workers, but recent figures suggests that as much as 60-70% of the workforce deployed on the latest projects have been UK based.[6] This is a considerable success story for the UK, with over 6,800 people directly employed in offshore wind in the UK.[7]

There are particular areas of success within the wider picture: around 70% of the man hours expended through the life of a wind farm[8] are in operation and maintenance, and by its nature these jobs are almost exclusively UK based. The majority of HVAC substations installed in UK waters have been designed and built in the UK.[9]

UK firms successfully winning contracts this year include:

- JDR Cables have built on previous successes by winning contracts totalling £100 million to supply:
    - Inter-array cables and cable accessories for Dudgeon[10] offshore wind farm in the UK.
    - Inter-array cables, cable accessories and post-delivery offshore services for Nordsee[11] offshore wind farm in Germany.
    - Inter-array cables for the Vattenfall AB Sandbank offshore wind farm in Germany.[12]

[5] Soon to be published analysis by BVG for OWIC
[6] Siemens internal figures
[7] http://www.renewableuk.com/en/publications/index.cfm/working-green-britain
[8] Siemens internal data.
[9] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[10] http://jdrglobal.com/jdr-wins-inter-array-contract-for-the-dudgeon-offshore-wind-farm/
[11] http://jdrglobal.com/jdr-wins-inter-array-cable-package-for-nordsee-one-wind-farm/
[12] http://jdrglobal.com/jdr-to-deliver-inter-array-cable-package-for-sandbank-offshore-wind-farm/

- Siemens (Manchester) has been awarded the substation platform contract for Dudgeon and has placed the fabrication contract with Sembmarine SLP (Lowestoft).[13]

- Atkins is now contracted to design five offshore substations for DONG Energy, which includes a contract to provide the detailed offshore substation designs for the Race Bank projects..[14]

- 3sun Group secured:
  - A contract renewal with Siemens UK to provide offshore wind turbine installation services in the UK until 2016.[15]
  - Secured a contract with MHI Vestas Offshore for the electrical and mechanical completion of 73 V112-3.0MW turbines to be installed at the Humber Gateway Offshore Wind Farm.[16]

- RES Offshore has won a contract to provide specialist engineering and project management services for the first project within the 1.1GW Moray Firth Round 3 zone off the north-east of Scotland.[17]

- UK-based recruitment company ERSG has won a contract to supply staff to Dong Energy's UK offshore wind farms.[18]

- UK Subsea firm Fugro has won two separate contracts to carry out survey work and bury the cables at two offshore wind farms in the UK.[19]

- A new offshore wind service vessel designed in West Cumbria is set for sea trials after getting a £90,000 grant from Britain's Energy Coast.[20]

- Tekmar have been awarded a number of cable supply contracts:
  - The contract for the first US wind farm, Cape Wind[21].
  - A multi-million pound contract for the Dudgeon offshore wind farm[22] in the UK.
  - A contract with with international EPC contractor Van Oord Offshore Wind Projects BV to work on the Eneco Luchterduinen offshore wind farm

[13] http://www.offshorewind.biz/2014/10/20/sembmarine-slp-to-build-dudgeon-substation/
[14] http://www.dongenergy.co.uk/EN/News/UK_news/news/Pages/AtkinswinRacebankoffshoresubstationcontract.aspx
[15] http://www.3sungroup.co.uk/3sun-group-successfully-secure-siemens-uk-contract-renewal
[16] http://www.3sungroup.co.uk/3sun-group-successfully-secures-contract-mhi-vestas-offshore-wind
[17] http://www.res-offshore.com/news-events/latest-news/res-offshore-working-with-moray-offshore-renewables-limited-on-first-project-in-moray-firth-round-3-zone
[18] http://renews.biz/76528/dong-chooses-ersg-for-uk-staff/
[19] http://www.fugrorenewables.com/fugro-renewables-news/News2014/Offshore-Wind-Farm
[20] http://renews.biz/71588/offshore-vessel-gets-cash-float/
[21] http://www.tekmar.co.uk/news/item/tekmar-awarded-cape-wind-cable-protection-contract
[22] http://www.tekmar.co.uk/news/item/tekmar-selected-as-dudgeon-cps-supplier

development in Holland.[23]

- Mec Com has won two contracts worth £8 million to deliver assembly and testing for Siemens and a large manufacturing package for Alstom.[24]

- The main construction contract for the ABP/Siemens Green Port Hull development at Alexandra Dock, Hull, has been awarded to a joint venture between two UK companies, Grahams and Lagan. This contract award is worth about £100 million. Many local suppliers will benefit directly from this award as sub-contractors. Firms such as Alan Wood Group and Expotrak are already playing an active role in this project.

Recommendation:

1. **Industry, through OWIC, needs to take a much more assertive approach to telling the success story of offshore wind in the UK to a wide audience.**

Clustering

As a result of this success, clustering is beginning to emerge across the UK:

- The New Anglia Local Economic Partnership area in Suffolk and Norfolk, where a number of operation and maintenance providers, such as 3sun Group, are located with other companies such as Seajacks, Sembmarine and ODE who also support the offshore wind sector;
- Grimsby[25], where Centrica, RES, Siemens and DONG have all established operation and maintenance bases;
- Barrow-in-Furness which is the operations and maintenance base for Barrow, Ormonde and West of Duddon Sands wind farms.

The attraction of manufacturing capability to the UK will also support the development of natural geographic clusters, with both direct suppliers and supporting companies having a logical attraction to manufacturing and project execution locations.

Clustering brings obvious benefits, such as the ability to collectively negotiate with ports, reduced logistics costs, establishment of a large skills base and the potential to share vessels and helicopters. The sector must realise the benefits of increased co-location and clustering and should do more to work collaboratively to ensure the sustainability of the industry.

[23] http://www.tekmar.co.uk/news/item/tekmar-seals-deal-with-van-oord-on-major-dutch-offshore-wind-farm-project
[24] http://www.offshorewind.biz/2014/08/11/offshore-wind-brings-gbp-8-mln-to-precision-sheet-metal-company/
[25] http://www.hull.co.uk/template01.asp?PageID=253

UK Skills

Research for this review revealed near consensus on skills, with both developers and suppliers praising the UK's readiness to compete. Supply chain companies said that the workforce was both accessible and mobile, that they had the potential to scale up quickly as orders were placed and that they were already investing in apprenticeships and on-going skill development.

Some concerns were raised about the need for particular specialisms such as electrical engineers and coded welders, the need for some additional training requirements and competition from the oil and gas sector where there is a perception of higher wages.

Developers also raised concerns about industry specific skills, such as the need for qualifications that build on the existing basic electrical qualification and add in the bespoke elements of working offshore. Others pointed to the need for increased project management skills to oversee the installation of complex, multi-million pound investments.

Recommendation:

2. **Industry should continue to drive forward investment in the right skills, and utilise the existing skills programmes. The Government should maintain funding in skills programmes and ensure that such programmes are long-term, strategic and co-ordinated.**

The view from the offshore wind supply sectors

There are distinct opportunities and challenges for each of the in-scope tier one sectors: substations, towers, foundations and cables.

Substations: a success story now

Substation fabrication and installation is a UK industrial success story, with high UK content (60-70%)[26] and export potential. The substation market has developed well in the UK, partly due to many of the electrical standards being unique to the UK. The only non-UK parts tend to be the larger items of electrical equipment, such as transformers, which are imported from global manufacturers.

Whilst this sector has been a success to date, a number of significant challenges are apparent. This market has been highly competitive in the UK, and a number of fabrication companies have faced closure or financial difficulties as a result of the 'peaky' nature of the workflow and high costs of maintaining a workforce and facility with fluctuating demand.

As developers look to plan programmes rather than individual projects, fabrication yards will look to secure 'repeat order' contracts to enable innovation and cost reduction. Repeat orders also provide an incentive to remain focused on offshore wind supply, rather than solely oil and gas sector work, which is identified as having higher potential margins.

The stop-start nature of the market, combined with the demands for cost reduction and other challenges highlighted in this report are key issues for this sector. A more stable long-term approach is required to ensure future viability and maintain current market players.

