

Skills and Labour Requirements of the UK Offshore Wind Industry

2018 to 2032

October 2018

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Abbreviations

BAME	Black, Asian or Minority Ethnic
CBI	Confederation of British Industry
CTV	Crew Transfer Vehicle
EOD	Explosive Ordnance Disposal
FTE	Full-Time Equivalent
GW	Giga Watt (1,000 MW)
HE	Higher Education
HEI	Higher Education Institution
HNC	Higher National Certificate
HND	Higher National Diploma
HV	High voltage
MW	Mega Watt (1,000KW)
NM	Nautical Miles
O&M	Operation and maintenance
R&D	Research and development
RUK	RenewableUK
SOV	Service Operation Vessel
UKCES	UK Commission for Employment and Skills
UXO	Unexploded Ordnance

1. Foreword

These are exciting times for the renewables sector. The UK is leading the world in offshore wind, with more installed capacity than any other country. We need to retain this position by continuing our investment in innovation and we can only do that with inspired and creative people.

On behalf of the offshore wind industry, I am delighted to introduce this study on the challenges we face over the next decade as we seek to attract the best people to our workforce. Commissioned from Energy & Utility Skills by the Aura partners, the report's publication is timely.

In response to the UK's Industrial Strategy, we have set ourselves some very ambitious targets in our Sector Deal Prospectus – A Sea of Opportunity. Tens of thousands of new jobs will be created as offshore wind becomes the backbone of a clean, reliable and affordable energy system.

This study provides the facts that underlie some of the future struggles we will need to overcome. Based on the current project pipeline, we are going to need approximately 36,000 people employed in the offshore wind industry by 2032. To fill these roles, we are going to have to compete against other sectors to attract talented people, in what is predicted to be a very tight labour market over the next four to five years. Too few school leavers are choosing the subjects needed to work in an industry driven by technology, such as ours. The UK is already short of approximately 20,000 engineering graduates per year. We need to change that.

Our aim is to become a leading industry for diversity and inclusion. We want to be the industry of choice for women and Black, Asian and Minority Ethnic workers who want a career in a Science, Technology, Engineering and Maths (STEM) sector. We will be proactive in ensuring more females progress their studies of STEM subjects post-16. Only 35% of post-16 females study STEM subjects such as maths, physics, computing or a technical vocational qualification (compared to 94% of post-16 males). This is despite females accounting for 50% of STEM students at GCSE level.

This study demonstrates the importance of delivering a sector-wide strategy to standardise education and skills training to support clear career pathways and qualifications for all levels across the industry. Education provision is fragmented and un-coordinated in the UK today. We want to make it easier for people to work within the industry and supply chain, and to transfer from other industries and professions.

We are still a young and pioneering sector and we need to build on that to ensure that we keep our dominant position in the world. We need a highly skilled, diverse and motivated workforce to deliver innovative technologies that drive decarbonisation across the economy in the coming decades.

Hugh McNeal
Chief Executive
RenewableUK

2. Introduction

Aura and Green Port Hull commissioned Energy & Utility Skills to undertake a comprehensive skills study of the UK's offshore wind industry and to provide a specific focus on that industry in the Humber region.

The purpose of the study is to provide a deeper understanding of nature and extent of workforce supply and demand issues within the development, construction and operation of the UK's offshore wind energy sector through to 2032.

We gratefully acknowledge the support of the following:

Supported by the
Regional Growth Fund



1.1 Objectives

In order to achieve this purpose, the following objectives were set:

1. To carry out a desk-top review of all existing research, studies and reports on the offshore wind sector skills and education – regionally and nationally
2. To understand what industry forums – locally, regionally and nationally – are involved in offshore wind sector skills and education as well as what activities / forums / meetings they are holding
3. To understand what activity is being carried out in The Energy Estuary by the relevant local Councils, the Local Enterprise Partnership and other providers
4. To produce a project-by-project lifecycle timeline of the UK offshore wind industry. To include all development, construction, operational & maintenance and decommissioning activities
5. The production of job role-level employment projections for the above timeline (building on the work recently completed by Cambridge Econometrics)
6. To produce a report setting out the results of each of the above objectives, including:
 - A summary of the research carried out
 - The issues highlighted by the reports / studies / initiatives
 - The gaps identified during the research
 - Recommended next steps

1.2 Our Approach

The approach taken in undertaking this research consisted of five stages:



Project Pipeline

A pipeline of existing and planned offshore wind projects was developed using a range of sources, primarily RenewableUK's Wind Energy Database¹. The data obtained from this database was augmented with data from other sources, such as the TEC Register (as at 23/11/2017), individual company websites and www.4coffshore.com.

This “bottom-up” approach was chosen so that a wholly transparent project pipeline could be produced which would enable us to examine it in terms of the size (MW and number of turbines), location (linked to standard Government regions) and, crucially, the timing of the construction and operational phases of (i) the constituent projects and (ii) the industry as a whole.

Employment Projections

In 2017 Cambridge Econometrics (CE) were commissioned by the University of Hull, on behalf of Aura and Green Port Hull, to produce employment projections for the UK offshore wind industry². Given that the approach employed by CE to produce those estimates is now well established, having been developed in 2011³ and repeated in 2013⁴, it was decided not to attempt to produce a new set of employment projections for this study.

However, given that the project pipeline developed by this study suggests that total installed capacity by 2032 could reach 35GW (11GW higher than reported in the 2017 report), it was necessary to provide an estimate of the additional *direct* employment demands of the industry.

¹ <http://www.renewableuk.com/page/UKWEDhome>, accessed on 28th November 2017.

² Future UK Employment in the Offshore Wind Industry, Cambridge Econometrics, June 2017.

³ Working for a Green Britain, RenewableUK and Energy & Utility Skills, February 2011.

⁴ Working for a Green Britain & Northern Ireland 2013-23, RenewableUK and Energy & Utility Skills, September 2013.

The estimate of future employment levels produced in this study were developed by Energy & Utility Skills using the high-level labour coefficients used in the 2017 report. We offer these employment estimates as one possible future scenario.

Literature Review

There have been many previous studies of the potential of the UK offshore wind industry from many different perspectives (e.g. its contribution to the UK energy mix, technological development, employment potential, cost reduction, etc.). Therefore, it was clearly important to review this previous learning and incorporate it into this new study. A wide range of reports produced by, for example, government departments, universities, local / regional bodies, technology developers, energy companies, etc. were reviewed. In addition, several data sources were analysed which relate to the wider UK infrastructure sector (e.g. National Infrastructure Plan), the labour market (e.g. various Office for National Statistics surveys) and the supply of skills into it (e.g. higher education achievement and destinations). Clearly, it was important to consider the timeliness of each source; ensuring that only those that were still relevant were included.

A full bibliography is included in Annex 1.

Expert Interviews

Finally, we identified 28 companies that we would contact and seek their views on the current and future state of skills and labour demand. These companies were identified from Aura's and Energy & Utility Skills' existing networks and contacts.

We were only able to interview representatives from seven of these companies, although several of these are major players in the offshore wind industry:

- Boston Energy (provider of recruitment, training and wind turbine services)
- GEV Group (blade maintenance, inspection and repair)
- JDR Cables (inter-array cables and product systems)
- Ørsted (developer, constructor and operator)
- Scottish Power (operator)
- Siemens Gamesa (developer, constructor and operator)
- SSE (operator)

The reasons why it has been so difficult to gain direct employer input into this study is unclear but may reflect a certain amount of “survey fatigue” given that engagement is also occurring in relation to the Offshore Sector Deal and that, for many companies, skills issues may not be a high priority at the moment.

We have also incorporated into this study the collective knowledge of colleagues from within both Aura and Energy & Utility Skills, which has built up from many years' experience of working in the wind and wider energy sector.

Reporting

All the analysis and findings from the above activities are included within this report.

3. Executive Summary

Aura and Green Port Hull commissioned Energy & Utility Skills to undertake a comprehensive skills study of the UK's offshore wind industry and to provide a specific focus on that industry in the Humber region.

The purpose of the study is to provide a deeper understanding of nature and extent of workforce supply and demand issues within the development, construction and operation of the UK's offshore wind energy sector through to 2032.

Offshore Wind – Industry Growth Potential (the project pipeline)

The UK offshore wind industry is moving fast from a niche technology to becoming a mainstream supplier of low-carbon electricity.

The project pipeline developed specifically for this study highlights the growth potential of the industry – there are currently more wind farms being constructed and planned than there are in operation (34 compared to 31) and the total power output could grow from 6.4GW in 2017 to 35GW by 2032.

**By 2032, the UK could see more than 35GW of
offshore wind generating capacity in its waters**

The pipeline contains details of 65 known / planned projects, all of which, if consented and constructed, could be built by 2032. The current situation is:

- 6.4GW is operational
- 8.1GW is being constructed
- 8.5GW has been given consent, but not yet started construction
- 12.1GW is being planned

Clearly there are many factors which can affect whether a planned wind farm ultimately becomes operational; for example, planning consents, the financial/ investment environment, government policy, etc. Therefore, we cannot be certain that all nine wind farms that have received consent and the ten that are in the planning stage will become a reality.

Therefore, this scenario of 35GW by 2032 should be seen as an ambitious, yet credible, scenario for the UK offshore wind industry (similar scenarios (around 30GW by 2030) are now reported by several other sources). This demonstrates the potential of the industry to play a major role in the UK's energy mix at a fast-reducing cost (in 2015 subsidies were between £114 and £120 per megawatt hour; in 2017 this had fallen to £57.50).

The vast majority of the potential growth is expected to occur in the North Sea, meaning that the regions along the eastern seaboard of the UK (particularly the East of England (up to 8.5GW), Scotland (up to 7.5GW), Yorkshire & Humber (up to 6.4GW) and North East (up to 4.9GW) could increase their share of UK offshore wind capacity from 33% in 2017 to 60% by 2032.

Peak construction of the project pipeline is estimated to be, firstly, in 2019 (when 8.6GW will be in construction) and, secondly, in 2024 (when 9.5GW will be in construction). By 2028, all 35 projects will either be operational or in construction.

The turbine technology being employed is becoming increasingly more sophisticated and larger – with the average operational turbine in 2017 being 4MW; the average turbine currently being installed is 7MW, and the average turbine in pre-consented projects is 10MW. There is evidence that turbines could reach 13-15MW by the mid-2020s and that capital costs could be reduced by 25-30%.

Overall, between the start of 2018 and 2032:

- Installed capacity could increase five-fold from 6.6GW to 35GW
- The number of turbines could more than triple from 1,660 to 5,358

Offshore Wind – Predicted Employment Opportunities

It is very difficult to estimate the likely scale of employment growth within a specific industry with certainty, especially in one that is as fast-developing, technologically-driven as offshore wind. However, we can be certain that a likely three-fold increase in the number of operational turbines will result in a substantial increase in employment compared to current levels.

Therefore, the employment estimates presented in this study, increasing from 10,000 jobs in 2017 to 36,000 in 2032, represent one possible scenario of an uncertain, yet almost certainly bright, future.

**Direct employment in offshore wind could reach
36,000 by 2032**

The location of this employment growth will, unsurprisingly, occur in those regions which will support the capacity growth in the North Sea, particularly Scotland (+6,400 jobs), East of England (+6,150), Yorkshire & Humber (+5,750) and North East (+4,050).

Employment levels are expected to increase in all phases of the project lifecycle, but particularly in Construction & installation (+6,700) and Operations & maintenance (+6,900). It is not expected that Decommissioning / repowering will experience significant jobs growth in the period to 2032.

Employment demand will be strongest for technicians and engineers, with an estimated additional requirement for 10,200 by 2032. This represents nearly half of new job creation and reflects the highly-skilled, technical nature of many of the tasks undertaken by the workforce.

However, the study has found that there are several factors could have a significant impact on the job creation (in addition to the factors stated above which may impact on the deployment of the project pipeline), such as the workforce strategies employed by owner / operators, technological progress / innovation and the speed / direction of industry maturing and consolidation.

Competition for Skills – Energy and Infrastructure Sectors

Over the next four years, £240billion will be invested in refurbishing and expanding the UK's essential infrastructure. The largest investments will be made in transport (£78.5bn), energy (£57bn) and the utilities (£47.5bn).

The offshore wind industry is the largest recipient of investment in the energy sector, with £18bn included for the expansion of generating and transmission infrastructure. The resulting demand for labour is likely to be significant – totalling around 760,000 people by 2024 (including 160,000 new jobs and replacing 600,000 retirements).

**With more than £240bn being invested in the UK's
infrastructure, competition for skilled talent will be
intense**

The availability of new talent could be an issue given that the labour market is currently extremely tight (record high employment and low unemployment) and shows little sign of easing – a situation that could be further impacted upon by post-Brexit immigration policies. Indeed, it is estimated that the UK is already short of around 20,000 engineering graduates per year.

Therefore, increasing the size of the available labour pool from which employers can recruit will be crucial – particularly in terms of attracting more females and those from a BAME background.

Furthermore, it will be essential that the offshore wind industry and its regional supply chains work together to ensure maximum access to the talent it needs – and to minimise the extent to which they compete for that talent. Business as usual will not be the optimal approach!

Skills Supply and Demand

The UK has a long history of creating a world class offshore workforce – from R&D through to operations and maintenance. This tradition continues with the UK leading the way in offshore wind deployment.

Many of the base skillsets needed for offshore electricity generation and transmission are similar to those already being demanded across the wider energy sector – both onshore and in the oil and gas fields (where, it should be noted, workforce reductions have slowed). Also, in addition to the critical technical roles required, business, commercial, stakeholder / supply chain management and advanced first aid and rescue skills are also central to a successful future.

Direct feedback from employers for this study suggests that attracting new talent isn't a major problem at the moment for the large companies in the offshore wind industry – certainly, many of the owner / operators and larger OEMs appear to have few difficulties in filling vacancies, be they for Apprentices or experienced hires. However, there is evidence to suggest that talent attraction and retention within the supply chain, particularly for SMEs, could be slightly more of a challenge.

The skills that are crucial to the success of the industry moving forward, and in maintaining the UK's status as a leader of offshore wind development and deployment, include:

- Asset management
- Project management
- Leadership
- Engineers and technical skills – mechanical, electrical and control & instrumentation, blade and turbine technicians
 - Increasingly, many of these roles now require elements of IT / network system skills, as areas such as fault findings and systems / performance monitoring are done through electronic, rather than mechanical, means
- Scientists – marine biology, geophysics, hydrography, oceanography
- Advanced first aid and rescue
- Offshore-specific skills – confined spaces, working at heights, team working, team living, etc.

Discussions with employers for this study have also highlighted the need to consider modular upskilling provision in leadership, updating / refreshing knowledge and understanding of safety rules and regulations and in advanced first aid and rescue (this provision should be similar in content and learning to that seen for mountain rescue-type situations and injuries).

Furthermore, the offshore wind industry will continue to develop tomorrow's innovators⁵, particularly in areas such as vessels and logistics, subsea cables and transmission, foundations, turbines, artificial intelligence, robotics and data analytics.

The supply of skills that the industry can call upon is mixed. The regions along the east of the UK, where the majority of offshore wind growth is expected to occur, appear to be relatively strong in terms of level 2 and 3 qualifications (the feedstock of Apprentices and technicians). However, there are issues reported by employers which relate to Apprenticeships including:

- How well is the full range of Apprenticeship frameworks and standards promoted and understood by employers across the industry's supply chain?
- How companies are approaching the Apprenticeship Levy (i.e. the extent to which it influences their skills development strategies)
- Whether the Apprenticeship Levy Transfer Policy could be better promoted and utilised to maximum effect for the industry and its supply chain
- The availability of training provision where it is required most
- Trainees being unable to gain the required on-the-job experience when access to offshore sites (i) cannot be gained while under 18 years of age and (ii) can be costly given that "down-time" of a site can be very expensive and, therefore, is kept to a minimum (meaning that training on-site can be a significant hidden cost)

The availability of Apprenticeship training and higher-level skills could be a challenge in some regions of the UK

The availability of locally-sourced higher-level skills may be an issue given the number of graduates leaving universities with relevant degrees. In 2015 / 16 there were 9,185 UK graduates with relevant degrees to the offshore wind industry. Universities in the East Midlands and Yorkshire & Humber produced 1,900 graduates from relevant disciplines in 2015 / 16 (740 of them in mechanical engineering). However, universities in the North East (595) and East of England (185) were not so successful.

⁵ *Offshore Renewable Energy Science and Innovation Audit*. A Science and Innovation Audit Report sponsored by the Department for Business, Energy and Industrial Strategy. Undated. *Ibid*.

As the population of the UK grows and changes in composition – with white males becoming a smaller proportion of the population – the offshore wind industry (as well as the wider energy, infrastructure and engineering sectors) needs to consider how it can make the most of the talent available to them, including females and those from a BAME background.

Action on these points is required in order to help the industry deliver on its potential and keep the UK at the forefront of the global industry. Solutions should seek to:

- Maximise the extent to which the local communities can benefit from the success of the industry
- Engage with the whole supply chain – ensuring that access to talent, training provision and the promotion of skills development as a principle is embedded throughout the entire industry

This is a dynamic, fast-paced and growing industry and, coupled with its green credentials, can provide a wide range of career opportunities to both new entrants and experienced workers. The challenge will be in promoting these opportunities to all sections of the community in a way that benefits the whole supply chain.

Energy Estuary

Already designated a Centre for Offshore Renewable Engineering (one of six COREs in England), these are exciting times along the Humber estuary, which is leading the UK renewables sector.

Offshore wind generating capacity is predicted to increase from 0.9GW in 2017 to 7.7GW by 2032 (22% of total UK capacity), including the installation of more than 1,000 new turbines. This could see employment in the Region growing to more than 9,200 (from 1,500 in 2017).

Gaining the required talent, although not a significant problem at the moment, may become more challenging as the project pipeline becomes a reality and, at the same time, the regional workforce will have to satisfy the demands of over £14bn of investment in the wider energy and infrastructure sector across the region. While offshore wind is a significant element of this investment, other energy, utilities and transport infrastructure will likely provide strong competition for good operative, technical and engineering skills in particular – which could reach demand for 100,000 people by 2024, including 30,000 skilled trades and nearly 30,000 operatives, technicians and engineers.

The ability of the regional labour market to meet these talent demands is unclear – while the region has a high proportion of people with level 2 and 3 skills (forming a good operative and skilled trades base) it may well lack the required higher-level skills, with fewer than 1,900 graduates in 2015 / 16 with relevant degrees from the region's universities.

As a result of this significant economic activity, a number of initiatives and collaborations aimed at supporting the industry along the Energy Estuary have already been established, including organisations such as Green Port Hull, Humber LEP and Team Humber Marine Alliance. Each of these organisations have already established skills-related groups or networks with a view to identifying the issues affecting the development of both technology and the required workforce / skills.

Recommendations

The main recommendations for the sector to consider are (full details are provided in chapter 8 below):

1. **Promote skills development throughout the supply chain.** A practical example of this could be the application of the Procurement Skills Accord principles within the sector.
2. **Promote and facilitate investment in skills for the benefit of the whole sector.** A practical example could be to use the Apprenticeship Levy Transfer Policy to benefit supplier workforce development
3. **Consider the creation of a talent network for the offshore wind industry.** Many energy and utilities companies use *Talent Source Network* to promote their vacancies and source appropriate candidates.
4. **Encourage and facilitate supply chain collaboration to aggregate training demand.** This could help ensure that appropriate training provision – particularly that which is low volume / high cost – is available when and where needed.
5. **Consider ways of supporting the workforce in gaining valuable on-the-job / practical experience before going offshore** – maximising their exposure to “real world” situations and assets prior to going offshore
6. **Investigate the potential for on-line, distance learning upskilling / refresher modules,** particularly in upskilling and refreshing leadership, H&S and safety regulations.
7. **Promote STEM educational progression and the opportunities and career pathways available for higher-level achievers,** allowing more of the local population to benefit from the planned expansion.
8. **The sector to consider how to bring about common technical training and H&S standards and relevant passport schemes** – enabling the free(er) movement of skills between technologies, companies and other sectors.
9. **Consideration should be given to how the Aura can develop its own value proposition for the industry / region,** bringing together existing organisations, networks, fora, etc. There are several agencies that aim to support the workforce development needs of the offshore wind industry along Energy Estuary and Aura needs to establish itself in that landscape.
10. **Facilitate the engagement between employers and schools** and other education institutions in a way that maximises the impact for the whole sector / regional supply chain.

11. Consider activities to **promote the offshore wind industry to females, BAME and other under-represented communities**
12. **Regularly review the offshore wind project pipeline** and high-level employment projections for the UK in order to maintain visibility of industry labour demands
13. **Regularly review the nature, timing and labour demands other major infrastructure projects in the area.**

Many of the recommendations above revolve around building industry collaboration – not just horizontally across the larger companies (e.g. Scottish Power, SSE, Siemens, Ørsted, etc.), but throughout the supply chain. Many of the tier 2 and below suppliers face difficulties in recruiting and training that many of the larger companies do not.

Therefore, the Offshore Wind Sector Deal⁶ really does need to work for the whole sector – taking all tiers forward together.

⁶ As introduced by Government in Industrial Strategy (2017) are partnerships between government and industry aiming to increase sector productivity. The Offshore Wind Industry Council is currently leading on the development of the Offshore Wind Sector Deal.

4. The UK Offshore Wind Industry – Now and in the Future

Headlines

- The offshore wind industry is moving fast from a niche technology to becoming a mainstream supplier of low-carbon electricity.
- The current project pipeline contains of 65 current and planned projects and totals 35GW:
 - 6.4GW is operational
 - 8.1GW is being constructed
 - 8.5GW has been given consent, but not yet started construction
 - 12.1GW is being planned
- Although ambitious, this scenario should be seen as a credible scenario for the UK offshore wind industry
- The regions with the highest potential offshore capacity by 2032 are East of England (8.5GW), Scotland (7.5GW), Yorkshire & Humber (6.4GW) and North East (4.9GW).
- The number of operational turbines is expected to grow from 1,660 in 2017 to 5,400 in 2032, with the average turbine capacity increasing from 4MW to 10MW
- So, although generating capacity is forecast to grow by 430% by 2032, the number of turbines will grow by a more modest 225% - reflecting the increasing power of turbines
- Peak construction of the current pipeline will be in 2024, when 9.5GW will be in construction. By 2028, all projects in the current pipeline will either be operational or in construction.

3.1 Introduction

This section provides a detailed analysis of the future potential of the UK's offshore wind industry through to 2032.

The approach used was based on identifying each operational and planned project from a range of sources, primarily RenewableUK's Wind Energy Database⁷ and augmented with data from the TEC Register (as at 23/11/2017), individual company websites and www.4coffshore.com.

⁷ <http://www.renewableuk.com/page/UKWEDhome>, accessed on 28th November 2017.

This “bottom-up” approach was chosen so that a wholly transparent project pipeline could be produced that would allow analysis in terms of size (MW and number of turbines), location (linked to standard Government regions) and timing of the construction and operational phases of each wind farms.

All efforts have been made to ensure that this project pipeline is accurate at the time of writing and, where assumptions have been applied, these have been made in good faith.

In total, 65 individual projects were identified at various stages of development:

- 31 were already operational
- 15 are under construction
- 9 have received consent (but not yet under construction)
- 10 are being planned (but not yet received consent)

For the purposes of this study, it is assumed that all projects in the pipeline will receive consent, be constructed and become operational before 2032 (where necessary, assumptions have been made relating to the likely / possible timing and duration of the construction phase).

The resulting project pipeline has a total generating capacity of 35GW by 2032. When compared to the Cambridge Econometrics report for Aura in 2017⁸, where a high scenario of 24GW by 2032 (going on to reach 40GW by 2040) was detailed, this new scenario may seem very high. However, the difference between the two scenarios primarily relates to the inclusion of planned, but not yet consented, projects in this new project pipeline.

Clearly there is a possibility that some of the consented and planned projects may not come to fruition. However, a potential “30 by 30” scenario (30GW operational by 2030), is supported by other recent research:

- Aurora reports that, with favourable economic and regulation conditions, 30GW by 2030 is achievable⁹.
- BVG Associates report an “upside” scenario of nearly 30GW¹⁰.
- Wind Europe’s report into potential scenario for the European offshore market contains a “High” scenario in which the UK achieves 30GW by 2030, and a “Central” scenario in which 22.5GW is installed (which coincides with our pipeline excluding pre-consented projects)¹¹.

⁸ Future UK Employment in the Offshore Wind Industry, Cambridge Econometrics, June 2017.

⁹ The new economics of offshore wind, Aurora Energy Research, January 2018.

¹⁰ Unleashing Europe’s offshore wind potential: A new resource assessment, BVG Associates and Wind Europe, June 2017.

¹¹ Wind energy in Europe: Scenarios for 2030, Wind Europe, September 2017.

Therefore, the project pipeline detailed in this report should be seen as an ambitious, yet realistic, level of installed capacity by 2032.

Finally, it is interesting to note how predictions for the growth of offshore wind capacity have changed over the years. In the pipeline presented below, we estimate that 12GW will be operational by 2021 – which is in line with the low scenario reported by RenewableUK and Energy & Utility Skills in 2011¹².

Furthermore, we estimate that 17GW will become operational by 2023 – similar to the medium scenario reported in the 2013 update of the 2011 report¹³.

3.2 The Project Pipeline

As at February 2018, there was 6.4GW of offshore wind installed capacity around the UK, with a further 8.1GW currently being constructed (1.5GW of which is expected to become operational during 2018 and all of it operational by 2024). 8.5GW has been given consent and 12.1GW of projects are being planned.

Figure 1: The current UK offshore wind pipeline – generating capacity

	Operational	Under construction	Consented	Planned (pre-consent)	Total
Generating capacity	6.4GW	8.1GW	8.5GW	12.1GW	35GW

Source: Energy & Utility Skills' estimate based on RenewableUK Wind Energy Database, TEC register and company websites.

Figure 2 below compares each phase of the project pipeline by several different metrics – generating capacity, number of wind farms, number of turbines and the average turbine capacity.