Further complexity is added by the increasing scale and distance from shore of the large Round Three UK projects currently being developed. These projects are expected to require the use of High Voltage Direct Current (HVDC) substations, to maintain electrical losses to a realistic minimum. The market for the technology is served by a small number of multi-national players, but the fabrication of the platforms represents a significant scale challenge to UK fabricators. Platform top-sides for HVDC stations can be up to 12,000 tonnes, substantially restricting the potential list of UK fabricators for both top-side and jacket and taking this work out of the league of many UK yards.

A key focus for the UK should be the identification and encouragement of potential UK providers to target this market, although the number of prospective players is limited by physical constraints of port side facilities. Whilst this may be a challenge for UK yards, it is worth noting however that the design of these large HVDC projects may include a number of smaller 'AC collector' stations, so opportunities may remain for existing players.

[26] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities

It is important that the success continues and companies need to adapt to stay ahead, for example by being ready to deliver larger orders, both in terms of scale and volume. To help UK companies rise to the challenges of the substation market, OWIO should continue to work to support the sector.

Towers: a potential success

Tower suppliers remain highly positive about the potential for the UK market, with the UK's pipeline creating a potential demand for up to 5,000 towers. With the lack of UK facilities capable of delivering towers at the current scale required for offshore, there is a significant opportunity for the UK.

Tower production is already a relatively mature industry with a number of international players dominating the market. The scale of offshore towers (typically 300-400 tonnes) means that logistics and handling costs are significant. Lower logistical cost could be achieved by proximity to, or ideally co-location at, the execution port. The benefits of lower logistics costs are not expected to be overshadowed by labour costs, which are relatively small in this highly automated industry, and comparable in the UK to other western European states.[27] None of the review respondents indicated that skills or workforce issues would be a constraint.

Inward investment projects in the UK are 'live' and would be triggered by the placement of firm orders, according to industry respondents. UK tower manufacturers would require significant investment, or re-location, to deliver the port-side facilities needed to deliver offshore towers. The overall level of UK content will also depend on the UK sourcing of steel plate and materials, which could be further increased by investment in the UK capability to produce the larger plate sizes required for cost-effective tower production. Attracting tower manufacturers to the UK would create additional local demand, and could potentially trigger UK investment in the production of slab and rolling plant to produce the larger plate sizes.

The UK manufacture of towers is a significant potential industrial development and is likely to provide the best opportunity for the UK in large 'flagship' investments in the short and medium term. The attraction of an existing tower manufacturer to the UK should remain a priority for OWIO.

The Foundation Story

After turbines, foundations are likely to be the largest procurement choices in offshore wind projects, significantly affecting the level of local content. A significant potential market exists for the manufacture of foundations in the UK.

The market is currently largely focussed on monopile foundations (and the associated transition pieces), which the UK has had some success in delivering. However, challenges

[27] http://www.bcg.com/media/PressReleaseDetails.aspx?id=tcm:12-159505

exist for UK manufacturers in terms of both scale and volume. Delivery of the full UK prospective pipeline would require up to 5,000 individual turbine foundations and this, coupled with the increasing dimensions of monopiles of up to 10 metres diameter and in excess of 1,000 tonnes, exceeds the current capability of UK manufacturers.

A number of projects are also considering the use of more complex, lattice based structures or jackets, similar to those used extensively in the oil and gas sector. The UK has a number of highly experienced steel fabricators with transferrable experience from the oil and gas industry who have the potential to enter the serial production of jackets. Improved local logistics will help to drive down future costs.

UK companies face a number of additional issues:

- Tooling and facilities at the yards are not aligned to serial production of large monopiles and/or serial production of jacket foundations;
- The financial strength of the companies limits the volume that can be placed with any one yard;
- Uncertainties on future foundation technology choice as turbine sizes are evolving quickly;
- Competition from established facilities outside the UK.

A significant capital investment would be needed to provide true serial production of foundations, with a 'product' rather than 'project' approach needed to achieve competitive pricing and delivery. Industry respondents did indicate that a number of UK facilities would be prepared to make further investment or consider partnering with other larger players in the market on the basis of a more certain project pipeline.

There is uncertainty over whether the logistical costs of importing foundations are significant enough to spur investment in UK facilities. To deliver major capacity in the UK foundations supply chain, partnerships are likely to be required between existing providers of foundations (bringing access to clients, expertise and a track record), with UK facility owners (with port-side land, UK labour experience and appropriate competencies). Such collaboration might make continental suppliers more attractive to developers seeking to enhance local content as well as providing UK jobs and developing UK facilities.

However, as projects move from monopiles to jackets, there will be an opportunity for UK manufacturers to position themselves as serial jacket manufacturers.

OWIO should continue to focus on helping to broker partnerships between well-capitalised companies with a track record of producing offshore wind foundations and UK facilities.

The Cable Story

The cable market is global in nature and can be subdivided into three separate market segments: array cable (<66kV, AC); export cable (>110kV, AC); and HVDC export cable.

In the array cable segment a notable success has been achieved in the UK with JDR cables having supplied a number of UK projects, as well as securing orders to export to four overseas offshore wind projects. The company successfully diversified from its core market of umbilical cables supplied to the oil and gas sector, and made significant investment to enter the market with some targeted government support.

The export cable market has three manufacturers in Europe, although none of these have export cable manufacturing facilities in the UK. These cables have a long multi-year lead time, suggesting an opportunity for additional capacity.

Whilst this has been a target area for UK investment for some time, to date no projects have been secured for the UK. This may result from a combination of factors; the 'cores' are not manufactured in the UK and would need to be imported; and cables are typically loaded, over a period of days or weeks onto an ocean-going vessel from the factory destined for the final installation location, meaning that the relative logistics advantages of being close to the final wind farm may be less of a factor than it is for towers and foundations.

Opportunities to attract further cable manufacturers would of course be welcomed, however the review work suggests that there is no over-riding rationale for export cable manufacture in the UK, and this should be less of a focus.

As the market moves towards HVDC connected projects at higher voltages, the introduction of new cable designs may prove to be an area where the UK can add value through innovation and testing services. The interconnector market has not been investigated in detail as part of this study, but it is clear that a market that includes significant interconnector projects coupled with HVDC connected wind could be of a more attractive scale for manufacturers. It is recommended that more work is undertaken in this area to evaluate the potential for future potential UK interconnectors to supplement wind as a potential 'pull' for this market.

Outside of the cables themselves, there are a range of cable related opportunities for UK firms to take advantage of, such as type testing, proving of cables and cable protection.

OWIO should continue to support the success of inter array cables for the UK market, and continue to look at attracting an export cable supplier.

Cross-cutting barriers

The cross-cutting barriers can be broadly grouped into five areas:

1. The investment pipeline;
2. The 'Catch 22' problem for new entrants;
3. Apportioning risk, including bonds and contracting;
4. Collaboration;
5. Support landscape.

The investment pipeline

The UK remains the market leader in offshore wind and is on track to deliver over 10GW by 2020. The UK has already laid the foundation for this with over 3.6GW installed and a further 1.4GW under construction and commissioning over the next two years. Through the Electricity Market Reform (EMR) process the Government has introduced the Contract for Difference (CfD) regime to provide certainty and stability on revenues for low carbon electricity through a 15-year contract at a guaranteed price. CfDs will help drive down costs for consumers and enable the sector to access the finance required for these projects.

Additionally, there remains the opportunity for a number of projects to seek financial support under the current Renewables Obligation and the Government has put in place a grace period to provide those projects with more certainty.

The Government has also confirmed that it is holding around £1billion back for future CfD rounds. There are a number of offshore wind projects in development that will not be able to bid until next year or later and might commission in 2020 or 2021. This staged approach to development should ensure a future steady, regular pipeline of projects rather than flurries of orders and large periods of famine which can create bottlenecks and drive up costs.

The EU has recently agreed a comprehensive energy and climate change framework for 2030, including a target to reduce domestic greenhouse gas emissions by at least 40% and an EU-level renewable energy target of 27%. The renewable energy target will be fulfilled through Member State contributions but this target is not binding on Member States. These targets should help provide certainty as to the direction and commitment of EU Member States to decarbonisation. There is now a need for the UK Government to provide clarity on how it will deliver on its share of this EU greenhouse gas target; this should be done sooner rather than later.

Clearly, it can be difficult for governments to commit future governments too far ahead. For offshore wind this prompts concerns in the sector about the long-term future of the supply chain. The evidence we heard coalesced into four key issues:

- The initial budget for the first round of CfDs, which was smaller than industry expected;
- The lack of visibility post-2020;
- The market opportunity changing;
- Messaging, including scenarios for offshore wind deployment.

The combination of the size of the initial CfD pot and the lack of clarity about support for offshore wind post-2020 led to some developers saying that they will be refraining or pulling back from developing future investments.

For supply chain companies, this translates into a lack of willingness to invest in new facilities and capacity to secure orders from the investments that do go forward. And where new capacity is brought forward it will be capitalised over a shorter period, resulting in higher prices than would have been the case.

There was also frustration expressed by many of those interviewed that the market opportunity had changed around them, for example the move to competitive allocation of CfDs sooner than had been expected. Many developers now find themselves competing in a smaller market than was expected when they signed their development agreements, making it difficult for them to enter into long-term supply chain commitments, rather than project-by-project commitments.

For some, these changes may have played a part in them exiting the industry, and hence losing their carefully built teams. This has seen the supply chain being asked to bid for several projects with no clarity of which might go ahead, and thereby introducing uncertainty into inward investment business cases.

The message from industry is simple: clear and consistent information is vital. Gaps and delays in sharing information can result in misinformation and varied interpretations taking hold; this can be difficult to correct. The consistency and clarity of messaging from government must improve.

As part of this, the range of plausible futures to 2020 must be narrowed and scenarios post 2020 updated to give a better indication of the ambition for renewables in that time period. Such scenarios are often perceived as potential real paths of development and thus play a role in investment decisions. Any updates should incorporate the new information on technology costs that will be available from the capacity auction and CfD allocation round. We recognise that governments can be reluctant to set targets that might be seen to tie the hands of future governments. However the range of scenarios last published by DECC in 2013 is too wide and now out dated. We urge the Government to provide all possible information which would give an indication of the likely electricity mix beyond 2020. By doing so it could start to signal the scale of offshore wind that will be required and hence indicate the size of the pipeline of projects.

Messaging for companies lower down the supply chain needs to consider what is helpful for them, to help them build business cases for investment: 'GWs per year' is simply not meaningful for many companies. It would be more appropriate to talk about the opportunity in numbers of towers, miles of cables, etc. and this should be a simple step.

Despite the real and current opportunity, there is a lack of confidence about the pipeline in the sector, and it needs concerted effort to set out positive messages to reverse this. There is a knock-on effect for investment, and this reduces the UK's ability to maximise the benefits of being the global leader in the offshore wind industry. It also impacts on cost reduction - logistical savings will be missed through a failure to locate facilities close to wind farms in UK waters and cost of capital will be greater over a shorter investment period.

Recommendation:

3. Government and industry should work together, through OWIC, to articulate a simplified message about the size of the supply chain opportunity in the offshore wind sector.
4. Government should narrow the scenarios for offshore wind to provide greater clarity to industry enabling stronger business cases for investment to be built.
5. In order for the UK to derive maximum benefit from its global lead in offshore wind, the industry needs sight of the world post-2020 as soon as possible. The Government should exercise the powers available through the Energy Act 2013, as early as possible in 2016, by setting a clear 2030 emissions target for the power sector. When setting the 2030 target, adequate consideration should be given by Government to the needs of the offshore wind industry; the industry has signalled strongly during the course of this review the need for both sufficient volume in and sufficient clarity about the market. This would be the first statutory power sector target in the world and would act to plug the gap in market knowledge post-2020, by giving a staging-post between 2020 and 2050.
6. The UK Government should provide clarity sooner rather than later on how it will deliver on its share of the EU 2030 greenhouse gas target.
7. To avoid a possible hiatus until 2016, Government should ensure all industry scenarios and policy announcements give a consistent message about market size, setting out the "direction of travel" if not final targets. There is an opportunity to revise current scenarios early in 2015 following the CfD and capacity market processes, which would help to reduce the range of uncertainty that would otherwise come in the pre-election period.
8. The Government should also give the market foresight of the Levy Control Framework from 2021 onwards as soon as possible.

New entrants – the Catch 22

Developers look for a balance of capability and capacity, financial robustness and track record from potential suppliers. This poses an obvious 'Catch 22' situation for potential new entrants to the market: how do you win an order requiring a track record if you are new to a sector, and without an order how do you attract the necessary investment to develop the required facilities?

Added to this, developers said that selecting a supply chain company with a thin balance sheet or lack of track record was becoming increasingly difficult as they move to funding projects through project finance. Developers no longer have the scope to take a risk on a new supplier as they might once have done when funding projects from their balance sheet.

Many UK supply chain firms have the skills and knowledge to deliver, but within the context of the order sizes typically placed, they do not have a sufficiently strong balance sheet, or they need to invest in new facilities to move from a project specific approach to a production basis requiring serial production.

In one or two cases this has resulted in UK firms reportedly having to turn down opportunities because they did not have sufficient capacity to meet the size of the potential order and were not confident that they could secure the investment to increase their capacity in time to deliver the order, should they take it on.

The result is that companies in the UK may be losing out on orders where they might otherwise be best placed to deliver, and the UK is losing out on the associated benefits of securing the supply chain. Together, Government and industry have the ability to tackle this situation:

- As part of the CfD allocation process, Government has successfully introduced the requirement for Supply Chain Plans, with a view to increasing supply chain competition and reducing costs. Feedback from developers and supply chain respondents indicates that this has led to a wider range of firms being considered to supply content, and this has included firms operating in the UK. An extension of this approach should be considered for other parts of the energy system, especially where there are synergies for offshore wind.
- Interviewees brought forward two ideas related to the use of the CfD contracts to help developers work with those companies not currently securing big orders due to capacity issues at their sites:
    - Where a supplier is not able to meet an order, this could cause the developer to miss their CfD backstop date, with large financial consequences. This naturally makes developers highly risk adverse when selecting suppliers. Government should therefore explore the insertion of a limited force majeure time relief clause into the CfD contracts for those developers that place orders with companies for first time application of innovation. This

would mean that, in certain circumstances, the developer is not penalised for delays caused by doing the right thing for the industry as a whole, and choosing an innovative first time supply chain entrant.

  - Government should explore the possibility of providing a small number of 'special CfDs' with a longer window between securing the CfD and needing to reach FID. Extending the period between a CfD being awarded and reaching FID would mean a longer window when the risks to the project were reduced and orders and investment could be discussed with supply chain companies in the context of lower risk. This would allow developers to place an order earlier with supply chain companies, allowing them time to invest in, and build, the necessary facilities.

- Developers and tier one suppliers could consider breaking down big contracts into smaller 'bite-size' contracts, providing opportunities for more firms with smaller facilities, or without a track record, to bid for orders they are confident of delivering. Helping firms to enter the supply chain should lead to increased competition and lower prices for developers, and increased security of supply of vital components.
- Larger supply chain companies could look to partner with some of their smaller UK competitors where it is advantageous to do so. While the UK supplier might not have the balance sheet to secure an order, it will often have a strong understanding of UK HSE laws, UK labour experience, appropriate competencies and port-side land. In such circumstances partnering brings mutual benefits.

The Green Investment Bank (GIB) has developed a good sense of the UK offshore wind industry through its activity with developers. Several respondents suggested that the GIB ought to take a role in investing in the supply chain for offshore wind. The Government should consider expanding the GIB's State Aid remit so that it can support the supply chain to encourage further benefits for the UK in terms of jobs and investment. It would be well-placed to understand the requirements of supply companies able to serve the market and thus offer financial solutions to accelerate the growth and development of these businesses. It may have a particular role in supporting those companies that lack a track record but who are otherwise well-placed to deliver in the market.