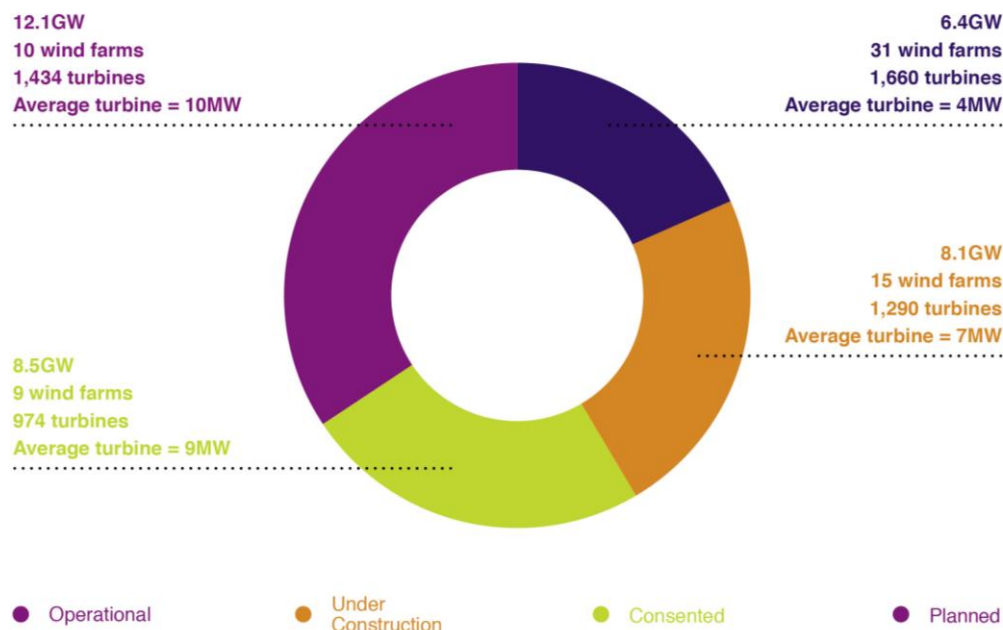
This chart clearly shows the potential of the offshore wind industry, with just under one-fifth (18%) of the project pipeline currently operational (compare this to the onshore wind industry, where 66% of the project pipeline is already operational).

**There are more offshore wind farms being planned
than there are currently in operation**

¹² Working for a Green Britain, RenewableUK and Energy & Utility Skills, February 2011.

¹³ Working for a Green Britain and Northern Ireland 2013-23, RenewableUK and Energy & Utility Skills, September 2013.

Figure 2: Characteristics of the UK offshore wind project pipeline



Source: RenewableUK Wind Energy Database

Looking further ahead, research by Aurora Energy Research¹⁴ estimates that turbine sizes could increase to around 13-15MW by the mid-2020s (reducing capital costs by 25-30% and further reducing the number of people needed to construct, install, operate and maintain).

So, as the offshore project pipeline becomes a reality, we will see a trend towards:

1. Individual wind farms generating more MW
2. Individual wind farms containing a greater number of turbines
3. Larger turbines (in terms of generating capacity) being installed

So, a point to note is that the predicted increase in GW output (+430% over 2017 levels) will not require a commensurate increase in the number of turbines (a forecast increase of 225%) or the required workforce (which is more aligned to the growth in turbines – more details in section 4 below).

Potential Installed Capacity around the Regions

Of the currently **operational** capacity, 24.7% is located in the South East, with 24.2% in the East of England and 21.1% in the North West. **Construction** activity is concentrated in the Yorkshire & Humber area – accounting for 2.6GW, or 31.9% of total construction activity.

¹⁴ The new economics of offshore wind, Aurora Energy Research, January 2018.

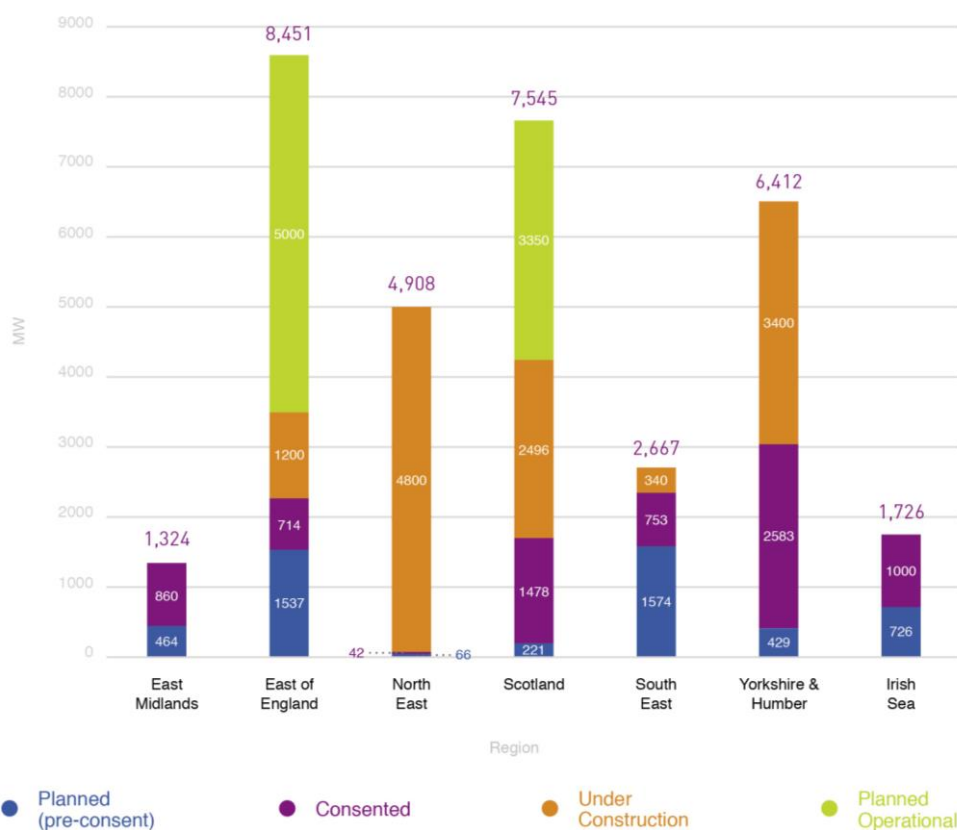
Only three regions currently have **consented** projects (prior to construction) – North East, Scotland and East of England.

Of the **planned** (pre-consent) projects, the majority are planned around the East of England (5GW; 41.4% of planned projects), while Yorkshire & Humber (3.4GW; 28.1%) and Scotland (3.4GW; 27.7%) account for nearly all of the remainder.

In total, the East of England (8.5GW), Scotland (7.5GW), Yorkshire & Humber (6.4GW) and North East (4.9GW) have the greatest growth potential through to 2032.

Figure 3 below shows the total planned offshore wind capacity by project phase and region.

Figure 3: The current UK offshore wind pipeline – generating capacity by region



Source: Energy & Utility Skills' estimate based on RenewableUK Wind Energy Database, TEC register and company websites.

Future growth of the offshore wind industry is focussed on the North Sea – and the regions along the eastern seaboard of the UK.

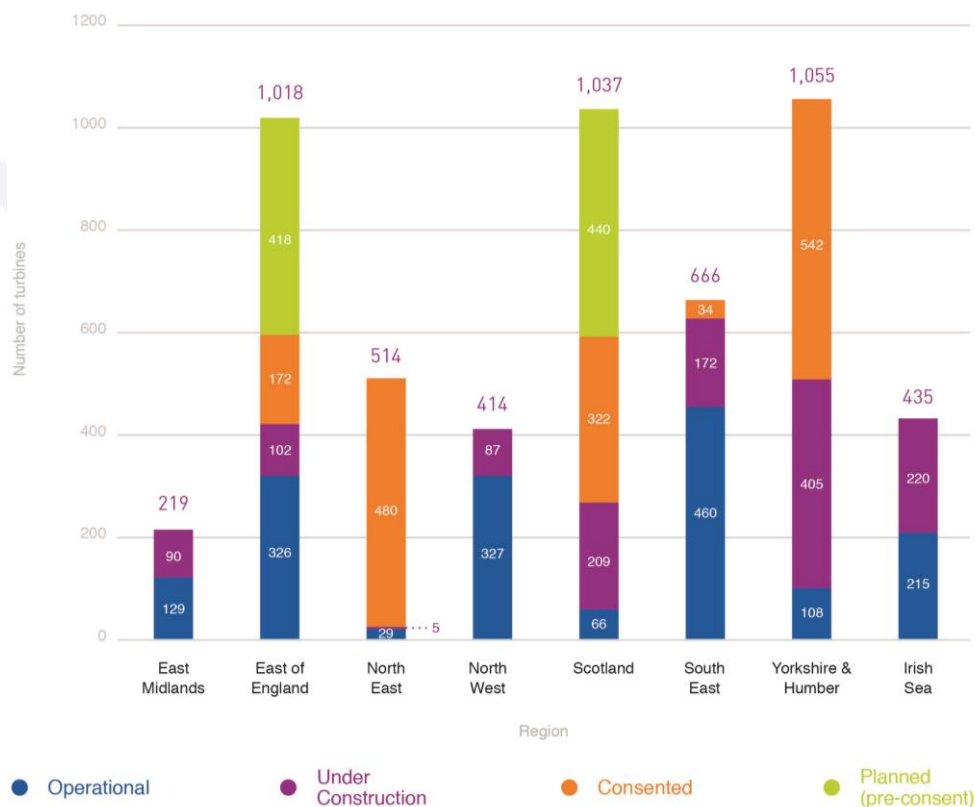
Not only is overall installed capacity expected to grow substantially over the coming years, but the scale of individual projects is also increasing.

There are currently an estimated 1,660 turbines in operation in UK coastal waters, with a further 1,290 turbines currently being constructed.

In total, the number of turbines could increase to around 5,400 by 2032 should the entire project pipeline be delivered – an overall increase of 225% over current numbers.

Figure 4 shows details of the current project pipeline in terms of the number of turbines in each region by project phase.

Figure 4: The current UK offshore wind pipeline – number of turbines by region



Source: Energy & Utility Skills' estimate based on RenewableUK Wind Energy Database, www.4COffshore.com, TEC register and company websites.

3.3 Project Timelines

The current known offshore wind pipeline contains details of 34 individual projects that are not yet operational; 23 of these are large-scale projects (i.e. 500MW or more).

Information relating to the timing of the construction phase and the year in which each wind farm is expected to become operational have been derived using publicly available sources (e.g. company websites, RenewableUK's Wind Energy Database, etc.) and, where possible, direct from the relevant developers and owner / operators. Where detailed dates / timings have not been accessible, we have estimated these (this mostly relates to those projects that are currently pre-consented).

Figure 5 below shows the predicted construction timeline for the 23 large-scale (i.e. 500MW or greater) offshore wind farms over the coming years.

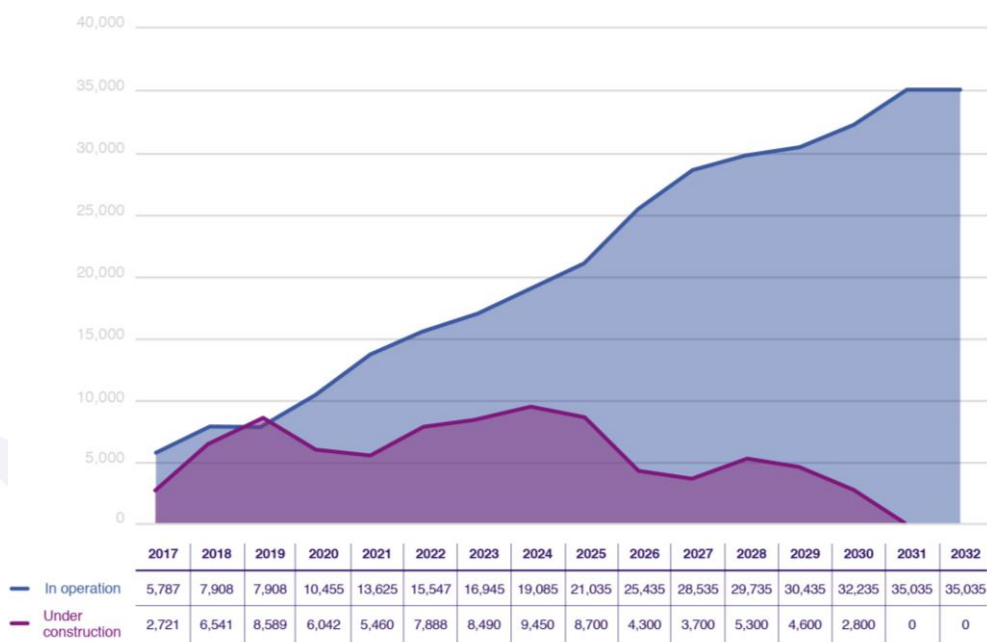
Figure 5: The current UK offshore wind pipeline – construction timescales for large (500MW+) projects

PROJECT	PROJECT FEBRUARY 2018	NUMBER OF TURBINES	MW OUTPUT	REGION	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
BEATRICE	Under Construction	84	588	Scotland															
EAST ANGLIA ONE	Under Construction	102	714	East Of England															
HORNSEA PROJECT ONE	Under Construction	174	1,197	Yorkshire & Humber															
CODLING PARK WIND FARM	Under Construction	220	1,000	Ireland/Wales															
INCH CAPE	Under Construction	110	784	Scotland															
HORNSEA PROJECT 2	Under Construction	231	1,386	Yorkshire & Humber															
TRITON KNOLL	Under Construction	90	860	East Midlands															
SEAGREEN ALPHA & BRAVO	Consented	150	1,050	Scotland															
MORAY FIRTH EASTERN DEVELOPMENT AREA	Consented	100	950	Scotland															
SEAGREEN PHASE 2	Pre-Consented	250	1,800	Scotland															
MORAY FIRTH WESTERN DEVELOPMENT AREA	Pre-Consented	90	750	Scotland															
EAST ANGLIA THREE	Consented	172	1,200	East Of England															
HORNSEA 3	Pre-Consented	400	2,400	Yorkshire & Humber															
DOGGER BANK TEESSIDE A	Consented	120	1,200	North East															
SEAGREEN PHASE 3	Pre-Consented	100	800	Scotland															
DOGGER BANK CREYKE BECK A	Consented	120	1,200	North East															
DOGGER BANK TEESSIDE B	Consented	120	1,200	North East															
EAST ANGLIA TWO	Pre-Consented	115	700	East Of England															
DOGGER BANK CREYKE BECK B	Consented	120	1,200	North East															
EAST ANGLIA ONE NORTH	Pre-Consented	115	700	East Of England															
NORFOLK VANGUARD	Pre-Consented	250	1,800	East Of England															
NORFOLK BOREAS	Pre-Consented	250	1,800	East Of England															
HORNSEA 4	Pre-Consented	112	1,000	Yorkshire & Humber															

Source: Energy & Utility Skills' estimate based on RenewableUK Wind Energy Database, TEC register and company websites.

Figure 6 below shows the predicted timing of construction activity associated with the known project pipeline as described above. It also shows the levels of installed capacity as projects become operational.

Figure 6: The current UK offshore wind pipeline – in-year construction and aggregated generating capacity



Source: Energy & Utility Skills' estimate based on RenewableUK Wind Energy Database, TEC register and company websites.

This chart shows two peak periods of construction activity:

- 2019 – when 8.6GW of construction activity will be taking place
- 2023 to 2025 – during this three-year period, at least 8.5GW of capacity will be in construction (peaking in 2024 at 9.5GW)

It is predicted that all 34 projects in the current pipeline will be operational by 2030. Clearly there will be subsequent, currently unknown, projects entering the pipeline over the coming years that will add further MWs under construction during 2030 to 2032 – thus avoiding the construction “cliff edge” shown in the final two years of the chart.

3.4 Conclusions

The project pipeline developed for this study highlights the growth potential of the UK offshore wind industry – there are more wind farms being constructed and planned than there are currently in operation (34 compared to 31) and the total power output could grow from 6.4GW in 2017 to 35GW by 2032. There is a similar picture developing across Europe, where 12.6GW could grow to 64GW by 2030¹⁵.

Clearly, there are many factors which could affect whether a planned wind farm ultimately becomes operational, for example planning consents, the financial / investment environment, government policy, etc. Therefore, it is not certain that all nine wind farms that have received consent and the ten that are in the planning stage will become a reality. This level of uncertainty makes planning the workforce and skills requirements very difficult (more on this in the following chapter).

However, the project pipeline does give a real sense of the potential for the offshore wind industry to play a major role in the UK's energy mix at a fast-reducing cost (in 2015 subsidies were between £114 and £120 per megawatt hour; in 2017 this had fallen to £57.50¹⁶).

The vast majority of the potential growth is expected to occur in the North Sea, meaning that the regions along the eastern seaboard of the UK (particularly the East of England, Scotland, Yorkshire & Humber and North East) could increase their share of UK offshore wind capacity from 33% in 2017 to 60% by 2032.

Peak construction of the project pipeline is estimated to be, firstly, in 2019 (when 8.6GW will be in construction) and, secondly, in 2024 (when 9.5GW will be in construction). It is anticipated that all 34 projects will be operational by 2030.

The turbine technology being employed is becoming increasingly more powerful sophisticated – with the average operational turbine in 2017 being 4MW; the average turbine currently being installed is 7MW, and the average turbine in pre-consented projects is 10MW. There is evidence that turbines could reach 13-15MW by the mid-2020s and that capital costs could be reduced by 25-30%.

The associated labour requirements of this scenario are discussed in the next chapter.

¹⁵ Unleashing Europe's offshore wind potential A new resource assessment, BVG Associates & Wind Europe, June 2017

¹⁶ <http://www.bbc.co.uk/news/business-41220948>, assessed on 30th April 2018.

4. Future Employment Opportunities in Offshore Wind

Headlines

- It is estimated that direct employment levels could increase from around 10,000 to 36,000 in 2032.
- Scotland is forecast to experience the largest growth in employment (+6,400), followed by East of England (+6,150), Yorkshire & Humber (+5,750) and North East (+4,050)
- Employment levels are expected to increase in all stages of the project lifecycle, but primarily in *Construction & installation* (+6,700) and *Operations & maintenance* (+6,900).
- Employment demand will be strongest for technicians and engineers, with an estimated additional requirement for 10,200 by 2032.
- However, factors that could determine the nature and extent of employment growth include:
 - The rate and impact of technical innovation
 - Offshore workforce transit and use of next generation service operation vessels (SOVs)
 - Operation and maintenance resourcing strategy
- The industry is forecast to become more efficient in its use of labour – in 2017 an estimated 1.75 FTEs were required to produce 1MW of power; this is expected to fall to 1.04 FTEs by 2032
- During the period up to 2032, it is not expected that *Decommissioning / repowering* will require any significant growth in the workforce.

4.1 Introduction

The offshore wind industry is a fast-paced, developing industry and, just as it is difficult for individual companies to plan their workforce requirements in this environment, it is equally difficult to predict industry-level demands. However, it is important that agencies working to support the development of the industry are given a sense of the direction and scale of the likely workforce requirements – and this chapter offers one potential future scenario (just as the project pipeline does in the previous chapter.)

In 2017, Aura commissioned Cambridge Econometrics to produce employment estimates for the UK offshore wind industry¹⁷ based on an established approach utilised in 2011 and 2013^{18, 19}. Included in their report was a “high” scenario of 24GW by 2032. Under this scenario, it was estimated that 25,000 people would be directly employed in the offshore wind industry.

These estimates were based on a set of input assumptions relating to:

- Industry wide learning rates – increase in efficiency of 9% for every doubling of total capacity deployed in the UK
- Average windfarm size and resulting economies of scale from this increasing over time
- Current and potential future locations of UK offshore windfarms.
- UK and EU projected offshore wind capacity and local content
- Prospect of future decommissioning / repowering activities (these activities are expected to have minimal impact on workforce requirements through to 2032)

However, as we seen in the previous chapter, the project pipeline developed for this skills study suggests that it is possible for the UK to achieve 35GW by 2032. The principal difference between these two scenarios being the inclusion of planned, but not yet consented, projects within the project pipeline developed for this study. It would, therefore, be reasonable to assume a greater demand for labour and skills for this study compared to the 2017 report.

Therefore, it was felt necessary to augment the 2017 direct employment estimates with the workforce requirements of this higher, more ambitious scenario.

The approach utilised to do this was based on using the same labour coefficients as used by CE to estimate 25,000 people required to deliver 24GW by 2032 – starting with 1.75 FTEs per MW in 2017, decreasing to 1.04 FTEs per MW by 2032. This downward trend in the number of FTEs per MW reflects the efficiency gains that are expected within the industry over the coming years. This is already occurring in the onshore wind industry where, although generating capacity is expected to increase by 50% (and the number of turbines by 43%) over the coming years, employment is only expected to grow by 12%.

These labour coefficients were then applied to determine the additional workforce requirements of an extra 11GW of generating capacity.

¹⁷ Future UK Employment in the Offshore Wind Industry, Cambridge Econometrics, June 2017.

¹⁸ Working for a Green Britain, RenewableUK and Energy & Utility Skills, February 2011.

¹⁹ Working for a Green Britain & Northern Ireland 2013-23, RenewableUK and Energy & Utility Skills, September 2013.

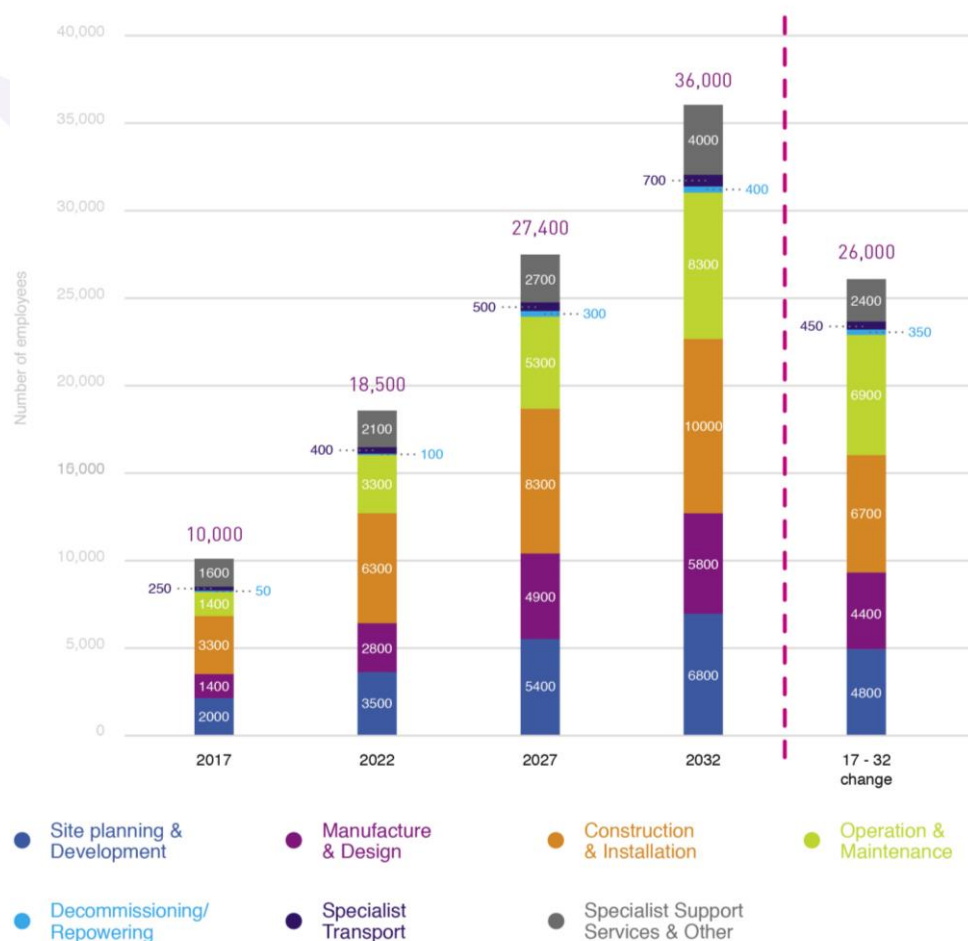
So, while it is not within the remit of this study to produce definitive new employment estimates for the industry, the data presented below is provided to add context and a sense of scale to a growing industry and the extent to workforce requirements will increase.

4.2 Employment Estimates

Employment levels in the offshore wind industry currently stand at 10,000 and are predicted to increase to 36,000 by 2032 – an increase of 260% (reflecting the 225% increase in the predicted number of operational turbines).

Figure 7 below provides a breakdown of total employment broken down by project stage.

Figure 7: UK Offshore wind employment growth by project stage



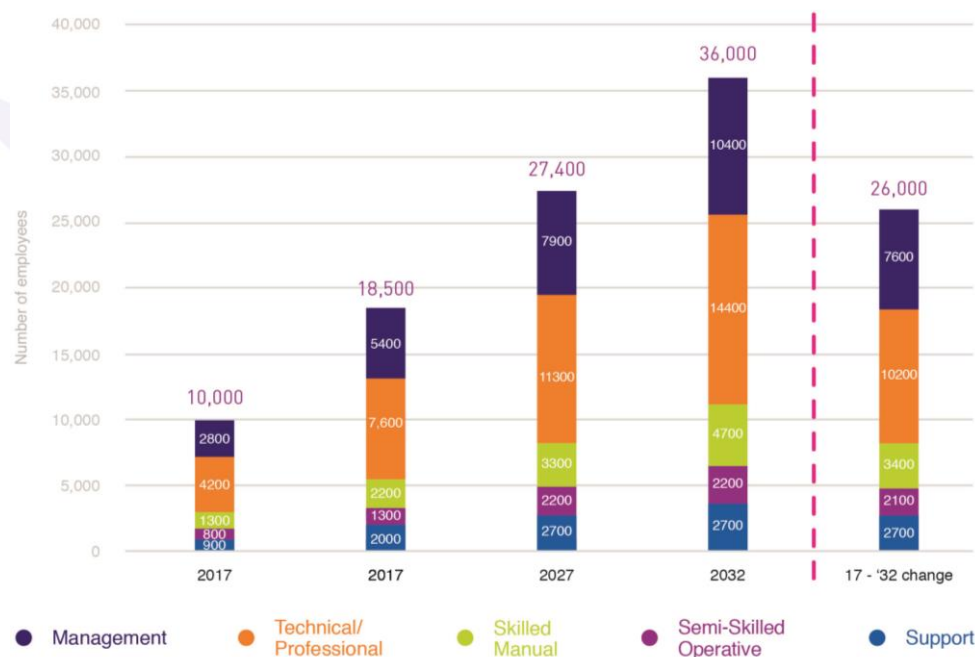
Source: Energy & Utility Skills' estimate using Cambridge Econometrics 2017 employment projections as a basis.

Employment growth is expected to occur mostly in the *Operations and Maintenance* and *Construction and Installation* phases (although the *proportion* of the total workforce working in *Construction and Installation* activities is predicted to fall over the period). Both phases will account for around 26% each of the total predicted growth (52% in total).

Direct employment in offshore wind could increase to 36,000 by 2032

Figure 8 below shows the predicted growth in employment across the five broad skill levels.

Figure 8: UK Offshore wind employment growth by broad skill level



Source: Energy & Utility Skills' estimate using Cambridge Econometrics 2017 employment projections as a basis.

Despite technological advances, it is anticipated that the occupational structure of the offshore wind industry (in terms of the proportion of people working at various levels) will remain much as it is today – with a continuing reliance on technicians and engineers. On this basis, demand will be greatest for *Technical / professional* staff and *Managers* (+10,200 and +7,600 respectively).

Therefore, it is likely that the main entry routes into the industry will remain as:

- I. Movers from other, technically-related, industries (including ex-forces and those from other aspects of the wider energy sector – both onshore and offshore)
- II. Apprenticeships and graduates (potentially providing a “base load” of new talent for the next generation)
- III. Movers with cross-sector skills (e.g. business / commercial, IT and data analytics, drone / ROV operators, etc.)

Figure 9 below gives a regional breakdown of employment growth at various points in time between 2017 and 2032.

Figure 9: UK Offshore wind employment growth by region

	2017	2022	2027	2032	2017-2032 Variance
Scotland	750	2,200	4,300	7,150	+6,400
East of England	1,000	2,400	4,500	7,150	+6,150
Yorkshire & Humber	1,400	3,000	4,900	7,150	+5,750
North East	500	1,400	2,800	4,550	+4,050
East Midlands	75	400	1,100	2,000	+1,925
South East	2,400	3,600	4,000	3,500	+1,100
North West	2,600	3,700	3,900	3,000	+400
West Midlands	75	100	150	200	+125
Northern Ireland	50	100	110	100	+50
London	75	100	120	100	+25
South West	75	100	120	100	+25
Wales	1,000	1,400	1,400	1,000	+/-0
UK	10,000	18,500	27,400	36,000	+26,000

Source: Energy & Utility Skills' estimate using Cambridge Econometrics 2017 employment projections as a basis.

The majority of employment growth is forecast to occur along the eastern seaboard of the UK – from the South East up to Scotland.

Factors that Could Affect Employment Demand

It is important to recognise that there are several factors that could affect nature and extent of future employment growth and, therefore, the accuracy of the employment estimates presented above, particularly:

1. Speed and impact of industry maturity and consolidation:

- Over the coming years, as the industry matures, consolidation (through mergers and acquisitions) may well change the industry structure and how services are purchased and deployed.
- Ownership models may also develop. For example, venture capitalists or pension funds becoming owners or more joint ventures. The impact on the employment of people is unclear at this stage – it may lead to more activities contracted out, potentially lowering the level of UK content.
- The introduction of common technical and engineering standards across the industry introduce efficiencies in a range of areas (from engineering design and manufacture through to installation and maintenance).

2. O&M manpower strategies:

- The strategies employed by owner / operators to staff their O&M activities post-warranty.

At the time of writing there seems to be little consensus across the industry as to the way forward for operators in terms of staffing O&M activities beyond the standard 5-year warranty period. There appear to four possible approaches (or variations thereof)²⁰:

- Renew the O&M agreement with the incumbent wind turbine OEM (this research has seen at least one example of this approach being employed)
- Take the O&M function in-house
- Either “TUPE”ing workers in from OEM, or bringing back in-house their own staff that were “inserted” into the OEM for training and development purposes (again, this research has seen an example of this approach being employed)
- Award the contract for O&M provision to an independent provider
- A hybrid approach – in-house, with specialist support from the OEM

3. Windfarm clustering:

- This will enable operating efficiencies and better sharing of fixed costs (e.g. the ability to collectively negotiate with ports, reduced logistics costs and the potential to share vessels and helicopters)
- Clustering has the potential to establishment of a large skills base
- It is recognised that the industry must realise the benefits of increased co-location / clustering and should do more to work collaboratively to ensure the sustainability of the industry²¹.

²⁰ GL Garrad Hassan, 2013 ‘A guide to UK offshore wind operations and maintenance’, Scottish Enterprise and The Crown Estate.

²¹ The UK Offshore Wind Supply Chain: A Review of Opportunities and Barriers, M. Chinn, November 2014.

4. Offshore logistics and workforce transit:

- How companies organise the mobility of the workforce – whether based onshore or out at sea (thus minimising transit time and maximising time on-site and the potential for multi-site support).
- Improved performance of next generation of Crew Transfer Vehicles (CTVs) and Service Operation Vessels (SOVs)
- Offshore-based strategies can become economical at a distance of more than 40NM from port²².

It is noted that Ørsted's Race Bank facility will be the first offshore wind farm to use a new SOV for O&M. The SOV can remain out at sea for up to 28 days and will greatly improve the efficiency of maintaining the assets²³.

5. Technological innovation:

- The introduction of new technologies could reduce the need for on-site human intervention (e.g. remote surveillance in wind turbine nacelles to allow improved remote diagnostics, expansion of ROV / drone use, etc.).
- Turbines are becoming larger, more reliable and less reliant on traditional mechanical technologies (e.g. gearboxes), requiring less frequent maintenance.
- Aspects of “industry learning” are taken into account in the above estimates, meaning that additional labour efficiencies during the period to 2032 are likely to be minimal.

6. Government policy:

- Making the industry attractive to investors is crucial maintaining the momentum that appears to have returned to the sector.

7. Realisation or project pipeline:

- The project pipeline as detailed above includes projects that have not yet entered their construction phase and some that have not yet received consent. It is possible that not all the pre-consented projects will become a reality, for a variety of reasons.

²² GL Garrad Hassan, 2013 'A guide to UK offshore wind operations and maintenance', Scottish Enterprise and The Crown Estate.

²³ <https://orsted.co.uk/Media/Newsroom/News/2018/02/Full-power-at-Race-Bank-Offshore-Wind-Farm>, accessed on 22nd February 2018.

4.3 Conclusions

The offshore wind project pipeline detailed in the previous chapter and the employment estimates presented above provide strong evidence of a growing industry, with employment opportunities in a range of roles and skill levels.

It is very difficult to estimate the likely scale of employment growth within a specific industry with certainty, especially in one that is as fast-developing, technologically-driven as offshore wind. However, we can be certain that a likely three-fold increase in the number of operational turbines will result in a substantial increase in employment compared to current levels.

Therefore, the employment estimates presented in this chapter, increasing from 10,000 jobs in 2017 to 36,000 in 2032, represent one possible scenario of an uncertain, yet almost certainly bright, future.

However, there are several factors could have a significant impact on potential job creation, such as the workforce strategies employed by owner / operators, technological progress / innovation and the speed / direction of industry maturing and consolidation.

Reflecting the regional distribution of future installed capacity (focussing largely on the North Sea), the majority of employment growth is predicted in Scotland, East of England, Yorkshire & Humber and North East.

Employment levels are expected to increase in all phases of the project lifecycle, but particularly in Construction & installation (+6,700) and Operations & maintenance (+6,900). It is not expected that Decommissioning / repowering will experience significant jobs growth in the period to 2032.

Employment demand will be strongest for technicians and engineers, with an estimated additional requirement for 10,200 by 2032. This represents nearly half of new job creation and reflects the highly-skilled, technical nature of many of the tasks undertaken by the workforce.

Given the uncertain nature of the scale of offshore wind deployment, it would be wise to refresh these employment estimates on an annual basis, keeping them up-to-date as the project pipeline develops, technologies develop, the industry structure matures and the industry generally becomes more efficient.

5. Competition for Talent - The Bigger Picture

Headlines

- The UK labour market is extremely tight – with record high employment and low unemployment
- Many firms and HR professionals report concerns about the availability of required talent now and expect the situation to get worse in the future
- The Government's National Infrastructure Pipeline details of £240billion of spend on infrastructure projects by 2020/21 and an additional £218billion for 2021/22 and beyond
- Up to 2020/21, the three largest sectors are:
 - Transport - £78.5bn
 - Energy - £57bn (including £15.6bn for offshore wind)
 - Utilities - £47.5bn
- Demand for labour in energy and infrastructure sectors through to 2024 could reach 760,000 (equivalent to 27% of the current workforce).
 - Growth in employment – 160,000
 - Replacement of retirements – 600,000
- Many aspects of the transport, energy and utilities sectors will be competing for highly skilled and talented people
- While much of this demand will not be in direct competition for skills, it will be in indirect competition for good quality technical and managerial skills, including mechanical / electrical / civil engineers, plant operators, logistics, welders, cable jointers, quantity surveyors and a range of construction (and marine) skills.
- Employment growth in onshore wind is expected to be minimal, so does not represent any significant challenge to the offshore wind industry in terms of being a competitor for skilled talent (although the base technical and business/ commercial skills are similar to those required for offshore).
- Therefore, competition for high quality school leavers, Apprentices, Graduates and those already skilled is forecast to remain high.

In addition to the demand for skills and labour from within the UK offshore wind industry, it is important to consider the wider external context – the demand for similar skills / skilled labour from other parts of the UK economy.

In this chapter we consider the current state of the UK labour market and planned level of investment (both public and private) in the construction of major infrastructure projects around the UK.

5.1 UK Labour Market Context

In a recent webinar on planning for a resilient and sustainable workforce²⁴, Energy & Utility Skills identified five major challenges facing the UK infrastructure sector:

1. The tightest labour market for over 40 years
2. Continued intense competition for talent
3. Supply of talent struggling to meet current demand
4. Changing population demographics
5. Adapting to an uncertain future

The Tightest Labour Market for Over 40 Years

In December 2017, there were 32.15million employed in the UK²⁵, with offshore wind's 10,000-strong workforce accounting for just 0.03% of total employment.

The UK labour market is arguably tighter than at any point since records began – over 40 years ago.

Data released by the Office for National Statistics (relating to the period November 2017 to January 2018²⁶) show that the UK is currently experiencing:

- **High levels of employment** – over 32million people in employment; representing 75.3% of all people aged 16-64 years (joint highest employment rate since records began in 1971)
- **Low levels of unemployment** – the unemployment rate stood at 4.3% (the joint lowest level since 1975)
- **Low levels of economic inactivity** – the economic activity rate (the proportion of 16-64-year-olds that are not in work or seeking it) was 21.2% (joint lowest since comparable records began in 1971)

From this data it is clear that there is not much room for expansion in the number of people available to fill current or future vacancies.

²⁴ The webinar can be accessed here: <http://www.euskills.co.uk/strategic-workforce-planning>

²⁵ Statistical Bulletin: UK Labour Market: 2018, accessed from <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/february2018#employment> on 12th March 2018.

²⁶ Accessed from: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/march2018#employment> on 27th March 2018.

Continued Intense Competition for Talent

In the 12 months to February 2018, the number of vacancies in the UK economy grew by 7.4% to 816,000²⁷. During the same period, the number of vacancies within the *Water supply, sewerage and waste management* sector grew by 10.5% (around 4,000 vacancies), while vacancies in the *Electricity and gas* sector grew by 2.3% to around 5,000 vacancies.

The availability, or lack, of suitably skilled labour is reflected in the prevalence of vacancies that are proving hard-to-fill by employers due to a lack of applicants with the required skills, qualifications or experience (known as skills shortage vacancies)²⁸. Within the energy and utilities sector, 36% of all vacancies in 2015 were reported as skills shortage vacancies – the highest proportion of any sector; compared to a national average of 23 per cent²⁹.

Looking forward, the Confederation of British Industry's (CBI) 2017 Education and Skills Survey found that 61% of businesses were not confident there would be enough people available in the future with the necessary skills to fill their high-skilled jobs.

Furthermore, a recent survey by CIPD suggests that 72% of HR professionals expect an increase in competition for well-qualified talent over the next three years³⁰. This may not be surprising given (i) the tightness of the current labour market and (ii) the fact that by 2024 there could be an additional 850,000 jobs in the UK economy³¹ and it will be necessary to replace 8million people who will have retired.

In 2015, 36% of vacancies in the energy sector were skills shortages

This situation appears to be impacting on salary levels. The median full-time gross salary in the UK in 2017 was £28,758, 2% higher than in 2016³². Across the *Electricity & Gas* sector, salaries increased 6.9%. Higher than average annual increases were recorded across a range of occupation and skill levels:

- Elementary construction: +4.7%
- Electrical technicians: +4.2%

²⁷ ONS Vacancy Survey (VACS02), February 2018.

²⁸ UK Employer Skills Survey (2015), UKCES.

²⁹ *ibid*

³⁰ Resourcing and Talent Planning survey 2017, CIPD, 2017.

³¹ Working Futures 2014-24, Warwick Institute for Employment Research / Cambridge Econometrics, 2014.

³² Annual Survey of Hours and Earnings, ONS, 2017.

- Plant operatives: +3.3%
- Engineers: +2.9% (Electrical engineers: +5.0%)

In a 2017 survey by the Open University³³, 56% of all firms said they had had to increase the salary of an advertised role to get the skills they needed.

It is unlikely that this situation will ease significantly given:

- The high level of investment being planned for UK infrastructure sector, and particularly in the energy and utilities sector (see chapter 6.1 below)
- The associated level of demand for skilled labour (see chapter 5.3 below)

Supply of Talent Struggling to Meet Current Demand

EngineeringUK³⁴ report that an estimated 265,000 skilled entrants are needed each year to meet the demand from engineering companies through to 2024. Given the numbers of such talent predicted to enter the labour each year, there could be a shortfall of some 20,000 engineering graduates per year. Further detail is provided in section 6 below.

Changing Population Demographics

The UK population is projected to increase by 3.6million (5.5%) over the next 10 years, from an estimated 65.6million in mid-2016 to 69.2million in mid-2026³⁵.

This growth presents both an opportunity and a challenge to the UK's infrastructure sector. On the one hand there will be a larger pool of available labour – an extra 3.2million people of working age and an extra 300,000 school-aged children – while on the other hand there will be a larger population to serve (including an extra 3.9million people of pensionable age) in terms of providing energy and utilities services and in constructing and maintaining other essential infrastructure.

The population will also become increasingly diverse. In 2011, around 14% of the population were Black, Asian or Minority Ethnic (BAME)³⁶; a figure which is expected to double by 2050³⁷. Meanwhile, in 2015 / 16³⁸, just 5% of the power sector's workforce were from a BAME background.

³³ The Open University Business Barometer, 2017.

³⁴ Engineering UK 2017: The state of engineering, EngineeringUK, 2017

³⁵ National Population Projections: 2016-based statistical bulletin, accessed from: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2016basedstatisticalbulletin> on 13th December 2017.

³⁶ Census of Population, ONS, 2011.

³⁷ A portrait of modern Britain, Policy Exchange, 2014.

³⁸ ONS (2016), Annual Population Survey (April 2015 to March 2016).

However, the distribution of the BAME population is focused on just three cities – London, Greater Birmingham and Greater Manchester. Between them they account for over 50% of the UK's entire BAME population. Indeed, in London, BAMEs out-number the White population in every age group up to 20.

The UK population is becoming more diverse – the energy sector needs to follow suit

With white males with good technical skills becoming a reducing proportion of the UK workforce, the benefits – even the necessity – of having a diverse workforce which draws upon the skills of the whole community is clear (although employers need to be mindful of the specific local / regional circumstances when determining how representative their workforce is, or should be, in terms of ethnic diversity).

Adapting to an Uncertain Future

Significant shifts are predicted to occur over the coming years in:

- **Population and the labour market** – a growing, more diverse and older population and workforce
- **Technology and data** – new technologies will change the required skillsets; smarter networks and connectivity will provide unheard-of quantities of data; increased use of AI and robotics for remote monitoring, access and repairs; physical and data security will be a priority
- **Brexit** – competition for good quality technical skills could intensify if a reduction in the supply of mid- and higher-level qualified labour from Europe diminishes the available pool of labour
- **Regulation and competition** – Utility regulators recognising the importance of a skilled workforce in terms of improving sector performance; increasing levels of competition are being introduced; industry consolidation
- **Customer expectations** – improved customer experience is a necessity; expectations higher than ever... and increasing

As a result, business as usual will not be an option. Organisations will need to make sure they're aware of these trends and of their potential impacts on their talent attraction and retention strategies.

5.2 Investment in Major National Infrastructure Projects

This section presents analysis of the National Infrastructure and Construction Pipeline, Autumn 2017, produced by the Infrastructure and Projects Authority³⁹.

The pipeline and its associated analysis report⁴⁰ set out details of over £245billion of planned infrastructure investment across the public and private sectors through to 2020 / 21 – a level not sustained in 40 years.

The pipeline also includes less specific details of £218billion of planned investment for 2021 / 22 and beyond; including £110 billion of electricity generation investment (partly based on National Grid's Future Energy Scenarios (FES)).

It should be noted that this pipeline is not a comprehensive picture of likely investment over the longer-term because government capital budgets and future price control periods for the regulated utilities have not yet been set for the period beyond 2020 / 21. For example, projects such as Crossrail2, Wylfa and Moorside nuclear projects and the Cardiff and Swansea Tidal Barrages are not yet included in the pipeline.

Over the entire term of the known infrastructure pipeline, nearly £463billion of investment is set out.

5.2.1 Investment from 2017 / 18 to 2020 / 21

The majority of investment during this period (£183bn; 74.8%) falls within three sectors:

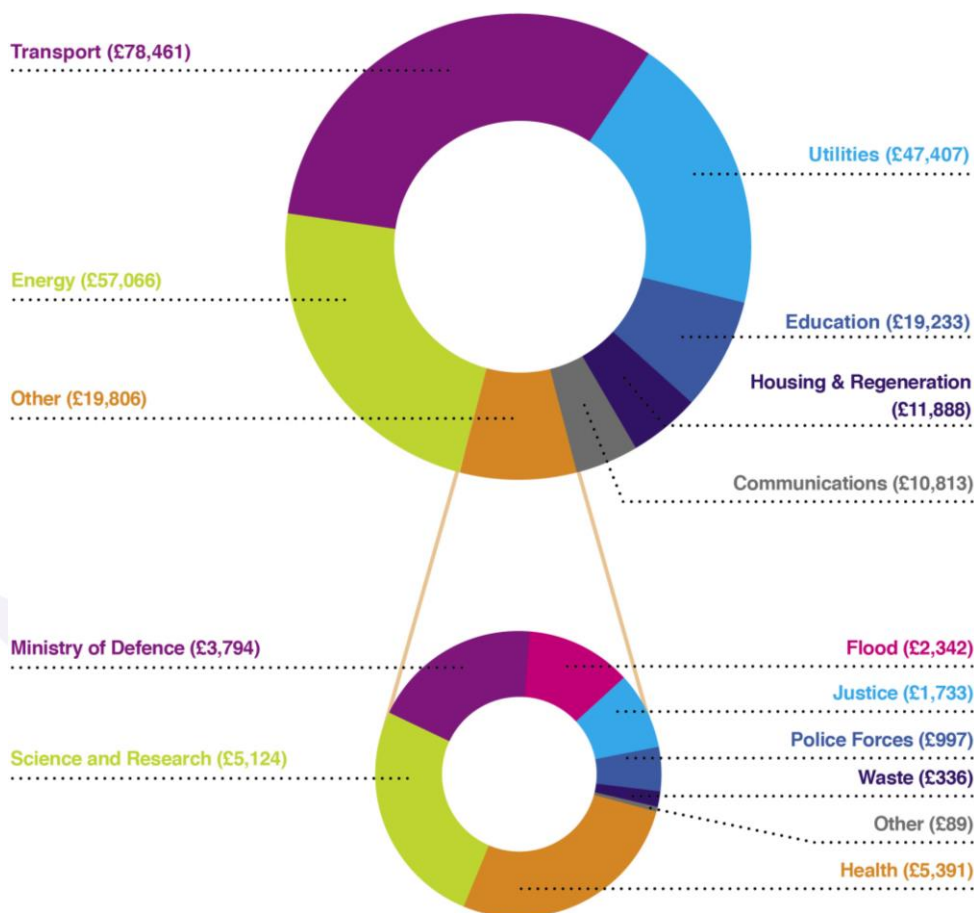
- £78.5bn – Transport (including rail, high speed rail, roads and airports) (32.1%)
- £57bn – Energy (including all forms of electricity generation, nuclear decommissioning and oil & gas) (23.3%)
- £47.4bn – Utilities (defined as electricity and gas transmission and distribution, smart meters and water & sewerage) (19.4%)

**£240bn is being invested in the UK's infrastructure –
with £57bn earmarked for the energy sector**

³⁹ National Infrastructure and Construction Pipeline, Infrastructure and Projects Authority, 6 December 2017.

⁴⁰ Analysis of the National Infrastructure and Construction Pipeline, Infrastructure and Projects Authority, 6 December 2017.

Figure 10: National Infrastructure and Construction Pipeline – Total spend (£m) by sector (2017/18 to 2020/21)



Source: National Infrastructure and Construction Pipeline, Infrastructure and Projects Authority, 6 December 2017.

Included within the energy sector's £57bn is £15.6bn allocated to offshore wind – the largest single sub-sector. This is followed by Hinkley Point C at £6bn.

The utilities' £47.4bn is largely taken up by water & sewerage (£16bn), electricity transmission (including interconnectors; £14.6bn) and electricity and gas distribution (£14bn combined).

The rail sector dominates the transport sector's investment plans, including £13.4bn for HS2. Of the remaining £61.7bn (25.2% of total investment), the largest sectors are Education (£19bn), Housing (£12bn) and Communications (£11bn).

Figure 11 below shows the regional breakdown of investments and the proportion that is allocated to offshore wind.

Figure 11: National Infrastructure and Construction Pipeline – Annual spend (£million) by region (2017/18 to 2020/21)

Region / Nation	Total £m	Offshore wind contribution
East Midlands	£7,023	61%
Yorkshire and the Humber	£7,306	34%
East of England	£9,631	27%
North West	£11,480	9%
South East	£12,243	9%
North East	£3,975	1% (Interconnectors = 23%)
London	£20,708	0%
South West	£11,456	0%
West Midlands	£5,657	0%
Northern Ireland	£50	58%
Scotland	£10,518	40% (Onshore Wind = 14%)
England	£56,556	0%
Wales	£2,602	0%
England and Wales	£7,780	0%
England, Wales & Scotland	£14,404	0%
UK-wide	£62,957	0%
Grand Total	£244,675	6.4%

Source: National Infrastructure and Construction Pipeline, Infrastructure and Projects Authority, 6 December 2017.

In the East Midlands offshore wind investments account for nearly two-thirds of all the region's infrastructure spend. However, in Yorkshire & Humber and East of England, although offshore wind growth is expected to be high, it will only account for around one-third of each region's infrastructure spend.

The implication of this is that there is much infrastructure activity planned across the UK which the offshore wind industry will have to compete for skilled talent, particularly:

- Upstream oil and gas (£21bn)
- HS2 (£13.4bn)
- The Rail sector's current and next price control periods (£13bn)
- Electricity Distribution (£9.5bn)
- Electricity Interconnectors (£5.4bn)
- Digital economy (£4.4bn)
- Gas Distribution (£4.4bn)
- London Underground (£4.1bn)
- Offshore transmission (£2.4bn)

5.2.2 Investment from 2021 / 22 and Beyond

In addition to the detailed investment plans for 2017/18 to 2020/21, further investments totalling £218bn are laid out in the pipeline for the period from 2021/22 and beyond. These plans are often less detailed and are incomplete as some government plans are yet to be finalised and, as is the case with regulated water companies, their investments beyond the current price control period are still being determined.

However, they do give a good indication of where current priorities lie, with significant investments planned within electricity generation, nuclear decommissioning and the final stages of HS2 and Hinkley Point C.

Figure 12 shows the largest investments (valued at greater than £1bn) that are included within the 2021/22 and beyond total investments.

Figure 12: Principal Energy, Transport and Utilities investments (£1bn+ investment) 2021/22 and Beyond

Sector	Projects	Investment post-2021 (£m)
Energy	Electricity Generation – Unspecified generation	£94,488
Transport	HS2	£37,798
Energy	Hinkley Point C	£11,532
Energy	Nuclear decommissioning	£6,922
Energy	Upstream Oil & Gas	£6,078
Transport	Rail – Intercity Express Infrastructure	£5,952
Transport	Rail – Future Enhancements	£5,243
Energy	Nuclear Decommissioning: radioactive disposal facility	£4,759
Utilities	Smart Metering Implementation Programme	£4,413
Energy	Offshore wind: Hornsea 1 & 2; Triton Knoll; East Anglia 1	£3,900
Utilities	Electricity transmission – other investments	£2,734
Utilities	Electricity transmission – Strategic North	£2,675
Energy	Nuclear Decommissioning: Plutonium disposal	£2,416
Utilities	Electricity transmission – Interconnectors	£1,151

Source: National Infrastructure and Construction Pipeline, Infrastructure and Projects Authority, 6 December 2017.

These 14 programmes/ projects alone account for 86% of the entire post-2021 investment pipeline.

5.3 The Scale of Competition for Skilled Talent

Figure 13 below shows estimates of the expansion demand (i.e. new jobs) and replacement demand (e.g. retirements) across the UK economy and for selected sectors which are adjacent to the offshore wind industry in terms of operational, technical and engineering skillsets between 2018 and 2024.

Figure 13: Total UK labour demand in energy and infrastructure sectors 2017-2024

	Total labour demand	% of 2017 workforce	Relevant occupational growth
Energy & infrastructure sectors	760,000 160,000 new jobs 600,000 retirements	26.7%	280,000 Skilled trades 100,000 Managers 80,000 Operatives 60,000 Engineers 20,000 Technicians
All Sectors	8,700,000 850,000 new jobs 8,000,000 retirements	25.8%	1.2m Managers 500,000 Operatives 420,000 Engineers 410,000 Skilled trades 120,000 Technicians

Source: Working Futures 2014-2024, UKCES, 2016.