Recommendation:

9. Government should ensure current Supply Chain Plans are delivered, and should continue to use Supply Chain Plans in the future.
10. Government should consider introducing a limited force majeure time relief clause into the CfD contracts for developers that place orders with companies for first time application of innovation.
11. Government should explore the potential of a 'special' CfDs which have a longer period between awarding of a CfD and FID, to encourage the use of new suppliers.

12. Developers and tier one suppliers should consider, where appropriate, ways of breaking their orders into "bite-size" multiple contracts. This could help firms enter the supply chain and lead to increased competition and lower prices for developers, and increased security of supply of vital components.
13. Government, through OWIO, should continue to offer help in brokering partnerships between larger European firms and UK supply companies to help both sides take advantage of mutual benefits, such as matching financial robustness and capital investment with local expertise, local content and understanding of UK regulation.
14. The UK Government should consider expanding the Green Investment Bank's remit to cover investments in supply chain companies.

Risk

Many in the supply chain, and some developers, pointed to the need to apportion risk better within the offshore wind sector, with a more considered approach to risk allocation, rather than simply pushing it down the supply chain. Specifically mentioned were the form of contracts used, the use of bonds and parent company guarantees, and the way the developers award contracts.

Base contracts

Most offshore wind farm developments in the UK use bespoke contracts, as may be expected in a nascent market. However, the sector is maturing and there is a need to work together towards standardising base contracts. This can result in quicker tendering processes, less negotiation and ultimately lower all round costs.

Supply chain respondents reported a current contracting landscape that is very legalistic as opposed to partnership based. This means that developers are looking for bankability, with less emphasis on distribution of risk within the supply chain. Such an approach, whilst offering greater potential certainty to investors, can drive higher costs and less efficient outcomes, threatening the future attractiveness of the offshore wind industry. The OWPB Alliancing and Contracting working group is looking to quantify inefficiencies in traditional delivery approaches and articulate the "size of the prize" that could be delivered through more collaborative approaches, consistent with investors' and developers' risk appetites.

This needs to lead to key principles of contracts for offshore wind going forward, that facilitate changes in behaviour to a more collaborative risk sharing approach. This work should be advanced at pace. As a first step OWIC should become more closely tied to this process and should set a target date for completion, thus providing a clear goal to work towards.

The impact of Performance Bonds and Parent Company Guarantees

Developers use performance bonds and parent company guarantees as mechanisms to manage the risk that suppliers will not meet deadlines or will not deliver products to the

required standards and to demonstrate this security to lenders. The performance bonds required are typically between 10-20% of the overall contract size, but can be much higher.

A number of the UK suppliers bidding for offshore wind contracts have highlighted that they are struggling to provide performance bonds through the usual channels. This 'underwriting' can be a significant issue as performance guarantees and bonds are typically demanding in this area of supply. Whilst banks are generally willing to provide performance bonds to these companies, they often require high, up-front cash security. This ties up working capital for the companies and restricts their ability to bid for further contracts, make investments and grow.

Many European competitors are able to meet performance bond requirements comfortably because they can access support through their government's export credit schemes. No similar support to UK Export Finance is currently available to UK manufacturers supplying UK customers, placing them at a competitive disadvantage in their home market.

As noted previously, partnerships with European firms can help address the balance sheet problem related to parent company guarantees.

Debate continues as to the appropriate level of bonding in this area, with some reporting that bonding levels are about the same as in oil and gas, and others allegedly forced to walk away from profitable and worthwhile contracts because the bonding requirements put their entire company at risk. There is therefore a need to assess and understand the underlying causes of the bonding levels in the UK and to agree action that can ensure they do not prevent healthy competition in the sector. In parallel, the Government should explore what support it can provide to companies struggling to meet bonding requirements to help create a level-playing field with their international competitors. This might include support from the British Business Bank and widening eligibility for UK Export Finance support.

Approach to supplier selection

As the sector increasingly moves towards project finance there may be a general drive towards fewer contract packages being placed directly by the developer. The evidence received as part of this review pointed to the diversity of contracting strategies across the sector: some developers place just three contracts while others might place 20 or more – Annex E shows the array of different components in the supply chain.

These different approaches can make it challenging for the supply chain to compete across all orders. Each firm will typically have its own system for potential suppliers to register, pre-qualify and complete tenders. These multiple systems add costs to suppliers, which need to be recouped, potentially driving up the price overall. The oil and gas sector resolved this challenge through the introduction of the FPAL (First Point Assessment) process, which has almost a hundred buyers and 3,200 suppliers registered.[28] The offshore wind industry,

[28] http://www.achilles.com/en/find-your-achilles-community?id=409

through RUK, has looked at this in the past and decided the FPAL approach was not the best solution. However, the landscape continues to be complex and costly, so there is still a need to address supplier registration.

Registering and tendering is a significant cost for the supply chain. OWIC should commit to implementing a common system for supplier registration and the OWPB sub-group on contracting should revisit this topic and look for novel ways to learn from initiatives such as FPAL, finding a simple and inexpensive solution that works for all in the offshore wind sector.

Recommendations:

15. OWIC should work to identify improved forms of contract for the offshore wind sector in the UK, which provide for a collaborative relationship between developers and the supply chain. A date for completion of this task needs to be set by OWIC.
16. Industry should, through OWIC, build consensus about the appropriate level of bonding and challenge punitive levels of bonding where it occurs. Industry should work with the finance industry to develop alternative options that genuinely mitigate the risks arising from the suppliers chosen.
17. While OWIC addresses the root causes of bonding requirements, the Government should continue to explore and develop support mechanisms to assist companies in the supply chain struggling with the bonding requirements arising from the project finance approach to offshore wind farms. In particular, the British Business Bank should consider supporting companies to provide the necessary bonds to enable them to take on orders.
18. In addition to any support the British Business Bank may be able to provide, the Government should also work to explore what support could be offered to UK companies to create a level-playing field with their international competitors who can access export credit guarantees, for example by widening eligibility for UK Export Finance support.
19. **OWIC should commit to identifying and implementing a common system for supplier registration.**

Working together as one industry

With the introduction of CfDs, the offshore wind sector has become more competitive at the developer level. However, there are some advances which can only be achieved by developers working together, and these are addressed here.

Standardisation

There was a general consensus that standardisation in the sector was both possible and desirable, albeit with limitations related to things such as intellectual property or the

structure of the sea-bed. Areas for attention could range from sub-station platforms to access ladders, transition pieces to crew transfer vessels, and storing spare parts.

It was suggested that if developers issued more functional specifications, the supply chain would be better able to deliver standard solutions and the associated lower costs. For example, specifying the size and forces that a tower needs to withstand, rather than detailing every item within the tower design.

Developer and international cooperation

Recently, individual projects have become so large that it challenges the ability of any one company to finance it. Alongside this, projects are being treated as 'one-off' so there is no ability to engage with the supply chain to allow investment in capacity for a future pipeline of projects. A few interviewees suggested that some degree of consolidation in the industry would be beneficial. This would allow the formation of stronger developers with greater experience, capability and financial strength and at the same time a greater likelihood of securing a share in a pipeline of projects.

There is also a role for cooperation between countries, as mentioned in the introduction. There is a need for the northern European countries to jointly articulate the size of the combined pipeline and the associated requirements and opportunities for competitive supply chain companies. It is reasonable to expect jobs and investment in the UK in return for presenting the industry with the largest offshore wind market in the world.

Such cooperation should ultimately help drive down the cost of offshore wind projects, something that the industry as a whole needs to deliver. Delivering cost reduction will provide Government with increased incentives to do more going forward, which in turn would lead to a bigger prize for all involved.

Recommendations:

20. Industry should continue to work together through OWIC to explore the extent to which standardisation is currently possible and practical and agree actions to deliver on those areas.
21. Government should seek to discuss with its northern European counterparts how all countries can maximise the supply chain benefits of the wider European market.