Note – Data is rounded to the nearest 10,000.

* includes power generation and onshore transmission and distribution

** includes onshore and offshore extraction only

Within the energy and infrastructure sectors, an estimated 760,000 people will be required by 2024 – equivalent to replacing 26.7% of the current workforce. Furthermore, nearly 3-out-of-4 (71.4%) of people recruited over this period will be in operative, skilled, technician, engineering and managerial roles.

By comparison, across the whole of the UK economy, some 8.7million people will be required, with just 28.9% of them entering jobs in the same broad occupational groups.

The scale of competition for skilled talent is clear – while offshore wind is increasing its workforce to deliver the bulk of the current project pipeline, the wider energy and infrastructure sector will be seeking around 760,000 people with similar or related operational, technical or engineering skillsets. Meanwhile, the whole of the UK economy will be seeking 8.7million people to fill new jobs and replace those that have retired.

By 2024, the UK economy will need to replace nearly eight million retirees as well as fill 850,000 new jobs

While these macro-level forecasts provide a general indication of the level of competition for skills and labour over the coming years, it should be recognised that they are only macro-level estimates and do not relate to the workforce requirements of specific projects. It is only at the project level that we start to get a real sense of the wider context and the level of competition for talent. For example:

- Thames Tideway Tunnel will create around 4,000 direct jobs (as well as 5,000 indirectly)⁴¹.
- Crossrail 2 will support 60,000 new jobs across the UK supply chain while under construction and 200,000 jobs across London and the South East once operational⁴².
- Hinkley Point C, Wylfa Newydd and Moorside nuclear sites are expected to create around 50,000 jobs during construction and around 3,000 jobs once they become operational⁴³.
- BT Open Reach Infrastructure are recruiting an additional 3,500 engineers across the UK (the largest recruitment drive in the company's history) to deliver the delivery of fibre broadband services⁴⁴.
- The potential number of jobs created by the proposed tidal lagoons at Cardiff, Colwyn Bay, Newport, Swansea, Bridgewater Bay and West Cumbria could reach as many as 34,700 during the construction phases and 6,400 once they become operational by 2030⁴⁵.

5.4 UK Onshore Wind

This chapter presents the findings of research into the extent and timing of the UK onshore wind energy pipeline as well as providing analysis of the employment opportunities and skills requirements of the industry.

Current and Future Installed Capacity

At the time of writing, there is 11.4GW of onshore wind generating capacity in the UK, with a further 1.5GW currently being constructed⁴⁶. In addition, there is 4.3GW which has been consented and awaiting construction. Therefore, the total project pipeline has the potential to deliver 17.2 GW of generating capacity.

⁴¹ <https://www.tideway.london/news/media-centre/thousands-of-jobs-to-be-created-as-contractors-named-for-londons-super-sewer/>, accessed on 21st March 2018.

⁴² <http://crossrail2.co.uk/>, accessed on 21st March 2018.

⁴³ <http://www.energylivenews.com/2017/06/27/uks-new-nuclear-builds-set-to-double-jobs/>, accessed on 21st March 2018.

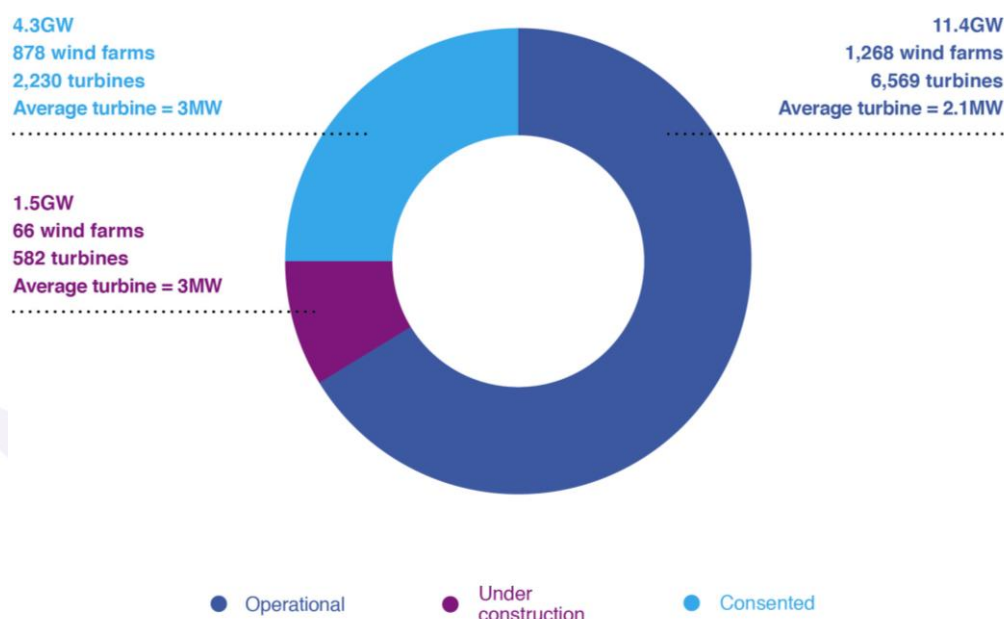
⁴⁴ <http://home.bt.com/tech-gadgets/tech-news/xxx-11364258123904>, accessed on 22nd March 2018.

⁴⁵ The Economic Case for a Tidal Lagoon Industry in the UK, Cebr / Tidal Lagoon Power Ltd, July 2014.

⁴⁶ <http://www.renewableuk.com/page/UKWEDhome>, accessed on 28th November 2017.

Unlike offshore wind, which is anticipated to grow much more rapidly, with new wind farms utilising a greater number of increasingly more powerful turbines, growth in onshore wind is expected to be much more moderate; with a plateau seemingly reached in terms of site size and individual turbine output.

Figure 14: Characteristics of the UK onshore wind project pipeline



Source: RenewableUK Wind Energy Database

Figure 15 below shows the levels of current and planned onshore wind capacity by nation.

Figure 15: Onshore wind generating capacity (MW) by nation

Region	Operational		Under construction		Consented		Total project pipeline	
	MW	%	MW	%	MW	%	MW	%
England	2,792	24.5%	64	4.3%	232	5.5%	3,088	18.0%
Northern Ireland	915	8.0%	137	9.2%	470	11.1%	1,521	8.9%
Scotland	6,782	59.4%	1,090	73.4%	3,202	75.3%	11,075	64.6%
Wales	930	8.1%	195	13.1%	347	8.1%	1,470	8.5%
UK	11,419	100.0%	1,486	100.0%	4,251	100.0%	17,154	100.0%

Source: RenewableUK Wind Energy Database

Scotland currently dominates the UK onshore wind industry with 6.8GW of installed capacity (accounting for 59.4% of current operational capacity). The current pipeline will grow Scotland's capacity to over 11GW (64.6% of UK onshore wind capacity).

There are currently 6,569 operational onshore wind turbines in the UK, with a further 582 currently being constructed. An additional 2,230 have been consented which, if they become a reality, will increase the number of UK onshore turbines to 9,381.

Figure 16: Onshore wind turbines by nation

Region	Operational		Under construction		Consented		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
England	1,720	26.2%	35	6.0%	220	9.9%	1,975	21.1%
Northern Ireland	554	8.4%	57	9.8%	500	22.4%	1,111	11.8%
Scotland	3,515	53.5%	394	67.7%	1,339	60.0%	5,248	55.9%
Wales	780	11.9%	96	16.5%	171	7.7%	1,047	11.2%
UK	6,569	100.0%	582	100.0%	2,230	100.0%	9,381	100.0%
Average capacity per turbine	2.1MW		3MW		3MW			

Source: RenewableUK Wind Energy Database.

The average size of onshore wind turbines is expected to increase slightly as we near the back-end of the current project pipeline, but is unlikely to increase much beyond 3MW during this period (when 3.6MW turbines will become the norm).

Onshore Wind Employment Opportunities

In 2016, an estimated 8,500 people were employed in the UK onshore wind industry⁴⁷. This figure is very close to the estimated forecast 8,000 in the 2013 report *Working for a Green Britain*⁴⁸.

In that same report, a scenario was presented which anticipated 17GW of onshore capacity by 2023 (matching exactly the project pipeline presented above in Figure 15).

The report goes on to predict that employment in onshore wind will go on to reach 9,000 by 2020/21, before falling back slightly to 8,600 by 2023.

⁴⁷ Low carbon and renewable energy economy final estimates (ONS), 31st January 2018.

⁴⁸ Working for a Green Britain and Northern Ireland 2013-23, RenewableUK and Energy & Utility Skills, September 2013.

**By 2023, onshore wind capacity will increase by 50%
and the number of turbines by 43% - employment
levels will remain stable**

So, while total onshore generating capacity is expected to increase by 50% and the number of operational turbines to increase by 43%, employment is expected to remain stable – increasing by just 6% by 2020/21 before falling back to current levels by 2023. This scenario, where additional capacity can be added to the system without any significant in employment levels, may be a precursor to what could happen in offshore wind – at the moment employment growth mirrors that of additional turbines (which is significantly less than growth in total generating capacity).

However, employment in each of the various stages of the project lifecycle could vary quite significantly. For example, in 2013, planning and development activities made up around 30% of total employment and construction and installation jobs a further 20%. However, by 2023, they will each account for about 10% of employment. This reflects the effect of the slowdown in new capacity being installed.

At the same time, the number of operation and maintenance jobs will rise as the requirement to service the additional capacity exceeds the efficiency effects. By 2023 employment in operation and maintenance activities could reach 2,800, up from just over a 1,000 at present.

This shift in the composition of jobs away from planning and other pre-operations activities and towards operations, maintenance and support also represents a shift away from short-term, contracted jobs and towards permanent employment.

So, while employment growth is expected to be minimal, and so does not represent any significant challenge to the offshore wind industry in terms of being a competitor for skilled talent, the base technical and business/ commercial skills are similar to those required for offshore.

5.5 Conclusions

Over the next four years, £240billion will be invested in refurbishing and expanding the UK's essential infrastructure. The largest investments will be made in transport (£78.5bn), energy (£57bn; including £18bn in offshore wind) and the utilities (£47.5bn). Looking further in the future, beyond 2021, £94bn is ear-marked for unspecified electricity generation programmes.

The demand for labour across the energy and infrastructure sectors is likely to be significant – totalling around 760,000 people by 2024 (including 160,000 new jobs and replacing 600,000 retirements).

The impact of this investment on the availability of skills to the offshore wind industry will be both direct and indirect:

- **Direct competition for skills** – many of the technical skills required throughout the project lifecycle of an offshore wind farm are equally applicable in other parts of the energy and infrastructure sector. For example, mechanical, electrical, C&I and civil engineers, plant operators, logistics, welders, cable jointers, quantity surveyors and a range of construction and marine skills
- **Indirect competition for skills** – in developing the workforce of the future, the offshore wind industry will be looking to attract many of the same high-quality new entrants to the labour market as demanded by many other sectors of the economy – both from a vocational and academic background

This clearly puts the 26,000 additional jobs in offshore wind by 2032 into the wider context, and while onshore wind is not expected to offer much in the way of competition for skilled talent, there are several individual projects around the UK which offshore wind employers and agencies should be mindful of as they could seriously impact on already-tight regional and local labour markets. For example:

- Thames Tideway Tunnel = 4,000 direct jobs (as well as 5,000 indirectly)⁴⁹.
- Crossrail 2 = 60,000 new jobs during construction and 200,000 jobs once operational⁵⁰.
- Hinkley Point C, Wylfa Newydd and Moorside nuclear sites = 50,000 jobs during construction and 3,000 jobs once operational⁵¹.
- BT Open Reach Infrastructure = 3,500 engineers⁵².
- Cardiff, Colwyn Bay, Newport, Swansea, Bridgewater Bay and West Cumbria tidal lagoons = 34,700 during the construction and 6,400 once operational⁵³.

⁴⁹ <https://www.tideway.london/news/media-centre/thousands-of-jobs-to-be-created-as-contractors-named-for-londons-super-sewer/>, accessed on 21st March 2018.

⁵⁰ <http://crossrail2.co.uk/>, accessed on 21st March 2018.

⁵¹ <http://www.energylivenews.com/2017/06/27/uks-new-nuclear-builds-set-to-double-jobs/>, accessed on 21st March 2018.

⁵² <http://home.bt.com/tech-gadgets/tech-news/xxx-11364258123904>, accessed on 22nd March 2018.

⁵³ The Economic Case for a Tidal Lagoon Industry in the UK, Cebr / Tidal Lagoon Power Ltd, July 2014.

The availability of new talent could be an issue given that the labour market is currently extremely tight (record high employment and low unemployment) and shows little sign of easing (it is estimated that the UK is already short of around 20,000 engineering graduates per year). This situation could be exacerbated by post-Brexit immigration policies.

It is expected that competition for high quality school leavers, Apprentices, Graduates and those already skilled is forecast to remain high. Therefore, increasing the size of the available labour pool and making the most of the talent the industry already has will be crucial – particularly in terms of attracting more females and those from a BAME background.

It will be important for those responsible for monitoring and addressing the needs of the offshore wind industry to regularly update assessments of the regional and local labour markets, including the scale and timing of other major infrastructure projects and the ability of the local labour markets to meet the associated skills demands. By communicating this intelligence to other agencies, including employers, the sector will be more able to respond in a proactive manner.

Furthermore, it will be essential that the offshore wind industry and its regional supply chains work together to ensure maximum access to the talent it needs – and to minimise the extent to which they compete for that talent. There is a particular onus on owner / operators and the OEMs to ensure that their recruitment and engagement activities, as well as procurement and other working practices, can also be leveraged to the benefit of their supply chain partners. If the offshore wind industry, throughout the entire supply chain, is to compete for talent against the rest of the energy and infrastructure sector, business as usual will not be the optimal approach.

6. Implications for Skills

Headlines

- To meet the needs of the whole sector, talent attraction and skills development needs to engage with all communities.
- Skills shortages are already affecting parts of the electricity sector, with 12 of the 13 electricity-related occupations currently listed on the UK's Shortage Occupation List being directly relevant to the offshore wind industry.
- Anecdotal evidence suggests that skills shortages are not having a detrimental effect on the development of the offshore wind industry at the moment and, where they do exist, are limited to specialist skillsets, locations or in the supply chain.
- Skills and qualification requirements differ between the various phases of the project lifecycle – ranging from Degrees in various engineering and environment-related disciplines to HNC and Apprenticeship programmes.
- Regional workforces along the east coast of the UK have strong Level 2 and 3 vocational skills, although they also have lower-than-average levels of higher-level qualifications (except Scotland). This could limit the extent to which the local workforce can provide the required higher-level skills.
- Take-up of energy-related Apprenticeships is on an upward trajectory – albeit with a slight reduction at the introduction of the Apprenticeship Levy.
- 62 separate Apprenticeship frameworks / standards have been identified as being potentially useful to offshore wind employers, although the availability of local training provision and trainees being able to meet the on-the-job requirements of the training can be an issue.
- Achievement of relevant degrees are slightly up over the past five years, though evidence still suggests a significant shortfall across engineering as a whole – with low numbers entering the energy sector
- There continues to be an issue with the progression of learners (particularly females) from GCSE, through A Levels and HE, into a STEM-related career.

6.1 The Demand for Skills

There are numerous types and levels of skills demanded by the offshore wind sector – from environmental surveys through to turbine maintenance – and the exact nature of the skills demanded vary significantly across the project lifecycle. The table below summarises sub-sectors that make up the offshore wind industry and the skills and qualification requirements of each.

Figure 17: Examples of skill requirements by project stage

Sub-Sector	General skills and qualification requirements
Development and project management <i>For consent applications, surveys and studies are needed to analyse environmental impacts and to inform early wind farm design. These include meteorological and oceanographic studies, wildlife surveys, geotechnical and geophysical surveys, port studies, visual studies, economic studies and onshore studies.</i> <i>The services are typically contracted to specialist onshore and offshore survey companies.</i>	Generally, these roles require degree-level qualifications in relevant disciplines such as environmental sciences, economics, engineering and project management. Graphic design skills are also required. Port studies: Degrees in environmental sciences, economics, engineering. Project management. Graphic design. Geotechnical and geophysical surveys: Degrees in environmental sciences. Master's degree in oceanography, hydrography and geophysics. Wildlife surveys: Degree or HND in biology, marine biology or environmental monitoring.
Turbine design and manufacture	Requiring a mix of skill levels. Ranging from degrees in mechanical engineering and physics to mid-range technical skills in welding, platers, electricians, fitters, etc. Apprenticeships, Higher Apprenticeships and HNC / HND being an important route into employment. Vocationally-achieved technical qualification in electrical and design engineering (achieved through an Apprenticeship of Higher Apprenticeship) – welders, platers, pipe fitters, electricians, mechanical fitter and riggers. HNC / HND in electrical engineering. Degree in mechanical engineering and physics. Research and development (R&D) and design requires degrees in subjects such as physics, electrical and mechanical engineering, and mathematics⁵⁴. Manufacturing and assembly requires craft persons and technicians.

⁵⁴ Your career in offshore wind energy, BCG Associates / RenewableUK, 2010.

Sub-Sector	General skills and qualification requirements
Balance of plant <i>Including foundations, the turbine tower and array cables that connect the turbines to each other and the offshore substation.</i> <i>Export cables connect the onshore and offshore substations.</i> <i>The onshore substation provides the interface between the wind farm and the onshore transmission grid.</i>	As well as high-level academic qualifications in naval architecture, marine engineering, mechanical engineering, high voltage design engineering and technicians, geophysics and environmental sciences, vocational and HNC / HND programmes also deliver the necessary technician-level skills. Construction and vessel-related training and certificates are also required. Turbine tower supply: Largely vocationally-achieved technical skills such as welding, plating, fabrication, and blasting (achieved through a relevant Apprenticeship). Degree in textile technologies or manufacturing production engineering. CSCS and NEBOSH accreditation. Foundation supply: Degree in civil, design, mechanical or fabrication engineering. Vocationally-achieved technical skills such as CAD. CSCS accreditation. Project management. Cable supply: HNC / HND in electrical engineering and degree in product design engineering (high voltage design and technicians). CPCS certification. Substation supply: Degree in product design engineering and electrical engineering. Project management. CIRS certification.

Sub-Sector	General skills and qualification requirements
Installation and commissioning <i>Foundation installation is undertaken using a jack-up vessel or a floating heavy lift vessel.</i> <i>Cables are installed using specialist cable vessels equipped with cable-handling equipment. The cables may be laid and buried in a single process using a cable plough or in two stages in which a first vessel lays the cable and a second vessel buries the laid cable using a remotely operated vehicle (ROV).</i> <i>Although the large cable manufacturers have their own vessels, the work is typically undertaken by specialist contractors. These contractors also work in oil and gas and telecomms.</i> <i>During the installation, the wind turbine manufacturer and main installation contractors complete the installation activities, while support services include unexploded ordnance (UXO) surveys and removal, the supply of guard vessels, oil-clean up services, the supply of fuel, waste disposal and insurance.</i>	Turbine and foundation installation: Degree in engineering, naval architecture and marine engineering. Vocational qualification in yacht and boatbuilding. Project management. CPCS certification. Cable installation: Degree in engineering or mechanical engineering. HNC / HND in technical engineering. Appropriate vocational qualification / experience (e.g. Apprenticeship). Project management. Installation support: Valid dive ticket. GWO module certificates. Explosive ordnance disposal qualification (ISSEE). Degree in geophysics and environmental science. Vessel (master, mate, deckhand) certifications. Maritime and Coastguard Agency (MCA) certification.

Sub-Sector	General skills and qualification requirements
Operations, maintenance and service <i>Operations activities provide support during the lifetime of the wind farm to ensure maximum energy production (typically 20 to 25 years). Operators generally look to use the nearest port that meets its specifications, which may not be the closest port to the wind farm.</i> <i>Operations include day-to-day workflow management and the use of systems to store and analyse data, such as supervisory control and data acquisition (SCADA) and condition monitoring systems (CMS). This allows the owners to respond to failures and, where possible, identify potential failures before they occur. Some owners use specialist contractors to provide this service, while others have developed in-house capability.</i>	<i>Activities are at, primarily, technician level. Relevant Apprenticeship programmes, HNC/ HND and specialist training courses (in high voltage work, working at heights, confined spaces and SCADA, amongst others) are demanded.</i> Turbine maintenance: IRATA Level 3 certification. Technology-specific training; high-voltage equipment handling, certification to undertake lifting, climbing and rope access training. Turbines are becoming much more electronic-based, needing a strong electrical / control and instrumentation skillset. Maintenance of the offshore substation: Largely specialist work with strong demand for technicians with high-voltage experience. HNC / HND in electrical or mechanical engineering. Onshore substation maintenance: Standard and specialist high voltage work. There may be challenges meeting the strong demand for technicians with high-voltage experience. Maintaining the turbine foundation: Specialist equipment skills. Valid diver ticket. IOSH. GWO certificates for offshore survival. Inspections of safety-critical devices including fall arrest systems, davit cranes, boat landing and ladders, external gates and railings and external evacuation equipment: It is likely that most owner / operators will seek to train up their own technicians. Supervisory control and data acquisition (SCADA) monitoring: 24/7 monitoring and occasional remote manual intervention, requiring several dedicated personnel per wind farm (data can also be analysed in-depth off site for condition monitoring purposes⁵⁵).

⁵⁵ A Guide to UK Offshore Wind Operations and Maintenance. Scottish Enterprise, 2013.

Sub-Sector	General skills and qualification requirements
Cross-cutting <i>During the life of an offshore wind farm there are many activities which support the owner, developer, turbine manufacturer and main contractors. These include unexploded ordnance (UXO) surveys and removal, the supply of guard vessels, oil-clean up services, the supply of fuel, waste disposal and insurance.</i> <i>Crew transfer vessels (CTVs) typically provide transport for technicians and spares from the onshore base to offshore wind farms. Some wind farms supplement CTVs with full-time helicopter support. Spare parts are stocked in onshore warehouses.</i> <i>Service operations vessels (SOVs) are larger and more capable than CTVs and are typically used for wind farms more than about 90 minutes transfer time from port. They are effectively a floating OMS base and accommodate between 60 and 90 passengers and contain workshops, equipment, consumables and spares.</i>	Activities are primarily linked to generic offshore requirements, including marine operations and logistics – at degree / higher technician level. Marine co-ordinator and ships agent: No specific technical knowledge or qualifications are required. Warehouse manager and operative: Degree in business, retail management or economics are desirable, as is Chartered Institute of Logistics and Transport Level 3 accreditation. Vessel operations and maintenance: Degrees in marine, electrical and mechanical engineering and/ or marine operations. Apprenticeships and subsequent upskilling can provide the broader technical know-how required to succeed. UXO (unexploded ordnance) diver: Qualifications in Explosive Ordnance Disposal (EOD), valid diver tickets and Global Wind Organisation (GWO) module certificates. EOD site manager and engineer: An advanced qualification in EOD is required. Typically gained through experience in the military or can through an International School for Security and Explosives Education (ISSEE) course. Vessel master: The master needs certifications in Standards of Training, Certification and Watch Keeping for Seafarers (STCW) to at least Master 200GT (STCW II/3), along with ENG 1 medical, STCW95 basic training and a radio communication certificate, for example Global Maritime Distress and Safety System (GMDSS) General Operators Certificate (GOC). The master must also complete a stability course, a Maritime and Coastguard Agency (MCA) Approved Engine Course (AEC) or Marine Engine Operator Licence (MEOL). Vessel mate and deckhand: The deckhand requires an ENG 1 medical and STCW95 basic training, alongside an MCA AEC or MEOL. Certification in STCW III/3 is desirable.

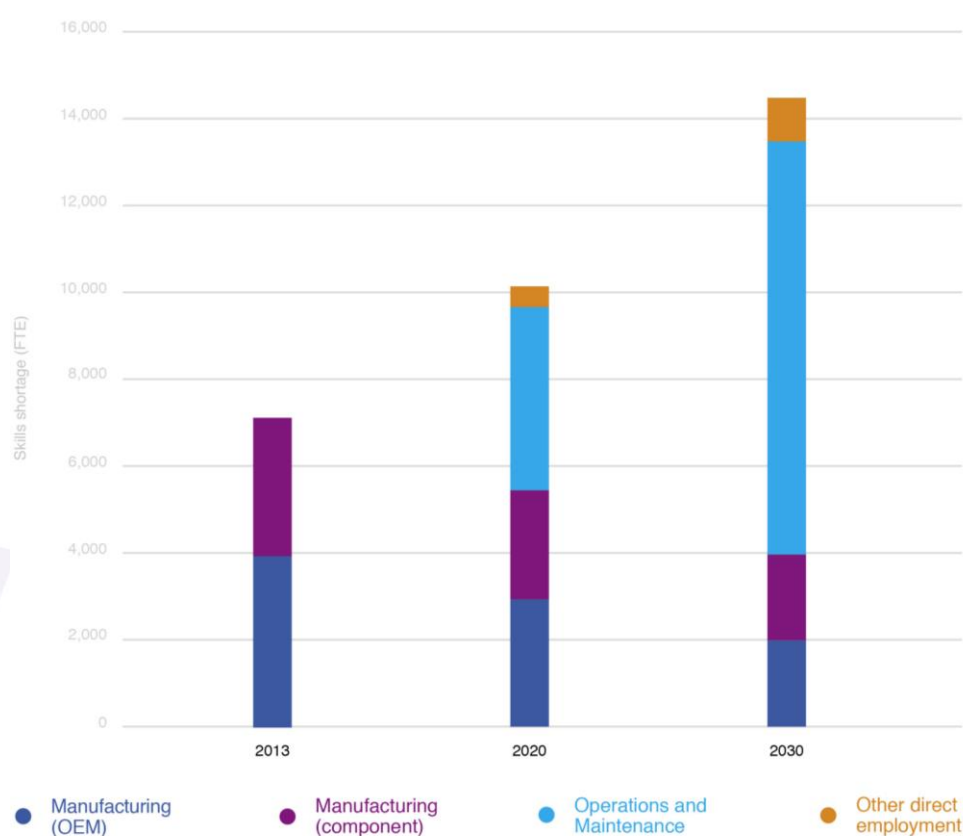
Source: Job Roles in Offshore Wind, BVG Associates/ Green Port Hull, 2017, unless otherwise stated.

Each phase and its associated workforce has a limited duration in relation to a specific wind farm. Once a wind farm becomes operational, it enters a 25-year phase of operation, maintenance and servicing, during which the site development, turbine design / manufacture and installation / commissioning activities largely become redundant (with the workforce moving onto the next project in the pipeline).

Therefore, as we move through to 2032, we will see a gradual increase in the O&M workforce as the level of operational generating capacity increases (accepting the previously stated caveats of labour efficiencies, impact of new technologies, etc.)

A potential impact of the shifting of the workforce towards O&M over the coming years could see skill issues becoming more prevalent. Research undertaken across the whole of the wind industry by the European Wind Energy Technology Platform⁵⁶ reports that, while skills gaps (where they exist) are currently focused in the component and OEM manufacturing sector, O&M skills gaps are predicted to take affect from 2020 and to become the principal skills gap in the industry by 2030.

Figure 18: Predicted extent of European skills shortages (2013 to 2030)



Source: European Wind Energy Technology Platform (2013)

⁵⁶ Workers wanted: The EU wind energy sector skills gap, European Wind Energy Technology Platform, August 2013.

Of course, over the coming years, additional, currently unknown, projects will enter the project pipeline – meaning that there is likely to be a continued need for the services, people and skills of the pre-O&M project phases for some years to come. As a result, we should expect to see:

1. Continued demand for degree-level qualifications (of various disciplines) to remain strong as the project pipeline continues to grow with new projects being added (to support the design, stakeholder engagement, consent application, procurement and project management activities)
2. Growth in the demand for technician-level skills (via Apprenticeships and HNCs/ HNDs) as the O&M workforce grows to support a larger number of turbines

Roles and Skills Crucial for Future Success

Skills shortages are often reported across the wider engineering and energy sector⁵⁷. however, anecdotal evidence collected for this study suggests that, at present, there are few signs that these are significant, wide-spread or hindering the development of the offshore wind industry – although attracting high-quality talent in certain parts of the supply chain can be difficult at times.

However, there are several skill areas that are reported as being critical to the future success of the offshore wind industry, including:

Figure 19: Skill areas identified as being important to the future success of the offshore wind industry

Skill area	Specific details
Asset management	- Specifically, environmental asset management - Compliance and engineering
Project management	Ability to handle contracts worth £100millions+
Leadership	- The ability to manage and organise teams - Developing the leaders of the future from the technical workforce (i.e. upskilling)
Engineers	- Across a range of relevant disciplines, including mechanical, electrical and control & instrumentation and high voltage - Including IT and associated network skills, enabling fault-finding through electronic means (e.g. assessing data on a laptop) rather than the more traditional, hands-on, mechanic approach.

⁵⁷ *Reviewing the requirements for high level STEM shortages*. UK Commission for Employment and Skills, in *National college for wind energy DEBATE PACK* Number CDP-2016/0197, Debate day 1 November 2016.

Skill area	Specific details
Scientists	Environmental and physical sciences – e.g. marine biology, geophysics, physics, environmental monitoring, oceanography.
Technicians	- Particularly relating to blade and turbine maintenance (this issue is not helped by a lack of common standards across technology manufacturers) - High voltage technicians
Health & safety	- Advanced first aid and rescue - The types of injuries that can occur, and the required first aid response, can often be similar to those seen in mountain rescue-type situations. - Safety rules and regulations – regularly updated/refreshed
Soft skills	Team working; team living, problem solving, etc.

Source: Employer interviews as part of this skills study

In addition, research undertaken by Energy & Utility Skills reports that shortages are reported in several areas across the power sector in general that will undoubtedly impact on the offshore wind industry; specifically:

Figure 20: Job roles reported as being in shortage in the wider UK electricity sector

Job roles		
Business and commercial	Maintenance technicians	Protection Engineer*
Customer service and stakeholder engagement	Marketing and communications	Site Manager*
Commercial capabilities	Planners	Substation electrical engineer*
Commissioning engineers*	Power System Engineer*	Substation fitters
Control Engineer*	Planning / development engineer*	Telecommunications and digitisation
Data analytics	Project Engineer*	Quality, health, safety and environment engineer*
Design Engineer*	Project Manager*	Quantity surveyors
Jointers (HV and LV)	Proposals Engineer*	

Source: Many Skills One Vision: Energy and Utilities Workforce Renewal and Skills Strategy: 2020, Energy & Utility Skills Limited, 2017 and UK Shortage Occupation List.

Note: Those job roles annotated with a * are currently on the UK's Shortage Occupation List (the other electricity-related job role on the list, but not relevant to offshore wind, is Overhead Linesworker).

The Focus of Innovation

Furthermore, and crucial for the offshore wind industry if it is to achieve its full potential, is the need to develop tomorrow's innovators⁵⁸, particularly in areas such as:

- **Training and technical standards** – industry is said to lack a consistent, standardised training requirement for the range of roles required. Opportunities exist for providers to shape this process and benefit from the outcome. This is particularly for the case of re-skilling personnel who are changing sectors (e.g. oil and gas, ex-forces, etc.)⁵⁹.
- **Vessels and logistics solutions** – reducing direct costs, increasing access and mitigating H&S and environmental risks (e.g. access systems (particularly as larger turbines and towers are installed), enhanced marine co-ordination software, personnel tracking systems and next generation workboats⁶⁰).
- **Subsea cables** – increasingly important as projects are constructed further afield and in more hostile environments and conditions⁶¹.
- **Transmission** – optimised / next generation transmission systems (e.g. high-voltage direct current (HVDC)) and improved, lower cost materials, cabling concepts, and installation techniques
- **Foundations** – novel foundation designs including both fixed and floating concepts for low-cost foundations, particularly for water depths of greater than 35m and to support larger turbines and development of serial manufacturing techniques for foundations
- **Turbine technology**⁶² – development of innovative materials and components for the next generation of larger capacity (up to 15MW), higher reliability turbines (including the design, materials and fabrication of longer blades, larger bearings, generators and drivetrain components).
- **Artificial intelligence and robotics** – Remote surveillance and inspection of offshore assets – both above and below the surface. There is significant potential for drones and remote operated vehicles (ROVs) to offer cost-effective and safe alternatives to human deployment in areas such as asset and environmental inspections (including non-destruction testing) both above and below the surface. Furthermore, the development of artificial intelligence within these technologies and other aspects of the network system can provide optimisation of asset performance. This appears to be an area of R&D that is now developing at pace:

⁵⁸ *Offshore Renewable Energy Science and Innovation Audit*. A Science and Innovation Audit Report sponsored by the Department for Business, Energy and Industrial Strategy. Undated. *Ibid*.

⁵⁹ *Offshore Wind Innovation*. Presentation given by Andy Kay, O&M Strategy Manager at the NOF Energy Event, Siemens Gamesa 01/11/2017

⁶⁰ *Ibid*.

⁶¹ *Ibid*.

⁶² *Offshore Renewable Energy Science and Innovation Audit*, Department for Business, Energy and Industrial Strategy, 2017.

- The Edinburgh Centre for Robotics recently won a £36m grant for research into offshore robotics.
- Furthermore, the recently published Artificial Intelligence Sector Deal⁶³ recognises the importance of these developments to the energy and, specifically, the offshore wind industry. It recommends investing £93m from the Industrial Strategy Challenge Fund into research and development of robotics and AI technologies for use in industries such as offshore and nuclear energy, space and deep mining. The aim being to support safer working practices for people in extreme environments and increase productivity.
- The British Standards Institute is currently developing BS ISO 21384, which will be the British standard for the specification and operation of unmanned aircraft systems (UAS). The public consultation period on the content of the standard is likely to be August / September 2018, with the final standard due for publication in mid-2019⁶⁴.
- **Data analytics** – there is huge potential to harvest asset performance data and to use that to optimise system performance, monitor and plan the replacement of failing equipment and improve the general management of assets.

6.2 The Supply of Skills

The evidence that skills shortages are affecting the offshore wind industry are mixed – while skills survey data suggests skills shortages are a serious issue right across the energy and infrastructure sectors, feedback direct from employers for this study suggests the situation is somewhat less urgent, with challenges, where they exist, being related to specific aspects/ niche skills and in various points in the supply chain.

This section looks at the supply of skills in the UK labour market and the extent to which these may be sufficient to meet future demands.

6.2.1 Regional Labour Markets

Section 5.1 above highlighted the state of the UK labour market towards the end of 2017 and provided evidence of:

- The tightest labour market for over 40 years
- Continued intense competition for talent
- Supply of talent struggling to meet current demand
- Changing population demographics
- Adapting to an uncertain future

⁶³ Industrial Strategy: Artificial Intelligence Sector Deal, HM Government, 2018.

⁶⁴ <https://standardsdevelopment.bsigroup.com/committees/50259034#in-progress>, accessed on 27th April 2018.

In terms of unemployment, regional variations go from a low of 3.3% in London to a high of 5.0% in North West, East Midlands and East of England – compared to a UK rate of 4.3%.

Figure 21: Unemployment rate for people aged 16+ by region of the UK

Region	Unemployment rate
North East	4.1%
North West	5.0%
Yorkshire & Humber	4.1%
East Midlands	5.0%
West Midlands	4.1%
East of England	5.0%
London	3.3%
South East	3.7%
South West	4.1%
Northern Ireland	3.2%
Scotland	4.3%
Wales	4.8%
UK	4.3%

Source: Quarterly Labour Force Survey, November 2017-January 2018, ONS.

Conversely, over the past year, the regions with the largest increases in the *employment rate* were the North East, East of England and London, all increasing by 1.3 percentage points, followed by Yorkshire and The Humber which grew by 1.1 percentage points.

Across the UK, 8.4% of people aged 16+ had no qualifications, while 15.4% had a Level 2 qualification, 3.7% had a Trade Apprenticeship and 16.8% had a level 3 qualification.

In total, 35.9% of the UK labour force held a qualification that was equivalent to a level 2 or 3. These qualification levels form the backbone of much of the offshore wind industry (and energy sector as a whole). An additional 38.1% held a level 4+ qualification (i.e. HNC / Diploma or higher).

Figure 22: Highest qualification held by resident population (16+)

Region	Level 4+	Level 3	Trade App'ships	Level 2	Below Level 2	Other qual	No qual
North East	31.1%	18.3%	5.0%	17.8%	10.6%	6.8%	10.5%
North West	34.2%	17.5%	4.6%	17.2%	11.2%	6.2%	9.1%
Yorkshire & Humber	33.0%	17.1%	3.8%	16.8%	12.7%	6.8%	9.8%
East Midlands	32.4%	17.6%	4.3%	16.5%	11.9%	8.2%	9.0%
West Midlands	32.0%	18.2%	3.1%	16.9%	11.6%	8.6%	9.7%
East of England	34.4%	17.5%	3.8%	17.4%	12.9%	6.1%	7.9%
London	50.9%	13.6%	1.4%	10.3%	7.2%	9.8%	6.9%
South East	41.5%	17.6%	3.4%	15.7%	10.5%	5.6%	5.6%
South West	38.6%	18.8%	4.2%	15.7%	11.8%	5.0%	6.0%
Northern Ireland	31.0%	15.9%	5.2%	16.4%	9.5%	4.6%	17.4%
Scotland	42.9%	14.4%	5.3%	12.8%	8.9%	6.2%	9.6%
Wales	34.5%	17.7%	3.8%	16.6%	11.0%	6.1%	10.2%
UK	38.1%	16.8%	3.7%	15.4%	10.7%	6.9%	8.4%

Source: Quarterly Labour Force Survey, October-December 2017, ONS.

The regions with a high potential for growth in the offshore wind industry – East of England, North East and Yorkshire & Humber – all have a high proportion of Level 2, Trade Apprenticeships and Level 3 qualifications, although a lower than average proportion of Level 4+ qualifications.

In Scotland, another area with high offshore wind potential, the reverse situation exists – with a lower than average proportion of Level 2-3 qualifications and a higher than average proportion of Level 4+ qualifications.

The availability of higher-level talent in regions of offshore growth could be an issue

While it is not possible to assess in which subjects these qualifications are held, it does appear that the resident population in key offshore regions have strong levels of vocational / technical-level skills, which are crucial to many aspects of the offshore wind industry and wider energy sector.

However, it may also be the case that the three English regions with high offshore wind potential suffer from a lack of higher-level qualifications in the resident population. This may potentially limit the extent to which that local workforce can provide the higher-level skills required for the continued development of the offshore wind industry.

6.2.2 Apprenticeships

The take-up of power industry Apprenticeships (Modern Apprenticeships in Scotland) has varied a lot over the last six years – although generally on an upward trajectory.

However, over the past year, since the introduction of the Apprenticeship Levy, the number of Apprenticeship starts has decreased slightly. This is largely due to many employers still getting to grips with the implications of the levy on their talent strategies and is expected to be a short-term situation.

The longer-term impact of the levy on employers' talent strategies is, of course, yet to be seen. Employers interviewed as part of this study varied in their opinions as to whether the levy made / will make any real difference to their Apprenticeship numbers (they take on as many as they need already) – with some treating it as a tax.

There were also signs that some employers were making attempts to maximise their use of the levy by using it to upskill existing employees.

Figure 23 below reports the number of starts on appropriate engineering-related Apprenticeship frameworks and standards over the last six years.

Figure 23: Number of starts on relevant Apprenticeship frameworks and standards – 2011 / 12 to 2016 / 17 (England only)

Apprenticeship	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Framework - Electrotechnical	4,980	5,080	4,610	5,740	5,870	4,580
Framework - Engineering Construction	480	460	490	460	410	240
Framework - Engineering Environmental Technologies	0	0	10	0	0	0
Framework - Engineering Technology	120	210	260	290	340	380
Framework - Power Industry	200	370	270	110	70	20
Standard - Control / Technical Support Engineer	0	0	0	0	0	10
Standard - Electrical / Electronic Technical Support Engineer	0	0	0	0	0	80
Standard - Engineering Technician	0	0	0	0	0	560
Standard - Maintenance and Operations Engineering Technician <i>(including Wind Turbine Technician)</i>	0	0	0	0	0	30
Standard - Network Engineer	0	0	0	50	200	350
Standard - Power Network Craftsperson	0	0	0	20	410	200
Standard - Utilities Engineering Technician	0	0	0	0	50	60
Total	5,780	6,120	5,640	6,670	7,350	6,510

Source: Department for Education, FE data library: Apprenticeships, accessed from <https://www.gov.uk/government/statistical-data-sets/fe-data-library-apprenticeships>.

The Maintenance and Operations Engineering Technician Apprenticeship Standard was only introduced in 2016/17 and, clearly, is still to make an impact. Given the likely employment demand for turbine technicians over the coming years, take-up of this Standard should be monitored closely.

Overall, there are approximately 62 separate Apprenticeship frameworks/ standards which are potentially relevant to the offshore wind industry – these are listed in full in Annex 4.

Clearly, there is potential for employers to make more use of all the available Apprenticeships frameworks and standards. In addition to those listed above in Figure 23 above, there are Apprenticeship frameworks and standards in civil engineering, engineering manufacture and construction, logistics, management/ team leader, maritime, marine, warehousing and supply chain management – and as these are available from Level 2 up to Level 7, there is clear potential to utilise the levy for upskilling across much of the workforce.

How the offshore wind industry interacts and engages with the Apprenticeship landscape is worthy of further investigation – not least in the following areas:

- How well is the full range of Apprenticeship frameworks and standards promoted and understood by employers across the industry's supply chain?
 - Not just in wind power, engineering, etc., but also in logistics, steel fixers, vessels, supply chain management, etc.
- The Apprenticeship landscape is shifting away from “frameworks” and towards “standards”. Frameworks which are in use and valued by employers are being transitioned into Standards – those that are not will, at some point in the not-too-distant future, be terminated.
- How companies are approaching the Apprenticeship Levy (i.e. the extent to which it influences their skills development strategies)
- Whether the Apprenticeship Levy Transfer Policy could be better promoted and utilised to maximum effect for the industry and its supply chain
- The availability of training provision where it is required most. For example, there are no providers of Wind Turbine Apprenticeship training in the East Anglia area and there are no training providers within 50 miles of Hull for 23 of the 62 identified Apprenticeship frameworks / standards
 - It appears that an important factor here is the perceived / actual lack of demand for such Apprenticeship training from industry, resulting in providers being unwilling / unable to develop such provision.
- Trainees being unable to gain the required on-the-job experience when access to offshore sites (i) cannot being gained while under 18 years of age and (ii) can be costly given that “down-time” of a site can be very expensive and, therefore, is kept to a minimum (meaning that training on-site can be a significant hidden cost).
- The administrative, coaching, mentoring and pastoral burden on small teams while offshore can be prohibitive.

6.2.3 Higher Education

9,185 Honours Degrees⁶⁵ were awarded from UK Higher Education Institutions (HEIs)⁶⁶ in subjects relevant to the offshore wind industry in 2015/16 (Annex 2 contains a full listing of the individual subjects than are contained within the broad headings used in Figure 24 below). This is an increase of 625 over 2011/12 achievement levels.

3,230 of these were in Mechanical Engineering, 2,060 in Civil Engineering and 1,930 were in Electronic & Electrical Engineering. 1,030 Degrees were achieved in Environmental Sciences.

Figure 24: Number of offshore wind-related Honours degrees achieved – 2011/12 to 2015/16

Broad subject area	2011/12	2015/16	Variance
Civil	2,290	2,060	-230
Design	80	80	0
Electronic & electrical	1,925	1,930	+5
Environmental sciences	1,170	1,030	-140
Marine	255	265	+10
Mechanical	2,230	3,230	+1,000
Naval	35	35	0
Production/ manufacturing engineering	475	480	+5
Structural	95	65	-30
Total	8,560	9,185	+625
Entering employment in energy sector	210	125	-85

Source: HESA Destinations of Leavers Survey and Student Record, 2011/12 and 2015/16

Note: The totals may not equal the sum of the subjects due to rounding.

Although the overall number of relevant degrees achieved increased in the period between 2011 / 12 and 2015 / 16, there were substantial differences by subject area – the number of Mechanical Engineering degrees increased by 1,000, while achievements in all other broad subject areas either remained stable or decreased.

**Growth in mechanical engineering graduates has not
been matched in other required disciplines**

Figure 25 shows the break-down of 2015 / 16 achievements by region and gender.

⁶⁵ Excluding Ordinary Degrees and unclassified results.

⁶⁶ HESA Destinations of Leavers Survey and Student Record 2015/16, HESA.

Figure 25: Number of Honours degrees achieved within offshore wind-related subjects by region (2015 / 16)

Broad subject area	East Mids	East of Eng	London	North East	North West	South East	South West	West Mids	Y&H	NI	Scotland	Wales	UK	Female proportion
Civil	220	15	360	135	205	145	160	130	165	75	345	100	2,060	15.0%
Design	10	0	5	0	6	0	45	5	0	10	0	0	80	19.5%
Electronic & Electrical	180	30	235	140	165	180	135	240	230	60	205	130	1,930	8.5%
Environmental Sciences	45	75	65	25	115	200	200	10	95	40	110	40	1,030	42.4%
Marine	0	20	0	5	*	130	0	0	10	15	20	70	265	47.9%
Mechanical	360	45	345	280	310	305	270	295	380	110	350	180	3,230	9.1%
Naval	0	0	0	0	0	*	0	0	0	0	35	0	35	13.8%
Production / Manufacturing Engineering	125	*	10	10	20	50	55	35	45	10	90	35	480	21.0%
Structural	0	0	*	0	*	0	0	5	30	10	20	0	65	25.3%
Total	940	185	1,020	595	830	1,010	865	730	955	325	1,175	550	9,185	16.0%

Source: HESA Destinations of Leavers Survey and Student Record, 2015 / 16

Note: Numbers are rounded to the nearest 5.

* Denotes fewer than 5.

The totals may not equal the sum of the subjects due to rounding.

16% of these graduates (1,470) were females, with high representations in Marine (47.9%) and Environmental Sciences (42.4%). Electronic & Electrical (8.5%) and Mechanical (9.1%) contained the lowest proportion of female graduates.

Across the regions of the UK, Scotland produced the most Honours Degrees in 2015 / 16 (1,175), closely followed by London (1,020) and the South East (1,010).

In the other regions where there is a strong offshore wind presence:

- Yorkshire & Humber (955)
- East Midlands (940)
- North East (595)
- East of England (185)

The stand out figure here is the number of relevant degrees being achieved in the East of England region. This region has the potential to contain the highest level of offshore capacity of any region of the UK by 2032 (8.5GW; 24% of all UK capacity) and yet just 185 relevant degrees were achieved in the region in 2015 / 16 (70 (38%) of which were in Environmental Sciences).

Figure 26 below shows the top three institutions in terms of the number of degrees achieved in each broad subject area in 2015 / 16. It also highlights the rank and number of degrees achieved within the universities of Durham, Hull and Sheffield specifically.

Figure 26: Regions and institutions achieving the highest number of offshore-relevant Honours Degrees (2015 / 16)

Broad subject area	Degrees in 2015 / 16	Principal regions	Institutions ranked by degrees achieved
Total	9,185	Scotland (1,180) London (1,020) South East (1,010)	1 st (out of 105) – Loughborough University (355) 2 nd – University of Strathclyde (345) 3 rd – University of Plymouth (280) 8 th – University of Sheffield (210) 61 st – University of Hull (60) 94 th – University of Durham (10)
Civil	2,060	London (360) Scotland (344)	1 st (out of 56) – Newcastle University (85) 2 nd – The Nottingham Trent University (75) 3 rd – Kingston University (70) 8 th – University of Sheffield (60) N/A – University of Durham (0) N/A – University of Hull (0)

Broad subject area	Degrees in 2015 / 16	Principal regions	Institutions ranked by degrees achieved
Design	80	South West (46)	=1 st (out of 9) – Bournemouth University (25) =1 st – The University of Bristol (25) 3 rd – Queen's University Belfast (10) N/A – University of Durham (0) N/A – University of Hull (0) N/A – University of Sheffield (0)
Electronic & Electrical	1,930	West Midlands (241) London (235) Yorkshire & Humber (232)	1 st (out of 78) – Birmingham City University (114) 2 nd – Loughborough University (79) 3 rd – The University of York (71) 36 th – University of Sheffield (20) 61 st – University of Hull (10) N/A – University of Durham (0)
Environmental sciences	1,030	South East (201) South West (201) North West (117)	1 st (out of 52) – University of Plymouth (134) 2 nd – The Open University (106) ⁶⁷ 3 rd – The University of East Anglia (70) 29 th – University of Durham (10) 38 th – University of Sheffield (10) 43 rd – University of Hull (5)
Marine	265	South West (130) Wales (68)	1 st (out of 16) – The University of Southampton (85) 2 nd – Bangor University (50) 3 rd – The University of Portsmouth (45) 7 th – University of Hull (10) N/A – University of Durham (0) N/A – University of Sheffield (0)
Mechanical	3,230	Yorkshire & Humber (382) East Midlands (361) Scotland (352)	1 st (out of 73) – University of Northumbria (145) 2 nd – Sheffield Hallam University (130) 3 rd – The University of Sheffield (115) 39 th – University of Hull (35) N/A – University of Durham (0)
Naval	35	Scotland (35) South East (*)	1 st (out of 2) – The University of Strathclyde (35) 2 nd – The University of Kent (*) N/A – The University of Sheffield (0) N/A – University of Hull (0)

⁶⁷ Included in South West figures.

Broad subject area	Degrees in 2015 / 16	Principal regions	Institutions ranked by degrees achieved
			N/A – University of Durham (0)
Production / Manufacturing Engineering	480	East Midlands (123) Scotland (90)	1 st (out of 30) – Loughborough University (105) 2 nd – The University of Strathclyde (80) 3 rd – University of Plymouth (25) N/A – The University of Sheffield (0) N/A – University of Hull (0) N/A – University of Durham (0)
Structural	65	Yorkshire & Humber (28) Scotland (20)	1 st (out of 8) – The University of Leeds (25) 2 nd – Heriot-Watt University (15) 3 rd – Queen's University of Belfast (10) 5 th – The University of Sheffield (5) N/A – University of Hull (0) N/A – University of Durham (0)

Source: HESA Destinations of Leavers Survey and Student Record, 2015 / 16

Note: * Denotes fewer than 5.

Of the 9,185 graduates, just 1.4% (125) were recorded as being employed in the UK energy sector (including electricity, oil and gas production, transmission and distribution) six months after graduation – down from 2.5% (210) in 2011 / 12.

*Figure 27: Number of Honours Degree graduates that enter employment in the wider energy sector (2015/16)*⁶⁸

Broad subject area	UK	Employed in energy sector
Civil	2,060	5
Design	80	*
Electronic & Electrical	1,930	55
Environmental sciences	1,030	10
Marine	265	0
Mechanical	3,230	60
Naval	35	0
Production / Manufacturing Engineering	480	0
Structural	65	0
Total	9,185	125
Entering employment in energy sector	125	1.4%

Source: HESA Destinations of Leavers Survey and Student Record, 2015 / 16

Note: * Denotes fewer than 5. The totals may not equal the sum of the subjects due to rounding.

⁶⁸ Energy sector includes electricity, oil and gas production, transmission and distribution, both onshore and offshore.