Support landscape

Governments are always keen to make new announcements and to set up new programmes. Schemes to help businesses to grow and thrive are often of great benefit to business, employees, those seeking employment, and the economy in general. However, in the case of offshore wind there is now a complex landscape of support initiatives. Indeed,

when the Offshore Wind Industrial Strategy[29] was published by Government in 2013, the document detailed a plethora of Government support for the sector. This can be a difficult landscape for businesses to understand and navigate, particularly smaller companies with limited resources, or companies based overseas.

Government support for companies

To support the top tier companies in the offshore wind sector Government formed the Offshore Wind Investment Organisation (OWIO). The purpose of this was to provide a single account manager to provide tailored support for each company. This includes helping them to navigate the different support mechanisms available to them within the UK. From the research for this report, OWIO is generally seen in a positive light, and very much moving in the right direction.

To further support the UK offshore wind supply chain, UKTI is publishing an offshore wind 'pitch book', in partnership with the Green Investment Bank, The Crown Estate, and Renewable UK. The publication will set out the UK's leading global market position, highlight the scale of the UK investment and export opportunities in this sector, and point companies to the support available from these four organisations to support their business success.

For companies further down the supply chain, the RGF funded GROW:Offshore Wind programme in England and various schemes in Scotland[30] are in place to provide support and guidance.

However, for these lower tier companies, the support landscape can still be complicated to navigate. While the OWIO intensive one-to-one support model is not appropriate for the very large number of potential companies who could be active in the supply chain, a mechanism to help these firms navigate the support available would be beneficial. The industry should work with Government to develop and design the forms of support that all tiers of the supply chain most need in future.

Additional to this, where clusters exist or are forming, OWIO should take a leading role in building on its model, and drawing in local authorities, LEPs, DECC, BIS and Catapult to provide tailored support across the cluster.

Recommendations:

22. Government should simplify existing initiatives to keep on improving its help for companies throughout the supply chain to help them better navigate the large array of support mechanisms that exist. This may mean better signposting, rather than new initiatives.

[29] Offshore wind industrial strategy: business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action

[30] http://www.offshorewindscotland.org.uk/index.php/home

23. Individual developments or clusters should have access to concentrated, tailored packages of support which adapt to meet the specific needs of the location – this should be provided by dedicated resource teams drawn from LEPs, local and central government and others as needed.
24. Looking to examples from other sectors, OWIC should work with Government to develop a support programme for companies, taking lessons from other programmes and industries. This should help companies seeking to enter the offshore wind supply chain, as well as helping the formation of local clusters of such companies. It should consider funding options for such a programme.

Annex A: Full List of Recommendations

The UK success in offshore wind

1. **Industry, through OWIC, needs to take a much more assertive approach to telling the success story of offshore wind in the UK to a wide audience.**

UK Skills

2. **Industry should continue to drive forward investment in the right skills, and utilise the existing skills programmes. The Government should maintain funding in skills programmes and ensure that such programmes are long-term, strategic and co-ordinated.**

The investment pipeline

3. **Government and industry should work together, through OWIC, to articulate a simplified message about the size of the supply chain opportunity in the offshore wind sector.**
4. **Government should narrow the scenarios for offshore wind to provide greater clarity to industry enabling stronger business cases for investment to be built.**
5. **In order for the UK to derive maximum benefit from its global lead in offshore wind, the industry needs sight of the world post-2020 as soon as possible. The Government should exercise the powers available through the Energy Act 2013, as early as possible in 2016, by setting a clear 2030 emissions target for the power sector. When setting the 2030 target, adequate consideration should be given by Government to the needs of the offshore wind industry; the industry has signalled strongly during the course of this review the need for both sufficient volume in and sufficient clarity about the market. This would be the first statutory power sector target in the world and would act to plug the gap in market knowledge post-2020, by giving a staging-post between 2020 and 2050.**
6. **The UK Government should provide clarity sooner rather than later on how it will deliver on its share of the EU 2030 greenhouse gas target.**
7. **To avoid a possible hiatus until 2016, Government should ensure all industry scenarios and policy announcements give a consistent message about market size, setting out the "direction of travel" if not final targets. There is an opportunity to revise current scenarios early in 2015 following the CfD and capacity market processes, which would help to reduce the range of uncertainty that would otherwise come in the pre-election period.**
8. **The Government should also give the market foresight of the Levy Control Framework from 2021 onwards as soon as possible.**

New entrants – the Catch 22

9. **Government should ensure current Supply Chain Plans are delivered, and should continue to use Supply Chain Plans in the future.**

10. **Government should consider introducing a limited force majeure time relief clause into the CfD contracts for developers that place orders with companies for first time application of innovation.**
11. **Government should explore the potential of a 'special' CfDs which have a longer period between awarding of a CfD and FID, to encourage the use of new suppliers.**
12. **Developers and Tier 1 suppliers should consider, where appropriate, ways of breaking their orders into "bite-size" multiple contracts. This could help firms enter the supply chain and lead to increased competition and lower prices for developers, and increased security of supply of vital components.**
13. **Government, through OWIO, should continue to offer help in brokering partnerships between larger European firms and UK supply companies to help both sides take advantage of mutual benefits, such as matching financial robustness and capital investment with local expertise, local content and understanding of UK regulation.**
14. **The UK Government should consider expanding the Green Investment Bank's remit to cover investments in supply chain companies.**

Risk

15. **OWIC should work to identify improved forms of contract for the offshore wind sector in the UK, which provide for a collaborative relationship between developers and the supply chain. A date for completion of this task needs to be set by OWIC.**
16. **Industry should, through OWIC, build consensus about the appropriate level of bonding and challenge punitive levels of bonding where it occurs. Industry should work with the finance industry to develop alternative options that genuinely mitigate the risks arising from the suppliers chosen.**
17. **While OWIC address the root causes of bonding requirements, the Government should continue to explore and develop support mechanisms to assist companies in the supply chain struggling with the bonding requirements arising from the project finance approach to offshore wind farms. In particular, the British Business Bank should consider supporting companies to provide the necessary bonds to enable them to take on orders.**
18. **In addition to any support the British Business Bank may be able to provide, the Government should also work to explore what support could be offered to UK companies to create a level-playing field with their international competitors who can access export credit guarantees, for example by widening eligibility for UK Export Finance support.**
19. **OWIC should commit to identifying and implementing a common system for supplier registration.**

Working together as one industry

20. **Industry should continue to work together through OWIC to explore the extent to which standardisation is currently possible and practical and agree actions to deliver on those areas.**

21. **Government should seek to discuss with its northern European counterparts how all countries can maximise the supply chain benefits of the wider European market.**

Support landscape

22. **Government should simplify existing initiatives to keep on improving its help for companies throughout the supply chain to help them better navigate the large array of support mechanisms that exist. This may mean better signposting, rather than new initiatives.**
23. **Individual developments or clusters should have access to concentrated, tailored packages of support which adapt to meet the specific needs of the location – this should be provided by dedicated resource teams drawn from LEPs, local and central government and others as needed.**
24. **Looking to examples from other sectors, OWIC should work with Government to develop a support programme for companies, taking lessons from other programmes and industries. This should help companies seeking to enter the offshore wind supply chain, as well as helping the formation of local clusters of such companies. It should consider funding options for such a programme.**

Annex B: Literature Review

Offshore wind is a multibillion pound industrial sector, with the UK at the forefront of deployment – indeed the UK has over half Europe's installed capacity and twice that of any other nation[31].

However, it is still a nascent industry with big opportunities for innovation, the building of larger, more competitive, supply chains and cost reduction. This is part of the reason why over the last few years there have been a number of reviews of the offshore wind supply chain in the UK,[32,33,34,35,36,37,38,39,40,41,42] many of which have looked at the potential for the UK to grow its share of the supply chain. In doing so, these reviews have been very useful in evidencing the issues the UK supply chain is facing, as well as identifying possible supply chain gaps or barriers to entry that can be addressed. The reviews also point to where the UK's strengths lie, as well as highlighting parts of the supply chain that are unlikely to see a significant move to the UK. This will be described in more detail below.