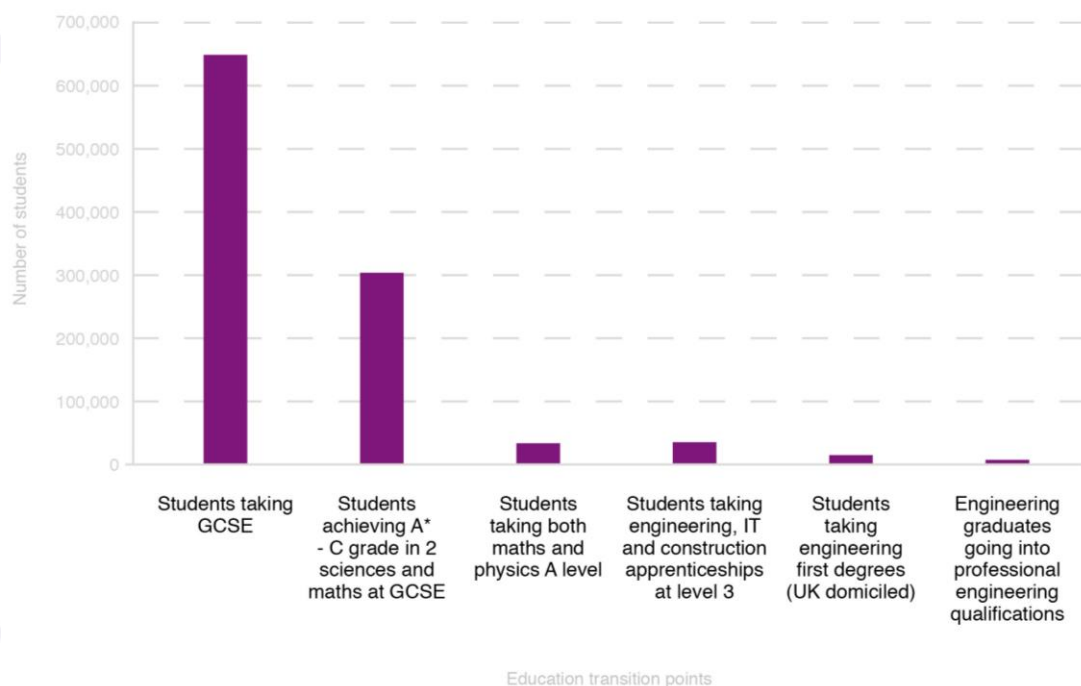
It is difficult to say whether this situation is caused by a lack of demand / ambition on the part of employers (i.e. employer demand was satisfied) or because the graduates choose other sectors on the basis of perceived improved rewards and / or working conditions / practices (leaving employer demands unsatisfied).

6.2.4 STEM Progress from School to HE

As we have seen, there are numerous pieces of evidence which points to a dearth of talent leading to shortages in STEM skills in the UK labour market.

Figure 28 below, we can see the progress from GCSE through to employment in the engineering sector.

Figure 28: Key transition points for young people across various stages of education towards engineering



Source: EngineeringUK, *The State of Engineering*, 2015.

There appear to be two significant transition points which affect the volume of STEM skills entering the labour market:

1. The proportion of GCSE entrants achieving A*-C grades in two sciences and maths (the most important thing for craft career is good GCSEs in science and maths⁶⁹) compared to the number of total GCSE entrants

⁶⁹ Your career in offshore wind energy, BCG Associates / RenewableUK, 2010.

2. The proportion of students that then continue their studies / learning into A Levels or Apprenticeships

There is evidence that more positive attitudes towards STEM careers are having an impact, but still too few young people are deciding to continue to study the subjects that keep the doors to engineering careers open. This limits the number who ultimately will be able to enter highly-skilled engineering careers⁷⁰.

There is much research and debate about the current value and extent of careers information, advice and guidance in schools, with the majority of employers spoken to as part of this research highlighting this as a critical factor in ensuring a sustainable workforce.

It is encouraging that The Department for Education has announced the forthcoming publication of a careers strategy that will develop the government's aims for careers guidance to 2020, including potential legislation to require schools to ensure non-academic routes receive "equal airtime" with academic routes in schools' career advice.

This is a crucial step as a significant minority of 15 and 16-year-olds have experienced little or no careers support during secondary school⁷¹ following the 2011 Education Act which removed the statutory duty of local authorities in England to provide careers information, advice and guidance to young people, placing that duty instead on individual schools and colleges.

Where careers support was supplied, the Royal Academy of Engineering⁷² report that most took place in schools and is delivered by specialist STEM organisations to a core audience of 11– to 14-year-olds, consisting mainly of "Talks and presentations", followed by hands-on and extra-curricular activities. However, they also report that it is unclear whether the efficacy of these single-activity ("transactional") interventions is suitable compared with longer-term, sustained interventions in terms of increasing attainment and progression.

Promotion of the industry within schools needs an industry-wide approach – which encapsulates the supply chain as well as operators and OEMs

⁷⁰ EngineeringUK, The State of Engineering, 2017.

⁷¹ EngineeringUK, The State of Engineering, 2017.

⁷² Royal Academy of Engineering: The UK STEM education landscape, May 2016

While it is recognised that many of the larger employers in the offshore wind industry do regularly engage with education institutions and promote the opportunities available within the industry, evidence from smaller companies within the supply chain does suggest that this is a far more difficult task for them to achieve – not least in terms of having the resources, time and expertise to engage properly and constructively with the audience on a regular basis.

Furthermore, many supply chain SMEs do not have the “employer brand” to gain access to schools in order to talk about potential career and Apprenticeship opportunities within their organisation (especially in locations dominated by the larger offshore wind employers).

Many supply chain SMEs do not have the resources or the “employer brand” to engage with schools

Too many pupils disengage with STEM through failure to see its relevance to their current life and future directions and underlined “the need for improved careers guidance and employer engagement and better articulation of the many pathways open to young people after school.”

There is an urgent need for better coordination of employer engagement in education, so that all pupils can benefit. Provision is full of overlaps and gaps, with many schools and employers confused as to what opportunities are available and how best to engage.

Women Studying STEM Subjects

At GCSE level, girls represent 50% of entries across science and maths and continue to outperform boys, with 66% of girls achieving A*-C / 9-4 grades compared to 62% of boys – and this remains true across all STEM subjects⁷³.

Across all GCSE STEM subjects, girls represent 50% of entries and outperform boys in exams

- In Construction, 100% of girls achieved A*-C grades (vs. 76% of boys)
- In Additional Maths 96% of girls achieved 9-4 grades (vs. 94% of boys)
- In Physics, 91% of girls achieved A*-C grades (vs. 90.5% of boys)
- In Statistics, 73% of girls achieved A*-C grades (vs. 69% of boys)

⁷³ <https://www.wisecampaign.org.uk/resources/2017/08/analysis-of-gcse-stem-entries-and-results>, accessed on 27th March 2018.

- In Biology and Chemistry, 91% of girls achieved A*-C grades (vs. 89% and 88% of boys respectively).
- In Computing, 66% of girls achieved A*-C grades (vs. 60% of boys)
- In Design & Tech, 73% of girls achieved A*-C (vs. 54% of boys)
- In Additional Science, 62% of girls achieved A*-C grades (vs. 55% of boys)
- In Engineering, 66% of girls achieved A*-C grades (vs. 42% of boys)
- In ICT, 72% of girls achieved A*-C grades (vs. 64% of boys)
- In Science, 51% of girls achieved A*-C (vs. 45% of boys)
- In Other Technologies, 55.6% of girls achieved A*-C (vs. 52.7%)

Despite this initial interest and exam success, there is a huge drop-off in the number of girls studying core STEM subjects post-16, with just 35% of girls choose maths, physics, computing or a technical vocational qualification compared to 94% of boys. Both proportions represent an increase on the previous year – in the case of boys it is 14 percentage points higher, while for girls it just 1 percentage point higher (largely driven by higher take-up of technical vocational qualifications.)

This reduces the number going on to do a degree or level 4 qualification in maths, physics, computer science or engineering – 9% of girls (up from 7% in 2016) compared to 29% of boys. Furthermore, more than 90% of STEM Apprenticeship achievers are male⁷⁴.

Progression of females through the STEM education system is still a challenge that needs addressing

As a result, there are approximately 50,000 fewer girls than boys leaving the UK education system with relevant qualifications to take up jobs in technology and engineering.

The reasons behind why females do not appear to progress into STEM-related careers are complex and cannot be done justice within the context of this report. However, while there are undoubtedly “push” factors away from STEM careers (e.g. lack of career information, perception of it being a “male” / masculine industry, an “I can’t do it” mentality, etc.) there are also “pull” factors towards other careers (i.e. they prefer / actively choose other sectors).

Therefore, the key to achieving a higher proportion of females in STEM sectors, including offshore wind, will be in tackling these two issues – providing clear visibility of the career opportunities in the sector in a way that is female-friendly.

⁷⁴ <https://www.wisecampaign.org.uk/resources/2017/11/from-classroom-to-boardroom-the-stem-pipeline-2017>, accessed on 27th March 2018.

The relative attractiveness of the power sector to both females and those from a BAME background is an on-going issue – with the majority of the energy sector workforce being white (94%) and male (76%)⁷⁵.

Potential UK Shortfall of STEM Graduates

EngineeringUK⁷⁶ has modelled the supply of entrants to engineering enterprises across the UK economy with Level 4+ skills through higher education and higher-level Apprenticeships. They project that there will be around 41,000 entrants of UK nationality annually, with graduates from the EU and other nations potentially adding a further 40,000. This would give a total supply of workers with higher level skills of just over 81,000 (this projection assumes that similar numbers of international students will continue to study in the UK and continue to be eligible to work in engineering in the UK post-Brexit). This leaves a projected short-fall of around 20,000 engineering graduates per year.

The UK is short of 20,000 engineering graduates per year

It is a similar situation across Europe. In the wind energy sector specifically, a shortfall of 7,000 qualified personnel was reported in Europe in 2013⁷⁷, and it was concluded that this could rise to 15,000 by 2030 if the number of STEM graduates entering the profession remains at the current rate.

There is also an urgent requirement to increase the supply of skills needed for the development of artificial intelligence and robotics. There are several measures stated in the Artificial Intelligence Sector Deal, including the introduction of T levels, which are aimed at this specific issue.⁷⁸

Overall, there are two issues that need concerted efforts to address:

1. Increasing the number of people entering STEM-related academic (and vocational) provision, including the full range of engineering disciplines (particularly electrical / electronic engineering)
2. Increasing the number of graduates entering employment in technical / engineering roles within the energy sector (addressing both supply-side (i.e. the number of available graduates) and demand-side issues (i.e. stimulating employer demand for graduates.)

⁷⁵ ONS (2016), Labour Force Survey, January-December 2016.

⁷⁶ Engineering UK 2017: The state of engineering, EngineeringUK, 2017.

⁷⁷ Wind Platform, Workers wanted: the EU wind energy sector skills gap, August 2013, p 12 in *National college for wind energy DEBATE PACK* Number CDP-2016/0197, Debate day 1 November 2016

⁷⁸ Industrial Strategy: Artificial Intelligence Sector Deal, HM Government, 2018.

6.2.5 Transferable Skills from Other Sectors

The skills required within the offshore wind sector (e.g. engineering, system design, control systems, robotics and artificial intelligence, high-voltage working, offshore working experience, etc.) are similar to those existing within other sectors, particularly in areas such as onshore electricity generation, transmission and distribution, general manufacturing and the offshore oil and gas sector.

The UK oil and gas sector has shed many jobs over the past four years – from a high of 460,000 in 2014 down to around 300,000 in 2017⁷⁹. Despite the recent price rise of oil, employment continued to decline as late as the first half of 2017. This workforce includes many high skilled roles, including subsea, geoscientists, technicians and craftspeople, mariners, divers and transfer vessel roles. Crucially, they often combine these technical skills with the required behavioural skills.

However, since January 2016, the price of crude oil has steadily increased from a low of \$30 up to \$61 in March 2018. If this trend were to continue – albeit it is still some way off the highs of 2010 to 2014 – it could signal the end of job shedding in the sector.

As this sector is close in terms of both geography and skillset, it is worth monitoring employment trends and how the offshore wind sector might either benefit from continued job losses or react if employment levels begin to increase.

Also, over 14,000 ex-Military personnel leave the Armed Forces each year, many of them being engineers and technicians having worked with some of the world's most advanced defence systems, with specialisms in aeronautical, avionics, electrical, mechanical, nuclear, communications and marine engineering. They also possess excellent soft / transferable skills that the energy sector finds desirable, including

- Communication skills practised with internal and external stakeholders
- Organisational skills
- Leadership & management skills
- High degree of professionalism
- Problem solving
- Health & Safety, Security awareness and best practice
- Team working
- Offshore-relevant behavioural skills

⁷⁹ Workforce Report 2017, Oil & Gas UK, 2017.

Overall, it is likely that the main entry routes into the industry are, and will continue to be:

- I. Movers from other, technically-related, industries (including ex-forces and those from other aspects of the wider energy sector – both onshore and offshore)
- II. Apprenticeships and graduates (providing a “base load” of new talent for the next generation)
- III. Movers with cross-sector skills (e.g. business / commercial, IT and data analytics, drone / ROV operators, etc.)

6.3 Barriers to Talent Acquisition

The industry has the following barriers when it comes to skills development:

- Uncertainty and lack of long-term visibility of projects
 - This is a major inhibitor of workforce planning and in engaging with longer-term skills development. The industry is often characterised by short procurement lead-in times (often 2-3 months) which make it especially difficult for the supply chain to predict, recruit and develop its workforce.
 - It is recognised that proactive recruitment, training and up-skilling is a very difficult “chicken and egg” balancing act in a developing industry:
 - Employers are reluctant to commit to recruitment and longer-term training initiatives (e.g. Apprenticeships) until they have certainty of need
 - Student take-up of relevant qualifications may not occur fully until they see employer demand / career opportunities
 - Education institutions may be reluctant to on appropriate provision until they see student / employer demand
 - When employers do identify a need for labour, they generally need it within a short timeframe
 - This limits long-term skills investment (although there is some evidence of individual owner / operators deliberately investing in skills (e.g. through Apprenticeships) on a larger scale than they need in order to “feed the supply chain”).
- Apprenticeships
 - The availability of local, relevant Apprenticeship training can be limited where there is an actual or perceived lack of industry demand for such provision (e.g. wind turbine Apprenticeship training in East Anglia).
 - It can be very difficult for Apprentices to gain the necessary on-the-job experience given that access time to offshore assets is extremely limited. As down-time of a turbine can be very expensive, companies are unwilling to undertake training and development activities during site visits.

- Diversity and inclusion
 - Poor sector attractiveness and ability of employers to recruit from non-traditional aspects of the community (i.e. females and BAMEs)
 - A lack of females looking to progress with their STEM studies and, ultimately, seek employment in the offshore wind industry
- While there is rapid technological advancement, it is counterbalanced by a lack of standardisation in materials, manufacturing processes and technical standards, which is being driven by a lack of co-ordination across different areas of OSW.
 - As a result, there is a common view across the industry that turbine training is controlled by the OEMs, that it is generally expensive and availability very limited.
 - Therefore, there is a strong need for common industry-wide technical and operational standards, facilitating workforce mobility across technology platforms and, therefore, reducing (re)training costs and easing workforce mobility.
 - This is affecting supply chains, reducing capacity optimisation and attempts to drive down costs across the OSW lifecycle.
- Existing training and education programmes can provide some of the expertise needed for future industry growth, but they do not currently meet the overall role, talent and expertise requirements of the industry now and over the next 15-20 years.
 - The UK's lack of a national strategy for skills means that education provision remains fragmented and un-coordinated save for some regional activities and individual employer-skills provider links.
 - There is a clear need for co-ordinated action on skills provision for the offshore energy industry. As part of the UK's industrial strategy, the offshore wind industry offers an opportunity to align national skills development requirements with local skills development expertise⁸⁰.

Furthermore, the same challenges often apply equally to other aspects of the UK energy and wider infrastructure sectors. The National Infrastructure Plan for Skills⁸¹ highlights the main skills challenges:

⁸⁰ *Offshore Renewable Energy Science and Innovation Audit*. A Science and Innovation Audit Report sponsored by the Department for Business, Energy and Industrial Strategy. Undated.

⁸¹ National Infrastructure Plan for Skills, HM Treasury, September 2015.

Challenge	Energy and utility sector specific challenges
Providing leadership and coordination	- Sectors need to work together to develop cross-sector strategies and approaches for workforce development. - There is a lack of regional planning resulting in the lack of a coherent, long-term picture of demand.
Improving data on supply and demand	- A key challenge is the changing profile and nature of roles. - The regions with key projects include the North, South West and East of England – with specific workforce demands. - There are specific skills gaps relating to nuclear, renewable and smart meter infrastructure targets.
Improving mobility and up-skilling the existing workforce	There is a need for greater mobility of employees within the energy, utilities and construction sector. The development of common industry standards and accreditation is one of the recommendations to encourage this.
Encouraging young people and greater diversity	There is a shortage of students undertaking STEM subjects and the relative low attractiveness of the energy sector for those who are studying STEM subjects.

6.4 Conclusions

The UK has a long history of creating a world class offshore workforce – from R&D through to operations and maintenance. This tradition continues with the UK leading the way in offshore wind deployment.

Many of the skillsets needed for offshore electricity generation and transmission are similar to those already being demanded across the wider energy sector – both onshore and in the oil and gas fields (where, it should be noted, workforce reductions have slowed). Also, in addition to the critical technical roles required, business, commercial, stakeholder / supply chain management and advanced first aid and rescue skills are also central to a successful future.

However, direct feedback from employers for this study suggests that attracting new talent isn't a major problem at the moment. Certainly, many of the owner / operators and larger OEMs appear to have few difficulties in filling vacancies, be they for Apprentices or experienced hires.

Recruiting skilled talent does not appear to be a major challenge for larger employers at the moment – but challenges do exist for some supply chain SMEs

Whether this situation still applies into the supply chain (e.g. at tier 2 level) is something that warrants further investigation. It does appear to be the case that while the “employer brand” of the owner / operators and OEMs is strong enough to attract talent from both within and from outside of the sector, this may not be the case with the smaller supply chain companies.

The skills that are crucial to the success of the industry moving forward, and in maintaining the UK’s status as a leader of offshore wind development and deployment, include:

- Asset management
- Project management
- Leadership
- Engineers and technical skills – mechanical, electrical and control & instrumentation, blade and turbine technicians
 - Increasingly, many of these roles now require elements of IT / network system skills, as areas such as fault findings and systems / performance monitoring are done through electronic, rather than mechanical, means
- Scientists – marine biology, geophysics, hydrography, oceanography
- Advanced first aid and rescue
- Offshore skills – confined spaces, working at heights, team working, team living, etc.

Discussions with employers also highlighted the need for modular upskilling provision in:

- Leadership – developing the leaders of tomorrow
- Updating and refreshing knowledge and understanding of safety rules and regulations
- Advanced first aid and rescue – ability to train / refresh onshore in as realistic conditions / assets as possible. This provision should be similar in content and learning to that seen for mountain rescue-type situations and injuries

Furthermore, the offshore wind industry will continue to develop tomorrow’s innovators⁸², particularly in areas such as vessels and logistics, subsea cables and transmission, foundations, turbines, artificial intelligence, robotics and data analytics.

Gaining the required skills could prove increasingly difficult as economic activity in the industry ramps up over the coming years and labour demands increase – the labour market is already at its tightest for 40 years and significant additional investment in infrastructure construction is planned for next few years.

⁸² *Offshore Renewable Energy Science and Innovation Audit. A Science and Innovation Audit Report sponsored by the Department for Business, Energy and Industrial Strategy. Undated. Ibid.*

The supply of skills that the industry can call upon is mixed. The regions along the east of the UK, where the majority of offshore wind growth is expected to occur, appear to be relatively strong in terms of level 2 and 3 qualifications (the feedstock of Apprentices and technicians). However, there are issues reported by employers which relate to Apprenticeships including:

- How well is the full range of Apprenticeship frameworks and standards promoted and understood by employers across the industry's supply chain?
- How companies are approaching the Apprenticeship Levy (i.e. the extent to which it influences their skills development strategies)
- Whether the Apprenticeship Levy Transfer Policy could be better promoted and utilised to maximum effect for the industry and its supply chain
- The availability of training provision where it is required most
- Trainees being unable to gain the required on-the-job experience when access to offshore sites (i) cannot be gained while under 18 years of age and (ii) can be costly given that "down-time" of a site can be very expensive and, therefore, is kept to a minimum (meaning that training on-site can be a significant hidden cost)

The availability of locally-sourced higher-level skills may be an issue given the number of graduates leaving universities with relevant degrees. In 2015 / 16 there were 9,185 UK graduates with relevant degrees to the offshore wind industry. Universities in the East Midlands and Yorkshire & Humber produced 1,900 graduates from relevant disciplines in 2015 / 16 (740 of them in mechanical engineering). However, universities in the North East (595) and East Midlands (185) were not so successful.

The progress of STEM learners through the education system continues to be an issue for the UK economy. While interest in STEM subjects is strong at GCSE level, for both males and females, this interest declines going into A levels and, further, into higher education. Finally, in terms of gaining employment in the energy sector, just 125 of the 9,185 graduates in 2015 / 16 with relevant degrees entered employment in the sector.

This is a particular issue for females, despite girls representing 50% of GCSE entrants in STEM subjects and out-performing boys in terms of achievement, just 16% of graduates with offshore wind-relevant degrees in 2015 / 16 were female.

Therefore, as the population of the UK grows and changes in composition – with white males becoming a smaller proportion of the population – the offshore wind industry (as well as the wider energy, infrastructure and engineering sectors) needs to consider how it can make the most of the talent available to them, including females and those from a BAME background.

Action on these points is required to help the industry deliver on its potential and keeping the UK at the forefront of the global industry. Solutions should seek to:

- Maximise the extent to which the local communities can benefit from the success of the industry
- Engage with the whole supply chain – ensuring that access to talent, training provision and the promotion of skills development as a principle is embedded throughout the entire industry

To meet the needs of the whole sector, talent attraction and skills development needs to engage with all communities

This is a dynamic, fast-paced and growing industry and, coupled with its green credentials, can provide a wide range of career opportunities to both new entrants and experienced workers. The challenge will be in promoting these opportunities to all sections of the community in a way that benefits the whole supply chain.

7. The Energy Estuary

Headlines

- The Humber region is one of six designated Centres for Offshore Renewable Engineering (COREs) in England
- A new Industrial Strategy for the Humber and Offshore Wind Sector Deal will strengthen the region's position as the UK's leading offshore centre
- Offshore wind generating capacity could reach 7.7GW by 2032, consisting of more than 1,000 extra turbines and employing more than 9,200 people
- Just 4% of the region's current energy sector workforce are from a black or minority ethnic background – compared to 8.5% of the region's total workforce
- Competition for skilled people is expected to remain strong, with more than £14bn being invested in the region's energy and infrastructure sector, which could demand more than 100,000 in total
- Although the region's labour market is tight, few of the industry's larger employers (e.g. operators and OEMs) report difficulties in recruiting talent – the situation along the supply chain is less certain
- Fewer than 1,900 graduates emerged from the region's universities in 2015/16 with relevant degrees – just 32 of these entered employment in the energy sector
- Of the 62 Apprenticeship frameworks / standards that are potentially of relevance to the offshore wind industry, there are no training providers within 50 miles of Hull for 23 of them
- As a result of this significant economic activity, there are already a number of initiatives and collaborations in place to support the development of the industry, including an O&M Centre of Excellence, Green Port Hull, Humber LEP and Team Humber Marine Alliance – most of these also have their own skills-related group or network existing.

7.1 Introduction

This chapter considers the current and future potential of offshore wind in and around “The Energy Estuary”.

Already designated a Centre for Offshore Renewable Engineering (one of six COREs in England⁸³), these are exciting times along the Humber estuary, which is leading the UK renewables sector with a collective of over £300million being invested through Siemens, ABP and the development of Greenport Hull. With investments in wind, tidal, biofuels and renewable energy, the region is building on its credentials in chemicals, offshore and marine engineering and exploring opportunities to capitalise on the global demand for sustainable energy⁸⁴.

Associated with this activity, there are several initiatives and collaborations which are designed specifically to maximise this potential economic growth. For example, a five-year, £2million collaboration between ORE Catapult and the University of Hull has seen the creation of an Operations & Maintenance Centre of Excellence⁸⁵ and a new Industrial Strategy for the Humber is being commissioned by Humber LEP⁸⁶ which will map out how the region will build on its position as the centre of the UK's offshore wind industry.

The Energy Estuary is at the forefront of the UK's offshore wind revolution

As “the Energy Estuary” is not a geographic area that is commonly used by the providers of statistics used throughout this report, there is no specific data we can use. However, as a proxy for this, we have combined the data relating to the Yorkshire & Humber region with that of the East Midlands. This consolidated area is referred to as “the Region” throughout the remainder of this section.

This presents a more realistic picture of the amount of economic activity that is / will be in, taking place in and around the Humber Estuary to support the offshore wind industry activities along much of the eastern coast of the UK.

⁸³

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/405959/CoreBrochure_2015.pdf, accessed on 17th May 2018.

⁸⁴ <https://thehumber.com/invest/growth-sectors>, accessed on 18th May 2018.

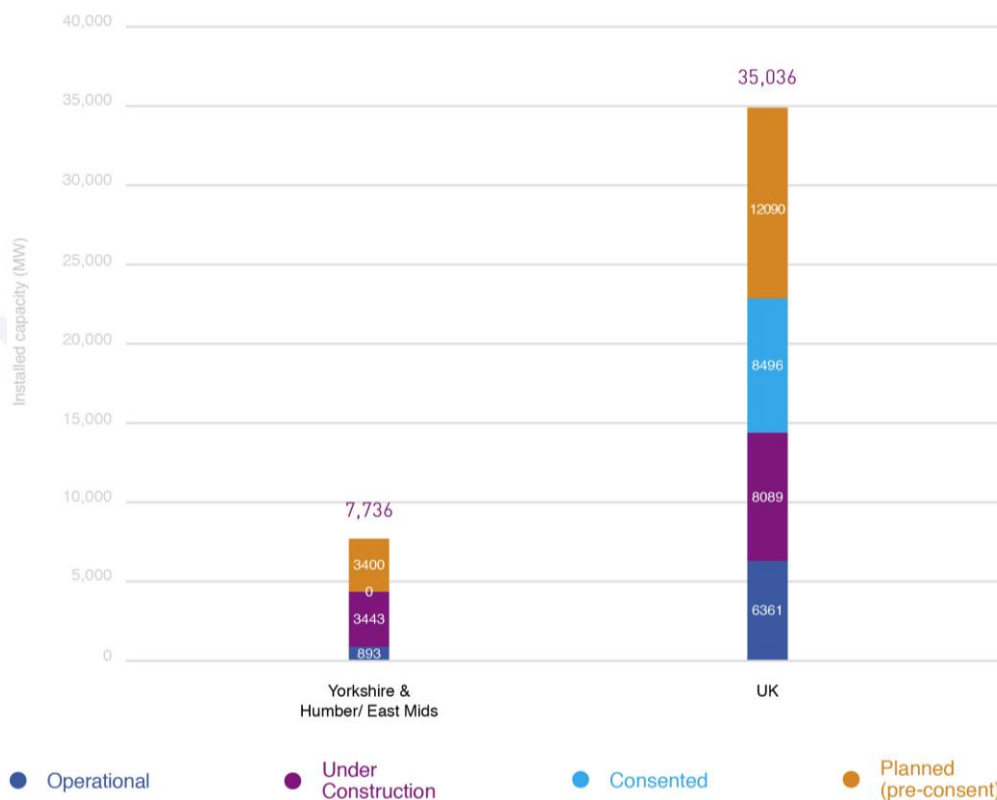
⁸⁵ <https://ore.catapult.org.uk/operation-performance/strategic-programmes/omcel/>, accessed on 18th May 2018.

⁸⁶ <http://www.humberlep.org/lep-to-lead-development-of-new-plan-for-next-phase-of-the-energy-estuary/>, accessed 18th May 2018.

7.2 Current and Future Project Pipeline

The Region currently accounts for 893MW (14%) of the UK's offshore wind capacity of 6.6GW. However, it has the potential to accommodate 7.7GW (22.1%) of the UK total capacity by 2032. Only the East of England region has greater potential, at 8.5GW (24.1%).

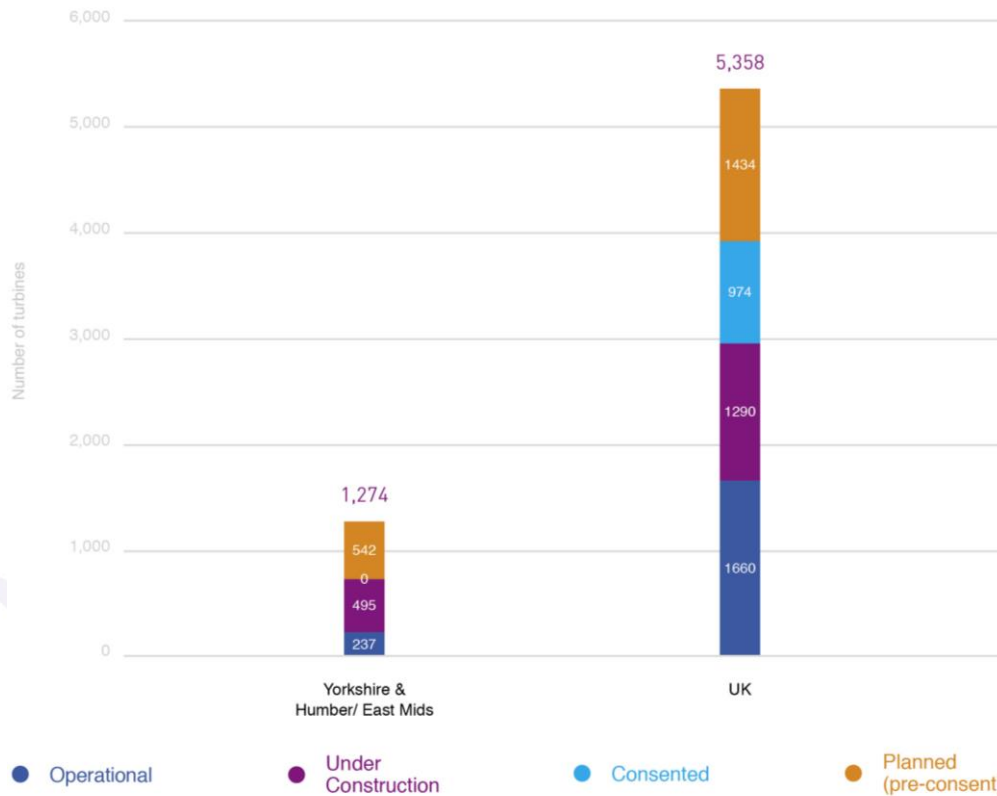
Figure 29: Potential offshore capacity (MW) by 2032 in Yorkshire & Humber / East Midlands and UK by project phase



Source: Energy & Utility Skills' estimate based on RenewableUK Wind Energy Database, www.4COffshore.com, TEC register and company websites.

In total, an additional 1,037 new turbines could be installed in the Region's waters over the next 15 years, resulting in 1,274 turbines in total (accounting for nearly 1-in-4 of the total number of turbines in UK waters) and making it the UK's leading region in terms of the number of operational turbines.

Figure 30: Potential number of offshore turbines by 2032 in the Yorkshire & Humber / East Midlands and UK by project phase



Source: Energy & Utility Skills' estimate based on RenewableUK Wind Energy Database, www.4COffshore.com, TEC register and company websites.

Overall, the peak year of construction new UK wind farms is predicted to be 2024, when 9.5GW could be being built. Also, in 2019, 8.6GW will be in construction.

However, the anticipated timing of construction of projects in the Region suggests that only two will be in construction at the same time – Ørsted's Hornsea One and Innogy's Triton Knoll.

The projected substantial potential increase in offshore wind activity in the Region could result in serious competition for skilled labour. However, on a positive note, it may have the advantage of becoming a magnet for skills as businesses become established and demand for labour increases.

7.3 Predicted Employment Demand

It is estimated that employment related to the offshore wind industry in the Region could increase from around 1,500 in 2017 to around 9,200 by 2032 if all the projects in the current pipeline become operational. Across the UK, employment could rise from 10,000 to 36,000.

Figure 31: Offshore wind employment estimates for Yorkshire & Humber / East Midlands and UK

	2017	2022	2027	2032	2017-2032 Variance
Yorkshire & Humber / East Midlands	1,500	3,400	6,000	9,200	+7,700
UK	10,000	18,500	27,400	36,000	+26,000

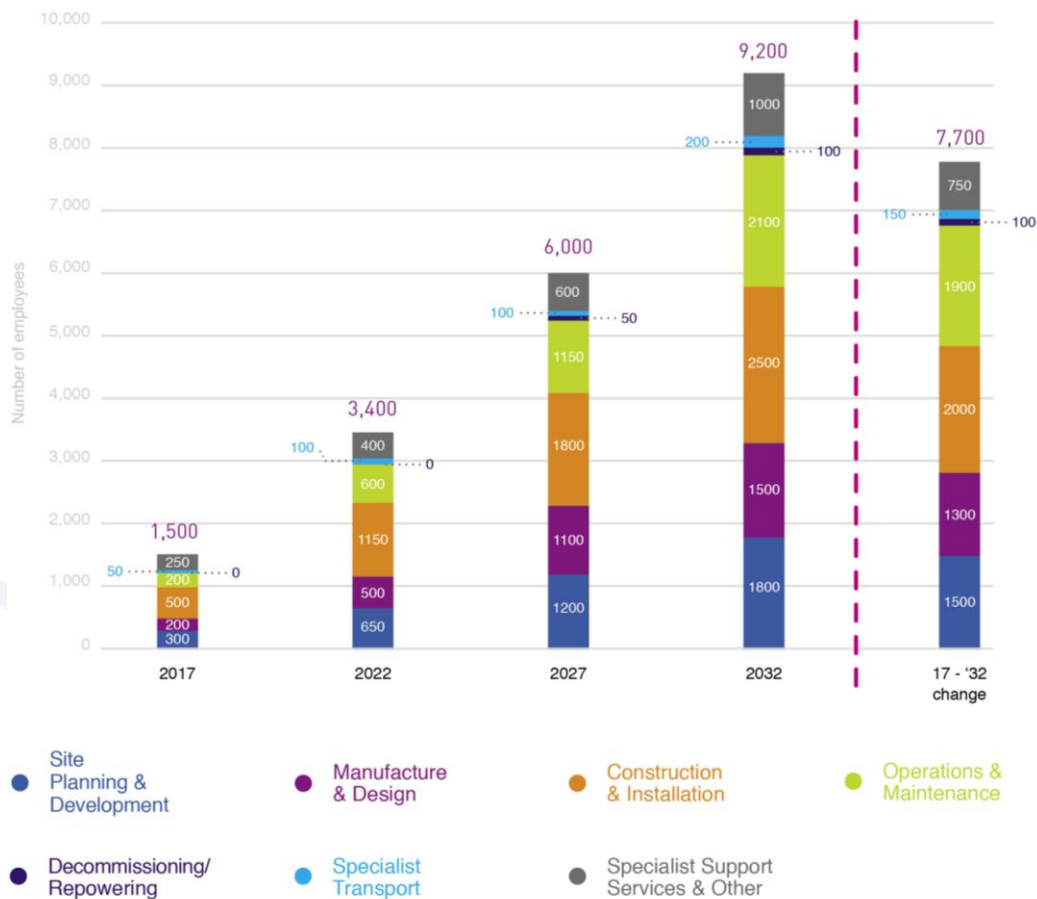
Source: Energy & Utility Skills' estimate using Cambridge Econometrics 2017 employment projections as a basis.

Along the north-eastern seaboard of the UK (including East of England, East Midlands, Yorkshire & Humber, North East and Scotland), employment is set to grow from around 3,700 in 2017 to nearly 21,000.

This obviously reflects where the majority of the economic activity will occur. Overall, this growth in employment mirrors much more closely the growth in the number of turbines becoming operational than it does growth in MW output (as turbine output is anticipated to increase quite substantially over the coming decade).

Employment growth in the region is expected to be concentrated mainly in *Construction & installation* and *Operation & maintenance*, with some growth occurring in both *Planning & development* and *Manufacturing & design*.

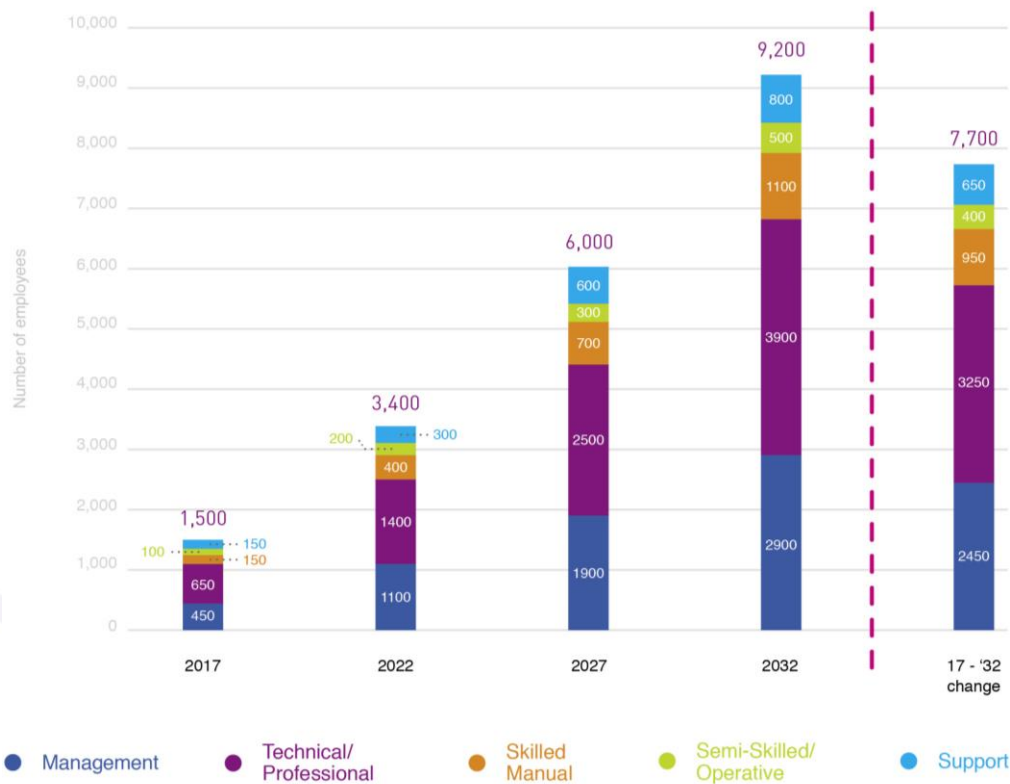
Figure 32: Offshore wind employment growth estimates for Yorkshire & Humber / East Midlands by project stage



Source: Energy & Utility Skills' estimate using Cambridge Econometrics 2017 employment projections as a basis.

The majority of employment growth will require technical- and professional-level skills, along with a large number of managerial staff.

Figure 33: Offshore wind employment growth estimates for Yorkshire & Humber / East Midlands by broad skill level



Source: Energy & Utility Skills' estimate using Cambridge Econometrics 2017 employment projections as a basis.

There are both internal and external factors that could affect the accuracy of these employment estimates, particularly:

- Project slippage
- Government policy
- O&M manpower strategies – the extent to which owner / operators deliver O&M activities in-house or contract out
- Use of offshore logistics and accommodation
- Speed and impact of industry maturity and consolidation
- Technological innovation and developments

7.4 Wider Competition for Skills

At the same time that economic activity and employment in the region's offshore wind industry is set to increase, there are other infrastructure construction projects planned in the Region.

In total, £14.3billion of investment is planned specifically for the Yorkshire & Humber / East Midlands region between 2017 / 18 and 2020 / 21 - £12.9billion of this is planned in just three sectors: Energy (£8.0bn (including £6.87bn for Hornsea One and Two and Triton Knoll)); Transport (£2.2bn) and Utilities (£2.8bn) (it is also possible that other nationwide investments will impact on the region, although it is difficult to estimate the extent the which this may occur).

The table below shows estimates of employment in the Region's energy and infrastructure sectors through to 2024.

Within the electricity and gas sector, there is minimal additional employment forecast for the Region's onshore wind industry, with total capacity forecast to grow by just 144MW over the coming years to a total of 1.2GW.

Total labour demand across the region is shown in Figure 34 below (though much of the data falls below the recommended threshold for publication).

Figure 34: Forecast employment demand in the Yorkshire & Humber / East Midlands energy and infrastructure sectors (by sector) 2017-2024

	Total labour demand	% of 2017 workforce	Relevant occupational growth
Energy & infrastructure sectors	100,000 20,000 new jobs 80,000 retirements	24.7%	30,000 Skilled trades 10,000 Managers 10,000 Operatives 10,000 Engineers <10,000 Technicians
All Sectors	1,150,000 90,000 new jobs 1,060,000 retirements	23.6%	140,000 Managers 80,000 Operatives 50,000 Engineers 50,000 Skilled trades 20,000 Technicians

Source: Working Futures 2014-2024, UKCES, 2016.

Note – Data is rounded to the nearest 10,000.

* includes power generation and onshore transmission and distribution

** includes onshore and offshore extraction only

Within the Region's energy and infrastructure sectors, an estimated 100,000 people will be required by 2024 – equivalent to replacing 24.7% of the current workforce. Furthermore, more than two-thirds (68.5%) of people recruited over this period will be in operative, skilled, technician, engineering and managerial roles.

By comparison, across the whole of the Region's economy, some 1.15million people will required, with just 29.1% entering jobs in the same broad occupational groups.

7.5 Implications for Skills Demand

The implications for the demand for skills in the future are discussed in detail in chapter 6 and can be summarised as:

Figure 35: Skill areas identified as being important to the future success of the offshore wind industry

Skill area	Specific details
Asset management	- Specifically, environmental asset management - Compliance and engineering
Project management	Ability to handle contracts worth £100millions+
Leadership	- The ability to manage and organise teams - Developing the leaders of the future from the technical workforce (i.e. upskilling)
Engineers	- Across a range of relevant disciplines, including mechanical, electrical and control & instrumentation and high voltage - Including IT and associated network skills, enabling fault-finding through electronic means (e.g. assessing data on a laptop) rather than the more traditional, hands-on, mechanic approach.
Scientists	Environmental and physical sciences – e.g. marine biology, geophysics, physics, environmental monitoring, oceanography.
Technicians	- Particularly relating to blade and turbine maintenance (this issue is not helped by a lack of common standards across technology manufacturers) - High voltage technicians
Health & safety	- Advanced first aid and rescue - The types of injuries that can occur, and the required first aid response, can often be similar to those seen in mountain rescue-type situations. - Safety rules and regulations – regularly updated / refreshed
Soft skills	Team working; team living, problem solving, etc.

Source: Employer interviews as part of this skills study

There is no evidence, or reason to assume, that the skills demands within The Energy Estuary or wider region will vary from this analysis.

7.6 Implications for Skills Supply

In terms of the supply of available skills, the Region's labour market remains tight in terms of high level of employment and relatively low levels of unemployment. Unemployment in Yorkshire & Humber stands 4.1% (slightly below the UK average of 4.3%), while in the East Midlands it is at 5.0% (slightly above the UK average). The Region has experienced relatively high levels of employment growth over the past year.

Figure 36: Unemployment rate for people aged 16+ by region of the UK

Region	Unemployment rate
East Midlands	5.0%
Yorkshire & Humber	4.1%
UK	4.3%

Source: Quarterly Labour Force Survey, November 2017-January 2018, ONS.

The Yorkshire & Humber and East Midlands regions have a high proportion of the resident workforce with Level 2, Trade Apprenticeships and Level 3 qualifications, although a lower than average proportion of Level 4+ qualifications.

Figure 37: Highest qualification held by resident population (16+)

Region	Level 4+	Level 3	Trade App'ships	Level 2	Below Level 2	Other qual	No qual
East Midlands	32.4%	17.6%	4.3%	16.5%	11.9%	8.2%	9.0%
Yorkshire & Humber	33.0%	17.1%	3.8%	16.8%	12.7%	6.8%	9.8%
UK	38.1%	16.8%	3.7%	15.4%	10.7%	6.9%	8.4%

Source: Quarterly Labour Force Survey, October-December 2017, ONS.

While it is not possible to assess in which subjects these qualifications are held, it does appear that the resident population in Yorkshire & Humber and East Midlands regions have potentially strong levels of vocational / technical-level skills, which are crucial to many aspects of the offshore wind industry.

However, it may also be the case that the regions suffer from a lack of higher-level qualifications in the resident population, which may potentially limit the extent to which the local workforces can provide the higher-level skills required for the continued development of the offshore wind industry.

In 2015 / 16, 1,895 degrees were achieved in the Region that are relevant to the offshore wind industry (see Annex 2 for a list of these degree subjects). Of these, just 32 entered employment in the energy sector.

The number of relevant degrees achieved in higher education institutions in the Yorkshire & Humber and across the UK are shown below.

Figure 38: Number of Honours degrees achieved within offshore wind-related subjects by region (2015 / 16)

Broad subject area	Y&H / EM Region	UK	Female proportion	
			Y&H / EM	UK
Civil	385	2,060	16.4%	15.0%
Design	0	80	--	19.5%
Electronic & electrical	420	1,930	6.0%	8.5%
Environmental sciences	140	1,030	41.2%	42.4%
Marine	10	265	66.7%	47.9%
Mechanical	740	3,230	8.6%	9.1%
Naval	0	35	--	13.8%
Production / manufacturing engineering	170	480	26.9%	21.0%
Structural	30	65	33.0%	25.3%
Total	1,895	9,185	14.3%	16.0%

Source: HESA Destinations of Leavers Survey and Student Record, 2015 / 16

Note: Numbers are rounded to the nearest 5.

* Denotes fewer than 5.

The totals may not equal the sum of the subjects due to rounding.

Relative to other regions of the UK with high potential for offshore wind growth, this is a high figure – Scotland (1,180), North East (595) and East of England (185).

The University of Loughborough produced 355 of the 1,895 degrees, with University of Nottingham (235) and Sheffield Hallam University (220) also providing high numbers.

More work needs to be done to create a more diverse and inclusive workforce across the Region's energy workforce:

- Females make-up just 22% of the energy sector workforce (predominantly in non-technical roles such as customer service and admin / secretarial)
 - Females accounted for just 14.3% of graduates in 2015 / 16 – slightly less than the UK proportion of females (16.0%) and that BAMEs accounted for 25.4%
- Just 4% of the Yorkshire & Humber region's energy workforce (5.2% in the East Midlands) are from a BAME background (compared to 8.5% and 8.0% respectively of the available workforce)⁸⁷
 - Employers need to be mindful of the specific local / regional circumstances when determining how representative their workforce is, or should be

⁸⁷ Annual Population Survey, April 2015 to March 2016. ONS.

Continued efforts to attract more females and BAMEs into the sector should be a priority

A key aspect of creating a more attractive sector proposition, including a more diverse workforce, is how the sector engages with its future talent pool. While it is recognised that many of the larger employers in the Humber area regular engage with education institutions and promote the opportunities available within the industry, evidence from smaller companies within the supply chain suggests that this is a far more difficult task for them to achieve – not least in terms of having the resources, time and expertise to engage properly and constructively with the audience on a regular basis. Furthermore, many supply chain SMEs do not have the “employer brand” to gain access to schools in order to talk about potential career and Apprenticeship opportunities within their organisation (especially in locations dominated by the larger offshore wind employers).

Therefore, making the most of the available workforce will (i) become increasingly important and (ii) require a sector-wide approach.

7.6.1 Apprenticeship Training Provision in the Region

Overall, 62 separate Apprenticeship frameworks / standards have been identified as being relevant to the offshore wind industry:

- 13 at Level 2
- 29 at Level 3
- 9 at Level 4
- 2 at Level 5
- 7 at Level 6
- 2 at Level 7

However, there are no training providers for 23 of these within 50 miles of Hull.

The following tables list each framework / standard by level and the associated training providers (where available). This list is taken from the Skills Funding Agency’s website⁸⁸. All training providers listed are within 50 miles of Hull (HU1 1AA).

⁸⁸ <https://findapprenticeshiptraining.sfa.bis.gov.uk/>, accessed on 9th May 2018.

There are potentially 62 Apprenticeship frameworks/
standards relevant to the industry – though 23 of
them have no current training provider

Figure 39: Offshore wind-related Apprenticeship training providers in and around the Energy Estuary

Level 2

Apprenticeship	Name of training provider
Construction Civil Engineering: Steelfixing	There are no training providers listed for this Apprenticeship within 50 miles of Hull. I.V.S. Training and Assessment Ltd is the closest (78 miles away).
Construction Civil Engineering: Steelfixing Occupations Major Projects	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Bridgwater and Taunton College is the closest (213 miles away).
Construction Steel Fixer	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Heyrod Construction is the closest (76 miles away).
Engineering Manufacture: Engineering Maintenance and Installation	East Riding College Babcock Training Tagadvance
Engineering Manufacture: Fabrication and Welding	Hull College East Riding College Grimsby Institute of Further and Higher Education North Lindsey College Wakefield College RNN Group
Engineering Manufacture: Marine (Ship, Yacht, Boatbuilding, Maintenance and Repair)	Babcock Training
Logistics Operations: Logistics Operative	Fleetmaster Training Ltd Intec Business Colleges DeeKay Technical Recruitment Vision West Nottingham College The Intraining Group
Logistics Operations: Logistics Support Operative	DeeKay Technical Recruitment Qube Learning

Apprenticeship	Name of training provider
Management: Team Leading	There are numerous training providers available for this Apprenticeship in the region.
Maritime Occupations: Able Seafarer / tug rating - engine room	Hull Training and Adult Education
Maritime Occupations: Port Operations	JC Ready4Work Rathbone
Maritime Occupations: Workboat Operation	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Park Education & Training is the closest (114 miles away).
Supply Chain Management: Supply Chain Operations	Hull College DeeKay Technical Recruitment Vision West Nottingham College

Level 3

Apprenticeship	Name of training provider
Civil Engineering Technician	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Salford and Trafford Engineering Group Training Association is the closest (83 miles away).
Engineering Construction: Electrical Installation	Babcock Training Grimsby Institute of Further and Higher Education Wakefield College
Engineering Construction: Electrical Maintenance	Grimsby Institute of Further and Higher Education
Engineering Construction: Instrument and Control	Grimsby Institute of Further and Higher Education
Engineering Construction: Mechanical Fitting	Grimsby Institute of Further and Higher Education Wakefield College
Engineering Construction: Mechanical Maintenance	Grimsby Institute of Further and Higher Education Wakefield College
Engineering Construction: Project Control	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Stockport Engineering Training Association is the closest (78 miles away).
Engineering Construction: Steel Erecting	North Lindsey College

Apprenticeship	Name of training provider
Engineering Manufacture: Electrical and Electronic Engineering	Hull College Hull Training and Adult Education Humberside Engineering Training Association East Riding College Babcock Training Selby College York College Grimsby Institute of Further and Higher Education
Engineering Manufacture: Engineering Maintenance	JTL Hull College Hull Training and Adult Education Humberside Engineering Training Association East Riding College Babcock Training Selby College Doncaster College Lincoln College Grimsby Institute of Further and Higher Education University of Sheffield
Engineering Manufacture: Engineering Leadership	Hull Training and Adult Education
Engineering Manufacture: Installation and Commissioning	Selby College Doncaster College University of Sheffield
Engineering Manufacture: Marine (Ship Building, Maintenance and Repair)	Babcock Training
Engineering Technician	Hull Training and Adult Education Derwent Training Association York College University of Sheffield
Construction Technical and Professional: Geomatics Data Analysis	There are no training providers listed for this Apprenticeship in the UK.
Logistics Operations: Logistics Operations Team Leader / Section Supervisor	Hull College Intec Business Colleges DeeKay Technical Recruitment Vision West Nottingham College North Lincs Training Group Lincoln College

Apprenticeship	Name of training provider
Maintenance and Operations Engineering Technician	Hull College Humberside Engineering Training Association Hull Training and Adult Education North Lindsey College York College
Marine Engineer	There are no training providers listed for this Apprenticeship in the UK.
Maritime Occupations: Officer of the watch on merchant vessels of less than 500 gross tonnage - near coastal	There are no training providers listed for this Apprenticeship in the UK.
Maritime Occupations: Officer of the watch on merchant vessels of less than 3,000 gross tonnage - near coastal	There are no training providers listed for this Apprenticeship in the UK.
Maritime Occupations: Merchant Navy (Deck)	There are no training providers listed for this Apprenticeship in the UK.
Maritime Occupations: Merchant Navy (Engineering)	There are no training providers listed for this Apprenticeship in the UK.
Power network craftsperson	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Utility & Construction Training Ltd (87 miles away) is the closest.
Project Controls Technician	T3 Training & Development (Barnsley)
Supply Chain Management	DeeKay Technical Recruitment Hull College
Surveying technician	There are no training providers listed for this Apprenticeship within 50 miles of Hull. University College of Estate Management (Reading) (160 miles away) is the closest.
Team leader / supervisor	There are numerous training providers available for this Apprenticeship in the region.
Utilities engineering technician	Trainspeople Ltd Develop Training Ltd
Warehousing and Storage: Senior Warehouse Person / Team Leader	Ensis Solutions Hull College Intec Business Colleges DeeKay Technical Recruitment Vision West Nottingham College North Lincs Training Group Lincoln College

Level 4

Apprenticeship	Name of training provider
Associate project manager	There are numerous training providers available for this Apprenticeship in the region.
Electrical Power Networks Engineer	There are no training providers listed for this Apprenticeship in the UK.
Electrical power protection and plant commissioning engineer	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Warwickshire College (113 miles away) is the only listed nationally.
Manufacturing Engineering: Electrical / Electronics	Wakefield College
Manufacturing Engineering: Maintenance	East Riding College
Manufacturing Engineering: Marine	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Sheffield Hallam University (53 miles away) is the only listed nationally.
Manufacturing Engineering: Mechanical	East Riding College University of Sheffield
Manufacturing Engineering: Wind Generation	There are no training providers listed for this Apprenticeship in the UK.
Project Management	GK Apprenticeships Acorn Learning Solutions

Level 5

Apprenticeship	Name of training provider
Supply Chain Management: Supply Chain Specialist	DeeKay Technical Recruitment
Supply Chain Management: International Supply Chain Manager	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Port of Tilbury London (113 miles away) is the closest.