[31] The European offshore wind industry – key trends and statistics 2013 - http://www.ewea.org/fileadmin/files/library/publications/statistics/European_offshore_statistics_2013.pdf
[32] Offshore Wind: A 2013 supply chain health check - http://www.bvgassociates.co.uk/Portals/0/publications/BVGA%20TCE%20Offshore%20Wind%20SC%20Health%20Check%201311.pdf
[33] Offshore Wind Cost Reduction Pathways – Supply Chain Work Stream - http://www.thecrownestate.co.uk/media/5614/ei-echarris-owcrp-supply-chain-workstream.pdf
[34] Generating Energy And Prosperity: Economic Impact Study of the offshore renewable energy industry in the UK - https://ore.catapult.org.uk/documents/2157989/0/ORE+Catapult+UK+economic+impact+report/2c49a781-ff1e-462f-a0c7-b25eb9478b0f?version=1.0
[35] Offshore Wind Cost Reduction Task Force Report - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66776/5584-offshore-wind-cost-reduction-task-force-report.pdf
[36] Building an Industry – updated scenarios for industrial development - http://www.renewableuk.com/en/publications/index.cfm/BAI2013
[37] Scotland's Offshore Wind Route Map – Developing Scotland's Offshore Wind Industry to 2020 and Beyond - http://www.scotland.gov.uk/resource/0041/00413483.pdf
[38] Towards Round 3: Building the Offshore Wind Supply Chain - http://www.energyparkfife.co.uk/content/publications/Supply_Chain_gap_analysis_-_BVG.pdf
[39] Technology Innovation Needs Assessment (TINA) Offshore Wind Power Summary Report - https://www.gov.uk/government/publications/offshore-wind-power-technology-innovation-needs-assessment
[40] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[41] Cable Manufacturing Capability Study - http://www.thecrownestate.co.uk/media/5732/Windfarm%20export%20cable%20market%20study.pdf
[42] Offshore wind industrial strategy: business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action

Currently the offshore wind market is concentrated in Northern Europe and other countries will be bringing forward installed capacity, such as Germany[43], France, Netherlands, Belgium and Denmark. Outside of Europe, other countries such as the USA and China[44] are also looking at deployment. This brings both opportunities and competition for the UK with others vying to house this supply chain, including countries such as Denmark who have a first mover advantage[45] in this sector. For UK companies to compete they need to be cost competitive, provide reliable, high quality products and have the capacity to bid for and win contracts. They may also require help to overcome the entry barrier of lack of experience.

While this review does seek to go over the same ground as the previous reports, it is important to capture the key insights and actions that the earlier work has identified.

For the supply chain in the UK to grow and companies to invest in facilities, capacity and training there must be a market to sell in to, both in the UK and worldwide. The size of the market is largely driven by national governments. For example, the UK has bought forward introduction of the feed-in tariff contract for difference (CfD) regime as part of electricity market reforms (EMR), which is intended to provide greater certainty of revenue for each individual project that will encourage investment by reducing risks to investors and by making it easier and cheaper to secure finance.[46]

The need for clear Government policy such as this is one of a number of overarching themes that is highlighted in the literature. Other themes include:

Economics

- A pipeline of projects for the foreseeable future to enable investment in facilities, which is a basic economic principle within any market. As mentioned above, for offshore wind this is largely driven by governments around the world.

- Even with a pipeline of projects, for new facilities to come on-line there must be either a supply gap in the global market or significant economic advantage to a new facility, which may for example come from more efficient technology driving lower costs or through a cost saving on logistics[47].

[43] http://www.offshore-windenergie.net/en/wind-farms
[44] Offshore Wind Market and Economic Analysis – Annual Market Assessment - http://www1.eere.energy.gov/wind/pdfs/offshore_wind_market_and_economic_analysis.pdf
[45] Offshore Wind Market and Economic Analysis – Annual Market Assessment - http://www1.eere.energy.gov/wind/pdfs/offshore_wind_market_and_economic_analysis.pdf
[46] Contracts for Difference (December 2013), https://www.gov.uk/government/publications/electricity-market-reform-contracts-for-difference
[47] Cost Reduction Potentials of Offshore Wind Power in Germany [short version] - http://www.offshore-stiftung.com/60005/Uploaded/SOW_Download%7CEN_ShortVersion_CostReductionPotentialsofOffshoreWindPower.pdf

- The literature also points to the need for a competitive supply chain, which should result in costs being driven down. However, this requires a route to market for new entrants, something which can be difficult due to the need to show a proven track record of delivery in offshore wind.[48]

UK Supply Chain

- An available workforce with the right knowledge and technical skills is a necessity for any sector. For the offshore wind supply chain in the UK, the literature suggests there is a shortage of skills in some areas, for example engineering design skills[49].

- For inward investment opportunities, there must also be a commercial advantage to locating in the UK.[50]

Enablers

- Several reports mention the need for more test facilities and demonstration sites, with these having two purposes:

    1. Providing an opportunity for new and innovative technologies;
    2. Enabling new players to showcase their capabilities.

    In both cases, such facilities would allow testing at locations, and in environments, that wind farm developers know and trust. Operating experience at an offshore site is vital before lenders will fund full scale commercial projects based on a new technology or supplier. Of course, test facilities do exist in the UK, including the Narec facilities in north east England[51]. The Scottish Government is also introducing new Renewable Obligation Certificate (ROC) bands to support offshore test and demonstration sites deploying innovative turbines or floating turbines (2.5 ROCs and 3.5 ROCs respectively), provided that they are accredited for ROCs by March 2017[52]. Demonstration sites are harder to arrange but are sometimes possible adjacent to an existing operating wind farm or as a small part of a site which is not being used.

[48] Offshore wind industrial strategy: business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action
[49] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[50] Building an Industry – updated scenarios for industrial development - http://www.renewableuk.com/en/publications/index.cfm/BAI2013
[51] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[52] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities

- The literature also points to standardisation as a way of driving down costs within the supply chain.[53,54,55] Examples might include standardisation of the export voltage for HVDC cables[56] and standardisation of the specifications and designs of offshore substations[57].

- Changes to contracting and procurement practices has been identified as having the potential to provide lessons, and drive down costs, for the offshore wind sector.[58,59] This includes changes to the way risk is shared, and bringing in more collaborative working relationships.

- Innovation – this can range from standardisation of elements such as substations[60] through to commercialisation of new technologies such as floating foundations[61] or new materials that allow longer blades[62].

- Changes to the way performance bonds are used within the sector[63], as these bonds can be difficult or expensive for smaller companies. When combined with high capital set-up costs this can result in a company needing access to funds of around 70% of the contract value before work can start.

Once this demand exists the supply chain is then driven by the offshore wind developers who can access support, whether through the Renewables Obligation or Contracts for Difference, and build the infrastructure.

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[53] Generating Energy And Prosperity: Economic Impact Study of the offshore renewable energy industry in the UK

[54] Towards Round 3: Building the Offshore Wind Supply Chain - http://www.energyparkfife.co.uk/content/publications/Supply_Chain_gap_analysis_-_BVG.pdf

[55] Offshore Wind Cost Reduction Task Force Report - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66776/5584-offshore-wind-cost-reduction-task-force-report.pdf

[56] Offshore Wind Cost Reduction Task Force Report - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66776/5584-offshore-wind-cost-reduction-task-force-report.pdf

[57] Towards Round 3: Building the Offshore Wind Supply Chain - http://www.energyparkfife.co.uk/content/publications/Supply_Chain_gap_analysis_-_BVG.pdf

[58] Applicability of Offshore Oil & Gas Initiative to the Offshore Wind Industry - http://www.thecrownestate.co.uk/media/162066/owdf_07_2012_-pilot-study-final-report.pdf

[59] Offshore Wind Cost Reduction Pathways – Supply Chain Work Stream - http://www.thecrownestate.co.uk/media/5614/ei-echarris-owcrp-supply-chain-workstream.pdf

[60] Towards Round 3: Building the Offshore Wind Supply Chain - http://www.energyparkfife.co.uk/content/publications/Supply_Chain_gap_analysis_-_BVG.pdf

[61] Building an Industry – updated scenarios for industrial development - http://www.renewableuk.com/en/publications/index.cfm/BAI2013

[62] Offshore wind industrial strategy: business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action

[63] Offshore wind industrial strategy: business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action

The supply chain at this point becomes interlinked and largely driven by the choice of turbine as this will affect the type of tower used, the requirements for the foundation as well as the nacelle utilised. This is shown graphically in Annex E.

As highlighted above, this review is focused on foundations, cables, O&M and towers.

Each of these elements of the supply chain is considered individually below.

Supply chain elements

Foundations

Foundations represent around 9% of the lifetime cost of an installed wind turbine[64], with three types of foundation that can currently be used in offshore wind:

- Monopile foundations;
- Non-monopile steel foundations (jackets);
- Concrete foundations.

More than 75% of installed offshore wind projects in Europe have used steel monopile foundations to date, with concrete accounting for most other projects.[65] However, as turbines get larger and projects move to deeper waters there is uncertainty around what will be the prevalent foundation type going forward.

According to a 2012 EC Harris report[66] the existing capacity for monopiles in Europe was 1,000 per annum, which was double the demand level at the time. The latest European Wind Energy Association Report (EWEA) trends and statistics report shows that the first half of 2014 has seen 233 foundations installed.[67]

Going forward there is an expectation in the market that non-monopile foundations will be increasingly used, as projects come forward for which monopile foundations are not suitable.[68] The UK is well placed for this transition with firms such as Bifab and OGN Group.[69] However, until orders are placed fabrication companies are unlikely to invest heavily in the required facilities, and there will be a need for the port infrastructure to be

[64] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[65] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[66] Offshore Wind Cost Reduction Pathways – Supply Chain Work Stream - http://www.thecrownestate.co.uk/media/5614/ei-echarris-owcrp-supply-chain-workstream.pdf
[67] The European offshore wind industry - key trends and statistics 1st half 2014 - http://www.ewea.org/fileadmin/files/library/publications/statistics/European_offshore_statistics_1st-half_2014.pdf
[68] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[69] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities

developed to house the larger turbines, foundations and other supporting structures that are anticipated.[70]

Export and Inter-Array Cables

Export cables are a global market and a piece of the supply chain which has competition from other uses, such as interconnector cables. It is therefore important to look at the full market rather than just focusing on the export cable element within the UK.

This was highlighted by a 2012 report[71] by Cabling Consulting International for the Crown Estate, and the analysis as part of this report concluded that:

…global demand for extruded windfarm export cables and competing requirement, such as interconnector cables, is [was] *in excess of global supply and that a significant supply chain gap exists*.

More recently, a January 2014 BVG associates report[72] for the Department for Business, Innovation & Skills restated this:

The supply of HV cables is constrained and there is less competition in the HV cable market than for the MV cable market. Feedback is that there are long lead times for HV cable supply and limited supply options, with the result that there is demand for new HV cable manufacturing.

At present the UK does not have a company manufacturing these HV cables, although JDR Cables do manufacture array cables in the UK, and has previously received a £2 million Government grant to assist with HV subsea cable development.[73] Additionally, Tekmar and Pipeline Engineering have both secured contracts in recent years to supply cable protection systems for DONG Energy and E.ON respectively.[74]

While the literature suggests that the demand will outstrip supply and hence present a potential opportunity for the UK to manufacture export cables, it also points to the possibility that existing sites may be extended to increase capacity rather than new facilities being developed due to the lead time involved[75].

[70] Offshore wind industrial strategy: business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action
[71] Cable Manufacturing Capability Study - http://www.thecrownestate.co.uk/media/5732/Windfarm%20export%20cable%20market%20study.pdf
[72] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[73] http://jdrglobal.com/jdr-awarded-2m-grant-to-develop-high-voltage-cables/
[74] Wind Energy in the UK - State of the Industry Report 2013 – http://www.renewableuk.com/en/publications/reports.cfm/state-of-the-industry-report-2012-13
[75] Cable Manufacturing Capability Study - http://www.thecrownestate.co.uk/media/5732/Windfarm%20export%20cable%20market%20study.pdf

Towers

The design of towers is driven by the turbine that will sit upon them, with larger turbines needing larger towers. This in turn leads to an increasing rational for locating tower manufacturing facilities at costal locations. The UK has provided towers for the onshore market, but it has only provided these in low volume for offshore, through Mabey Bridge and Wind Towers Scotland.[76] Both of these locations have logistical issues for larger towers. If the UK is to play a role in this part of the supply chain there is therefore a need for investment, either by the existing companies in the UK or through inward investment. If investors can be assured that the UK will remain the dominant European offshore wind market, locating within the UK will offer lower logistics costs, as well as lowering project risk.[77]

Operation & Maintenance (O&M)

According to a BVG report operation, maintenance and minor service represent around 20% of the lifetime cost of an installed wind turbine, with major services being around 7%.[78] Combined, this represents a large opportunity for companies in this part of the supply chain. It should be noted that the BVG report, along with the 2012 EC Harris report[79], notes that greater optimisation of turbines going forward should increase reliability and hence reduce the cost of O&M. This is clearly good for reducing the overall cost of wind, although it may reduce the size of the O&M opportunity.

With its history in the oil and gas sector, the UK has a strong record in offshore O&M.[80] This provides an opportunity for the offshore wind sector to learn from oil and gas best practice, such as the sharing of vessels, helicopters, etc. One report[81] states that the oil and gas industry made savings of around 38% per barrel of oil through initiatives that introduced benchmarking, commitment to training, streamlining regulations and promoting innovation rather than maintaining compliance.

[76] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[77] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[78] https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[79] Offshore Wind Cost Reduction Pathways – Supply Chain Work Stream - http://www.thecrownestate.co.uk/media/5614/ei-echarris-owcrp-supply-chain-workstream.pdf
[80] Offshore wind industrial strategy – business and government action - https://www.gov.uk/government/publications/offshore-wind-industrial-strategy-business-and-government-action
[81] Offshore Wind Cost Reduction Pathways – Supply Chain Work Stream - http://www.thecrownestate.co.uk/media/5614/ei-echarris-owcrp-supply-chain-workstream.pdf

Substations, fabrication and jackets

Substation supply can be divided into the supply of electrical systems and the supply of structure.[82] For HVAC substations the UK is well positioned with firms such as ABB, Alstom, Siemens and Petrofac, with firms such as BiFab, Harland and Wolff and Heerema supplying foundations and platforms for the substations. The electrical components are usually sourced from facilities around the world.

HVDC substations are bigger than HVAC substations, and to those that have been delivered to date have been made in Europe.[83] No UK offshore wind project has, to date, used a HVDC solution though this is expected to change when the further from shore Round 3 sites are developed.

Example actions from other reports

The table below highlights a selection of recommendations from previous reports.

Foundations

Technology Innovation Needs Assessment (TINA) – Offshore Wind Power Summary Report, February 2012	- Development of serial manufacturing processes (<30m water depth). - Development of novel foundation designs – concept development, detailed design and demonstration of foundations tailored for larger turbines in 30-60m water depths (30-60m water depth). - Development of serial manufacturing processes and potentially fabrication facilities (30-60m water depth). - Development and demonstration of new concepts such as floating foundations (>60m water depth).
Cost Reduction Potentials of Offshore Wind Power in Germany (short version), August 2013	- Continuous production and optimised manufacturing processes regarding the support structures reduce downtimes at the manufacturers and thus decreases costs, especially for the foundations. This trend is further enhanced by increasing turbine capacity from 4 MW to up to 8 MW.

[82] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities
[83] UK offshore wind supply chain: capabilities and opportunities - https://www.gov.uk/government/publications/uk-offshore-wind-supply-chain-capabilities-and-opportunities

	- Optimising the foundation design provides an opportunity for standardisation. Particularly jacket fabrication can become more efficient with higher volumes. In the short to medium term, processes for installing support structures can be optimised by drilling or vibration, for instance. In the long run, new substructure concepts such as gravity or floating substructures can lead to further improvements.
Offshore Wind: A 2013 supply chain health check, November 2013	- Without greater clarity on technology trends, investment in optimal foundation installation vessels is likely to be slow. - There is uncertainty about future foundation technology choices. By 2020, the greater mass and rotor diameters of the next generation of larger turbines, combined with the development of projects in greater water depths, could mean that cost and logistics considerations will preclude the use of monopiles for many projects. - There are few suppliers of monopiles with a diameter greater than 7.5m. There is limited competition in the market for XL monopiles. If uncertainty in the market persists, further investment may be deterred, and the price advantage over jackets or tripods may be eroded. - Early commitment by developers may be needed if production capacity is going to be ready to meet demand. Assuming the availability of a suitable site with planning consent, industry feedback is that the lead time for a new production facility from FID is about 18 months with a further 12 months to ramp up to full production. This could represent a challenge for developers who are unlikely to be able to give full commitment to suppliers before their own FID for a given project. This issue may be addressed by

	some form of alliancing or framework agreement to give suppliers the opportunity to make some progress before receiving an order. - For non-pile foundations the lack of demonstration sites for deep water foundations has the potential to restrict the introduction of new designs. - For concrete foundation greater access to demonstration sites is needed.

Export Cables

Offshore Wind: A 2013 supply chain health check, November 2013	- De-risk new investment in manufacturing capacity by tendering for more than one project. There are options to achieve this through strategic action by one developer with a portfolio of projects or collaboration between multiple offshore wind developers. - Take benefit from synergies with subsea interconnectors. Contracts for these interconnectors tend to be larger than for offshore wind farms and are therefore more likely to trigger investment if the lead time permits. There are opportunities to de-risk investment in manufacturing capacity or smooth demand through dialogue with investors in subsea interconnectors such as National Grid Electricity Transmission or Scottish Power Transmission, or their overseas counterparts.

Towers

UK offshore wind supply chain: capabilities and opportunities, January 2014	- Low margins may deter investment. Towers are considered by some turbine manufacturers as commodity items and fabrication has been associated with low margins, which has been compounded by

	oversupply for the onshore wind market. Any investment case for a tower manufacturer will need to be focused on supply for offshore wind where there is a limited coastal manufacturing capacity in Europe. - A new tower facility would need to supply more than one offshore wind customer. Suppliers will need to have confidence they can supply two or more wind turbine manufacturers to enable investment. By supplying more than one wind turbine manufacturer, the investment risk for the supplier is reduced. Wind turbine manufacturers will also see value in their supplier supplying other companies as this enables them to benefit from shared learning, greater economies of scale and they have greater assurance that the supplier is more stable financially.
Offshore Wind: A 2013 supply chain health check, November 2013	- Incentives to stimulate investment are still likely to be required if new sources of supply are to be established and on-going work is needed to communicate the opportunity and promote suitable sites to potential investors.

Operation and maintenance

Technology Innovation Needs Assessment (TINA) – Offshore Wind Power Summary Report, February 2012	- New technologies enabling access to turbines in rougher sea conditions will reduce down time for far from shore turbines and increase yield. - Better O&M planning by using data from monitoring devices smartly will reduce down time from turbines.
Cost Reduction Potentials of Offshore Wind Power in Germany (short version), August 2013	- Developing inter-operator maintenance and installation concepts: In the medium term, substantial cost benefits could be achieved by joint concepts for the operation and maintenance of wind farms. The goal should be to jointly use fleet and logistics

	infrastructures (landing and fuelling facilities for helicopters, ships, material storage, joint rescue and safety concepts). Offshore logistics centre where replacement components of various manufacturers are stored would reduce downtimes of wind farms. In the long run, operators of adjacent wind farms using the same type of plant could develop joint concepts and thus achieve cost benefits also during the installation phase.
Offshore Wind: A 2013 supply chain health check, November 2013	- Chartering vessels on an ad hoc basis to address major faults as soon as they occur. - Waiting until a critical number of turbines have developed (or are predicted to develop) major faults and then chartering a vessel to address all of them in one campaign. - Chartering a vessel for a given period every few months on the assumption that some major faults will occur within a wind farm each period. - Chartering a vessel long term or purchasing a vessel. This could be attractive for developers that have a critical mass of operating turbines. For clusters of wind farms, feedback suggests that "owners clubs" could emerge, particularly if they are coordinated by a third party. Developers indicate that they do not consider operating a large vessel as their strength. They would be more likely to contract this to a company that can provide an operating service.

Substations and fabricators

Offshore Wind: A 2013 supply chain health check, November 2013	- A joint industry project could usefully establish best practice in housing solutions for DC converter platforms and in standardising HVDC systems. We understand that the Carbon Trust plans to fund an HVDC optimisation study to support standardisation and reduce lead times. A challenge is that VSC technology is still developing and there is a competitive advantage for the company that can increase the VSC power rating most. This may limit the opportunities for standardisation in the short term.

Annex C: Question Sets

Interviews were semi-structured so question sets were used as guides. Below are examples of the sort of questions asked.

1. How and what do you procure through the supply chain?
    a. What do you buy and when?
    b. Do you buy every element of the supply chain, or do you outsource that process to managing-contractors?
    c. How many contracts do you place? What are their size and scope?
    d. What else do you buy?
    e. Where are the procurement decisions taken? (e.g. all in a central procurement team, or some at a local level by a site manager)
    f. When in the process do you place your orders?

2. In addition to price, how do you select your preferred suppliers?
    a. Financials standing and stability
    b. Payment terms
    c. Industry experience/proven technical expertise
    d. Skills/innovation
    e. Knowledge of the local area

3. How effective is the current competition in the supply chain?
    a. Where is the supply chain most competitive? Towers/foundations etc.
    b. What is the potential level of competition in the UK?

4. What are your views on the efficacy of the current contracting approach in the sector?
    a. More specifically, what is the role of performance bonds in the supply chain?
    b. If you use performance bonds, to what extent has this requirement affected your choice of supplier? Have there been instances where a potential supplier was not able or willing to meet this requirement or the requirement had a significant impact on a potential supplier's price leading to an uncompetitive bid? How far down the supply chain do performance bonds go?
    c. Do performance bonds really mitigate the risk, or are they a procurement check box?

5. What effect would greater standardisation have on the supply chain [base in the UK]?

a. How could/would standardisation benefit the UK over international competitors?
b. Which areas of the supply chain would benefit most from standardisation?
c. What is the key benefit for the offshore wind industry of moving towards greater standardisation?

6. To what extent does the UK offer the right workforce to support the development of the supply chain?

7. What are the most significant barriers to entry into the UK supply chain?
    a. Barriers could include, but are not limited to, lack of visibility of future projects/orders, lack of innovation, lack of policy incentives for supply chain development, suitable sites, contract size/financial strength, experience/expertise, customer contacts, contract terms etc.
    b. What more can government and industry do to provide practical support for the future development of the UK offshore wind supply chain?
    c. What would you change about the operation of the offshore wind supply chain if you could?

8. What have you supplied to date for offshore wind?
    a. Are you already a supplier, engagement in onshore only, facility with capability to produce towers through conversion etc.?
    b. What percentage of your production is for the offshore wind market now and what do you expect it to be in the medium term?
    c. Do you have existing capacity to manufacture higher volume or to expand tower supply for UK and other European projects?

Annex D: List of Participants to the Review

Developers	**Turbine Foundation Suppliers**
Centrica	BiFab
DONG	Bilfinger
EDFE	Bladt
Eneco	EEW
EON	Global Energy Group
Fluor	HOCHTIEF
Mainstream	OGN Groups
Repsol	SIF
RWE Innogy	Smulders
SSE	**Tower Suppliers**
Statkraft	CS Wind
Statoil	Gestamp
Cable Suppliers	Mabey Bridge
JDR Cables	Wind Tower Scotland
J-Power	**Substation Jackets and Fabrication**
Nexans	Harland & Wolff
Prysmium	Wilton Engineering
Other organisations	**OEMs**
Climate Change Capital	Alstom
Copenhagen Infrastructure Partners	MHI Vestas
RenewableUK	Areva
Scottish Enterprise	
Tata Steel	

Annex E: Offshore Wind Supply Chain