Level 6

Apprenticeship	Name of training provider
Chartered manager degree apprenticeship	Hull College University of Hull Encompass Consultancy ioda Ltd North Lindsey College York St John University Lincoln College Coventry College (Scarborough) University of Lincoln
Chartered surveyor	Rathbone Leeds Beckett University
Civil Engineer	Leeds Beckett University
Construction Management: Construction Site Management	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Nottingham Trent University (64 miles away) is the only listed nationally.
Construction Management: Management Quantity Surveying and Commercial Management	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Middlesex University (149 miles away) is the only listed nationally.
Control / technical support engineer	University of Sheffield
Electrical / electronic technical support engineer	There are no training providers listed for this Apprenticeship within 50 miles of Hull. Sheffield Hallam University (53 miles away) is the only listed nationally.

Level 7

Apprenticeship	Name of training provider
Power Engineer	There are no training providers listed for this Apprenticeship within 50 miles of Hull. London South Bank University (155 miles away) is the only listed nationally.
Postgraduate Engineer	University of Sheffield

As the above tables demonstrate, there are a substantial number of potential Apprenticeship Frameworks and Standards available to support the skills development of the workforce in most aspects of the offshore wind industry – 62 are identified above.

How the industry interacts with the Apprenticeships landscape is worthy of further investigation – not least in the following areas:

- How well is the full range of Apprenticeship frameworks and standards promoted and understood by employers across the industry's supply chain?
 - Not just in wind power, engineering, etc., but also in logistics, steel fixers, vessels, supply chain management, etc.
- The Apprenticeship landscape is shifting away from “frameworks” and towards “standards”. Frameworks which are in use and valued by employers are being transitioned into Standards – those that are not will, at some point in the not-too-distant future, be terminated.
- How companies are approaching the Apprenticeship Levy (i.e. the extent to which it influences their skills development strategies)
- Whether the Apprenticeship Levy Transfer Policy could be better promoted and utilised to maximum effect for the industry and its supply chain
- The availability of training provision where it is required most. For example, there are no providers of Wind Turbine Apprenticeship training in the East Anglia area and there are no training providers within 50 miles of Hull for 23 of the 62 identified Apprenticeship frameworks / standards
 - It appears that an important factor here is the perceived / actual lack of demand for such Apprenticeship training from industry, resulting in providers being unwilling / unable to develop such provision.
- Trainees being unable to gain the required on-the-job experience when access to offshore sites (i) cannot be gained while under 18 years of age and (ii) can be costly given that “down-time” of a site can be very expensive and, therefore, is kept to a minimum (meaning that training on-site can be a significant hidden cost).
- The administrative, coaching, mentoring and pastoral burden on small teams while offshore can be prohibitive.

7.7 Regional Networks, Fora and Agencies Active in Offshore Wind

This section outlines the main networks, fora and other bodies that exist to support the offshore wind sector both within The Energy Estuary.

A further list of other networks, fora and agencies that cover the UK and Europe can be found in Annex 3.

Figure 40: Support networks and bodies in and around the Energy Estuary

Name	Description	Coverage	Extent of involvement in skills
Centre for the Assessment of Technical Competency (CATCH)	Working across the private and public sectors CATCH runs capital and business support programmes, network groups, skills programmes, conferences, events and publications aimed at encouraging best practice, knowledge exchange and business excellence. http://www.catchuk.org/	Located in Grimsby	They run several networks including: • Skills & competency • Human factors • Science Industries Apprenticeship Consortium • Human Resources • Humber Contractor Competency Forum – including <i>ConCom</i> and <i>PreQual</i> which assess contractor competencies. They are also a training provider for Mechanical, Process and Health & Safety training.
Green Port Hull	Collaboration between Hull City and East Riding Councils and Associated British Ports (ABP) along with other partner organisations. Significant funding has been secured for skills & employment, business support, and research and development to ensure that local people and business gain maximum benefit from the renewable energy sector. http://greenporthull.co.uk/	Port of Hull East Riding	Promotes job vacancies in the area, particularly with Siemens. Provides high-level advice and labour market information and signposts to other useful resources.

Name	Description	Coverage	Extent of involvement in skills
Grimsby Renewables Partnership	The Grimsby Renewables Partnership is a local group which has formed to promote local companies to the rapidly increasing offshore wind activity in the area. Activities of the Grimsby Renewables Partnership include: • Showcasing the North East Lincolnshire's local business offer to the industry • Regular networking events • Seminars and informative sessions on opportunities • Notifications of key developments in the industry • Work with top tier companies to understand their requirements and help promote member companies to satisfy that demand http://investnel.co.uk/grp	Grimsby	No specific actions are listed on their website other than promoting the area, and its workforce, to current and prospective companies.

Name	Description	Coverage	Extent of involvement in skills
Humber LEP	They are a partnership of business, education and the four Humber local authorities working together to promote and develop the area surrounding the Humber Estuary and provide strategic economic leadership to create jobs and deliver growth. Their priorities are: • A skilled and productive workforce • An infrastructure that supports growth • Thriving successful businesses http://www.humberlep.org/	Humber	Their Employment and Skills Board (the university is represented by Adam Greenwood) has lead on the development of a six-year Employment and Skills Strategy, aligned to the Strategic Economic Plan (SEP) that identifies the skills needed to support local growth and priority interventions to deliver them. Key projects include: • Skills Pledge (which employers can sign up to) • The Humber Gold Standard (for careers education & IAG providers) • The Skills Network (it appears that University of Hull is not in this network) • Area Based Review • Skills Support for the Workforce A new Industrial Strategy for the Humber is being developed (see recommendation 1 below).

Name	Description	Coverage	Extent of involvement in skills
Team Humber Marine Alliance	With 200 members across the marine and offshore supply chain, including commercial shipping, marine engineering, support vessels, specialist health & safety, ports and logistics. They provide expert advice, bring companies together to collaborate on joint ventures and supply chain opportunities, lobby government and represent their members at key UK and European conference and exhibitions. They also host and organise numerous events throughout the year, including the Offshore Wind Connections conference. http://www.thma.co.uk/skills/	Humber	Team Humber Marine Alliance has joined with other organisations on a number of important initiatives: • Humber University Technical College (now called Engineering UTC Northern Lincolnshire) • Hull College – Ports & Logistics Sector Lead as Humber LEP's <i>Skills Support for the Workforce</i> initiative (see Humber LEP above) • Humber Marine Academy (no information can be found relating to this) • THMA Marine & Offshore Skills forum (no information about this forum has been found or received following a request from THMA) • Hull Training – THELMA Project (no information can be found relating to this)
Operations and Maintenance Centre of Excellence (OMCE)	OMCE is funded by a £2m collaboration between ORE Catapult and the University of Hull, building on the region's energy heritage, location and experience of servicing UK offshore wind farms. The five-year partnership will see a series of research and innovation projects developed to improve the way that offshore wind farms are operated and maintained. https://ore.catapult.org.uk/operation-performance/strategic-programmes/omce/	Located on the Humber National resource	No direct involvement in skills development issues.

7.8 Conclusions

The Energy Estuary is right at the heart of the UK's offshore wind industry and will play a central role in delivering and supporting the growth of the industry in the North Sea.

Offshore wind generating capacity is predicted to increase from 0.9GW in 2017 to 7.7GW by 2032 (22% of total UK capacity), including the installation of more than 1,000 new turbines. This could see employment in the Region growing to more than 9,200 (from 1,500 in 2017).

Gaining the required talent, although not a significant problem at the moment, may become more challenging as the project pipeline becomes a reality and, at the same time, the regional workforce will have to satisfy the demands of over £14bn of investment in the wider energy and infrastructure sector across the region. While offshore wind is a significant element of this investment, other energy, utilities and transport infrastructure will likely provide strong competition for good operative, technical and engineering skills in particular – which could reach demand for 100,000 people by 2024, including 30,000 skilled trades and nearly 30,000 operatives, technicians and engineers.

The ability of the regional labour market to meet these talent demands is unclear – while the region has a high proportion of people with level 2 and 3 skills (forming a good operative and skilled trades base) it may well lack the required higher-level skills, with fewer than 1,900 graduates in 2015 / 16 with relevant degrees from the region's universities.

In terms of how the offshore wind industry engages with Apprenticeships, several issues have been identified that warrant further investigation:

- How well is the full range of Apprenticeship frameworks and standards promoted and understood by employers across the industry's supply chain?
- How companies are approaching the Apprenticeship Levy (i.e. the extent to which it influences their skills development strategies)
- Whether the Apprenticeship Levy Transfer Policy could be better promoted and utilised to maximum effect for the industry and its supply chain
- The availability of training provision where it is required most. It appears that there is a perceived / actual lack of demand for such Apprenticeship training from industry, resulting in providers being unwilling / unable to develop new provision.
- Trainees being unable to gain the required on-the-job experience when access to offshore sites (i) cannot be gained while under 18 years of age and (ii) can be costly given that "down-time" of a site can be very expensive and, therefore, is kept to a minimum (meaning that training on-site can be a significant hidden cost).
- The administrative, coaching, mentoring and pastoral burden on small teams while offshore can be prohibitive.

Creating a larger and more diverse talent pool is essential if the region is to capitalise fully on the benefits of a growing offshore wind industry.

As a result of this significant economic activity, several initiatives and collaborations aimed at supporting the industry along the Energy Estuary have already been established, including organisations such as Green Port Hull, Humber LEP and Team Humber Marine Alliance.

Each of these organisations have already established skills-related groups or networks with a view to identifying the issues affecting the development of both technology and the required workforce / skills. Therefore, an initial task for Aura should be to identify where it can fit into this landscape in order to maximise impact – see the recommendations in chapter 8 below.

Overall, both the sector and region need a holistic education and training focus to ensure that growth is not constrained⁸⁹, and as part of the UK's industrial strategy, the offshore renewable energy industry presents a golden opportunity to align national skills development with local spatial skills development⁹⁰. Therefore, Aura will need to ensure that its voice is heard in terms of the new Industrial Strategy for the Humber (lead by Humber LEP) and the Offshore Wind Sector Deal (being led by the Offshore Wind Industry Council).

⁸⁹ *Solutions to Offshore Wind Sector Needs – Draft 2.* Aura, 16.07.17

⁹⁰ *Offshore Renewable Energy Science and Innovation Audit.* A Science and Innovation Audit Report sponsored by the Department for Business, Energy and Industrial Strategy. Undated.

8. Recommendations

Number	Recommendation	Issue
1	Promote skills development throughout the supply chain. A practical example of this could be the application of the Procurement Skills Accord principles within the sector.	• The promotion of skills development down through the supply chain, via procurement processes, is a growing area within the energy and utilities sector. • The Energy & Utility Skills Partnership's <i>Procurement Skills Accord</i> offers a structured and supported approach to achieving this and currently has 40 companies signed up to it. • Aura should consider the relevance to this type of activity to the offshore wind industry and whether it is appropriate to promote such supply chain collaboration within the offshore wind industry. • More information can be found at (http://www.euskills.co.uk/about/energy-utilities-skills-partnership/skills-accord/).

Number	Recommendation	Issue
2	Promote and facilitate investment in skills for the benefit of the whole sector. A practical example could be to use the Apprenticeship Levy Transfer Policy to benefit supplier workforce development	- Many companies in the offshore wind industry will be paying 0.5% of its salary bill into the Apprenticeship Levy. From May 2018, these employers will be able to transfer up to 10% of funds to another organisation to pay for their training and assessment against an Apprenticeship standard (however, this does not apply to Apprenticeship frameworks). - This could allow larger asset owners and tier 1 suppliers, if they have unused Levy funds, to help fund the Apprenticeship training of one of its smaller supply chain companies, who might otherwise struggle to fund / engage with Apprenticeships. - Aura should look to promote / facilitate this opportunity throughout the offshore wind industry. Energy & Utility Skills run a Levy Advisory Group (http://www.euskills.co.uk/about/our-work/apprenticeship-services/apprenticeship-levy/) and more details about the transfer policy can be found at https://www.gov.uk/guidance/transferring-apprenticeship-service-funds.

Number	Recommendation	Issue
3	Consider the creation of a talent network for the offshore wind industry	- Many of the larger, and more well-known, organisations in the offshore wind industry may not struggle to find appropriate applicants for many of their job vacancies and trainee programmes (though certain exceptions will apply). However, this may not be the case down in the supply chain, where the “employer brand” may not be so strong. - Aura should consider whether an initiative such as <i>Talent Source Network</i> might be beneficial to the offshore wind industry. The Network seeks to bring together employers and those looking to for employment – whether they’re looking for Apprenticeship or graduate opportunities, or they’re service leavers, career changers or those looking to return to work. The Network also looks to link-up unsuccessful applicants with other employers who are looking for similar skills. - The Network is currently used by 24 of the largest utility companies in the UK and contains the details of over 3,700 people with utilities-relevant skills. - More information can be found at http://www.talentsourcenetwork.co.uk/.
4	Encourage and facilitate supply chain collaboration to aggregate training demand, ensuring provision is there when needed	- We have seen evidence of several issues affecting the training of Apprentices in specific localities (notably in East Anglia, where Wind Turbine Technician Apprentices have been sent up to the Humber region to receive their technical training). This issue of putting on low-volume / high-cost training can be a barrier for many skills providers. - Aura should consider whether there is an opportunity for them to facilitate the aggregation of such low volume / high cost training which could result in aggregated demand being sufficient to persuade training bodies to supply the necessary provision within the required local area.

Number	Recommendation	Issue
5	Consider ways of supporting the workforce in gaining valuable on-the-job / practical experience before going offshore – maximising the exposure to “real world” situations and assets prior to going offshore	• Gaining on-the-job experience without actually going offshore is an issue that many employers must deal with. With teams working offshore typically being very small and the allowable down-time of a turbine being kept to a minimum for commercial reasons, undertaken training and development on-site is a challenge. • Aura should consider how the industry can tackle this issue through the provision of training via realistic assets onshore. • This would aid Apprentices in completing their programmes as well as supporting upskilling and refresher training (e.g. advanced fault-finding and Advanced first aid and rescue) without the time and expense of going offshore.
6	Investigate the potential for on-line, distance learning upskilling / refresher modules	• Aura should consider engaging with industry to identify specific skills areas where upskilling / refresher training development could benefit from the creation of targeted modular provision. Such provision might be accessible on-line 24/7 and focus on such areas as: ○ Leadership skills - upskilling the leaders of the future (e.g. building on the technical skills developed through the Apprenticeship) ○ General H&S and industry safety rules and regulations

Number	Recommendation	Issue
7	Promote STEM educational progression and the opportunities and career pathways available for higher-level achievers	• The proportion of Yorkshire & Humber residents that hold a Level 4+ qualification is the third lowest of the 12 regions in the UK and just 12 of the 955 graduates from relevant disciplines in 2015 / 16 entered employment in the energy sector. • If the local workforce is to benefit from the potentially significant growth in offshore wind over the coming 15 years, more needs to be done to increase progression – especially of females – from GCSE, through A Levels and vocational training, into higher-level STEM education, and eventually into employment in the sector. The alternative is that skills are brought in from outside of the region.
8	The sector to consider how to bring about common technical training and H&S standards and relevant passport schemes – enabling the free(er) movement of skills between technologies, companies and other sectors	• Many employers spoken to as part of this research have highlighted the lack of common standards across technologies, companies and infrastructure sectors. This adds significantly each employer's training costs and time. • This may be a symptom of being a relatively immature industry, but there appears to be an increasing recognition that it is time to start work on this issue. • It may well require the engagement and co-ordination of several other organisations active in the sector and in infrastructure sectors (for example, RenewableUK, Global Wind Organisation, etc.). • EU Skills has some experience of developing industry-wide “Competency Accords” as well as developing and administering Passport schemes and would be happy to help.

Number	Recommendation	Issue
9	Consideration should be given to how the Aura can develop its own value proposition for the industry / region, bringing together existing organisations, networks, fora, etc.	• There are several agencies that aim to support the workforce development needs of the offshore wind industry along Energy Estuary and Aura needs to establish itself in that landscape. • Aura should actively engage with all agencies to promote and support the skills and workforce development activities of the offshore wind industry. Including: ○ Involvement in the development of the new <i>Industrial Strategy for the Humber</i> (https://www.insidermedia.com/insider/yorkshire/lep-sets-out-energy-estuary-plans) ○ Involvement in the Humber LEP's <i>Skills Network</i> (http://www.humberlep.org/skills/skills-network/) ○ Join the <i>People and Skills Working Group</i> as part of the Offshore Wind Sector Deal • The Humber LEP Board should consider how best to engage with Aura and identify areas where Aura can actively support the activities of the Board. • The University of Hull does not appear to be represented on Humber LEP's Apprenticeship Group – given some of the issues relating to Apprenticeships identified in this report, membership of this group may be something to consider

Number	Recommendation	Issue
10	Facilitate the engagement between employers and schools and other education institutions in a way that maximises the impact for the whole sector / regional supply chain	• There is plenty of research to that suggests employer engagement with schools and other education institutions is valuable in terms of turning pupils / students on to specific career paths. • However, the <i>quality</i> of the engagement is a crucial factor – both in terms of specific activities on any particular day and also in terms of the longer-term relationship between the employer and institution and students. • Some employers interviewed as part of this research have stated that as they are not “high profile” in the community (e.g. a tier 2 supply chain company), it can often be difficult to get into schools to promote their career opportunities. • Aura should consider how it can promote the opportunities on offer within the sector, and the Humber regional supply chain, to young people and the extent to which it can facilitate the collaboration of regional employers (including all aspects of the supply chain) to maximise the impact of employer-school engagement. • A key aspect of this will leveraging the brand names of Siemens, Ørsted, etc. to bring about benefits for lower tiers of the supply chain (e.g. tier 2 and below) who are generally smaller employers, with fewer resources and little in the way of recognisable “employer brand”. • Finally, employers are not educators or careers advisers. Therefore, where necessary, Aura should seek out and embrace the specialist support that is available in this area.

Number	Recommendation	Issue
11	Consider activities to promote the offshore wind industry to females, BAME and other under-represented communities	- Although data relating to the gender and ethnicity of the offshore wind workforce is very difficult to find, we do know that 22% of the wider electricity industry's workforce is female – and that these are primarily in non-technical roles (e.g. admin / secretarial and customer services). - In terms of ethnic diversity, just 5% of the UK power sector workforce is from a BAME background – in Yorkshire & Humber this figure is 4% and in the East Midlands 5.2%. In comparison, 14% of the UK population is from a BAME background, as is 8.5% of Yorkshire & Humber and 8.0% of the regions' available workforces. - With white males with good technical skills becoming a reducing proportion of the UK workforce, the benefits – even the necessity – of having a workforce that draws upon the skills of the whole community is clear. - Therefore, if the offshore wind industry wants to demonstrate that it is an inclusive employer and that it makes the most of the skills on offer across the whole of the communities in which it operates and serves, it should consider what activities it can undertake to promote the opportunities they have to offer in a way that facilitates access to all sections of the available workforce.

Number	Recommendation	Issue
12	Regularly review the offshore wind project pipeline and high-level employment projections for the UK in order to maintain visibility of industry labour demands	• The project pipeline for offshore wind detailed in this report contains a total of 35 individual projects, at various stages of development. • It is important to maintain visibility of this pipeline as it developments over the coming years – monitoring the progress of already known projects and identifying new projects as they come along. • Knowing the size, timeframe and likely employment demands of these individual projects (as opposed to high-level industry forecasts of MW output) will be important in determining how they might affect a region's workforce strategy. • It is also important to regularly update the high-level employment projections carried out by Cambridge Econometrics. However, in future updates, more analysis should be sought on the skills and job roles principally affected by growth in overall labour demand.

Number	Recommendation	Issue
13	Regularly review the nature, timing and labour demands other major infrastructure projects in the area	• With £7.3bn of investment across the infrastructure sector planned for Yorkshire & Humber by 2020 / 21, it will be important to monitor how this impacts upon the local labour force and the ability of offshore wind companies to recruit the skills they need locally. • The National Infrastructure Pipeline is regularly updated regularly and is easily accessible in Excel format (https://www.gov.uk/government/organisations/infrastructure-and-projects-authority). • Furthermore, as the offshore oil and gas sector is often quoted as being a valuable source of skilled labour, it would be wise to continue to monitor the economic and labour / workforce trends of the sector. The workforce reductions that have occurred over the past few years appear to be slowing down as the price of crude oil has risen (albeit only slightly). • Oil and Gas UK produce an annual workforce report which suggests that the decline in employment in the sector is starting to slow down (https://oilandgasuk.co.uk/workforce-report/).

Many of the recommendations above revolve around building industry collaboration – not just horizontally across the larger companies (e.g. Scottish Power, Siemens, Ørsted, etc.), but throughout the supply chain. Many of the tier 2 and below suppliers face difficulties in recruiting and training that many of the larger companies do not. This is a key theme throughout the Industrial Strategy⁹¹.

Therefore, the Offshore Wind Sector Deal really does need to work for the whole sector – taking all tiers forward together.

⁹¹ Industrial Strategy: Building a Britain fit for the future, HM Government, 2017.

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Annex 2 – Honours Degree Groupings

The subjects highlighted in **red** had no Honours degree achievements in 2015 / 16; but otherwise would have been included in the analysis in section 6.2.3

Broad subject	4-digit JACS code
Civil	(H200) Civil engineering (H290) Civil engineering not elsewhere classified
Design	(H150) Engineering design
Electronic & Electrical	(H600) Electronic & electrical engineering (H610) Electronic engineering (H620) Electrical engineering (H630) Electrical power (H690) Electronic & electrical engineering not elsewhere classified
Environmental sciences	(F660) Geophysics (F700) Science of aquatic & terrestrial environments (F750) Environmental sciences (F751) Applied environmental sciences (F790) Science of aquatic & terrestrial environments not elsewhere classified (F810) Environmental geography (H220) Environmental engineering (H223) Environmental impact assessment
Marine	(C161) Marine biology (F710) Marine sciences (F720) Hydrography (F730) Ocean sciences (H350) Offshore engineering (J610) Marine technology (J690) Marine technology not elsewhere classified
Mechanical	(H300) Mechanical engineering (H390) Mechanical engineering not elsewhere classified
Naval	(H500) Naval architecture

Broad subject	4-digit JACS code
Production / Manufacturing Engineering	(H700) Production & manufacturing engineering (H790) Production & manufacturing engineering not elsewhere classified
Structural	(H210) Structural engineering

Annex 3 – Other Relevant Networks and Fora

The following organisations, networks, fora and agencies are active in the skills arena of the UK offshore wind industry.

Name	Description	Coverage
East of England Energy Group (EEEGR)	EEEGR provides its members with a range of benefits including business introductions, networking opportunities, free job advertising, event discounts and up-to-date industry intelligence (https://www.eeeegr.com/). They run a programme called Skills for Energy (https://www.eeeegr.com/skills-for-energy/) which consists of: • Energy Skills Foundation programme – One-year, NVQ Level 2 pre-Apprenticeship • Degree Programme Support – MSc supporting University of East Anglia's undergraduate and postgraduate energy engineering programmes • Military in the Energy Industry – Providing help, support and guidance to service leavers, including working with those that are serving, have left or are leaving the forces. • Introductory Training Courses – An “introduction to offshore wind” one-day course (suitable for non-technical roles). • Annual Skills for Energy Event – aimed at connecting young people, parents and teachers with energy companies.	East of England region
Energy Skills Partnership (ESP)	The ESP (http://www.esp-scotland.ac.uk/) vision is of a college sector which works collaboratively to deliver the right skills, in the right place at the right time for the energy, engineering and construction sectors, maximising Scotland's economic development and the generation of industry capacity for jobs growth. ESP secured £500k funding to establish the Wind and Marine Training Network, a formal college network to support large-scale renewables across Scotland. ESP has supported the development of the Wind Turbine Technician course, now delivered across the network. ESP have also supported Wind Turbine Technicians to gain other vital qualifications for the wind sector such as working at heights which allows students to gain work placements in industry by gaining first-hand experience of working at heights.	Scotland

Name	Description	Coverage
Offshore Wind Industry Council (OWIC)	The OWIC is responsible for overseeing implementation of the Offshore Wind Industrial Strategy and is the sponsoring body of the Offshore Wind Programme Board. They are currently leading on the development of the Offshore Wind Sector Deal. https://ore.catapult.org.uk/work-with-us/industry/offshore-wind-industry-council/	UK
RenewableUK – Offshore Wind Policy Forum	Policy Forums help form RenewableUK's policy position and industry strategy and are made up of representatives from our membership who are experts in their field. They are open exclusively to RenewableUK members and are designed to provide updates on the latest policy and business news. The Forum is chaired by Jane Cooper of Ørsted https://www.renewableuk.com/events/EventDetails.aspx?alias=offshorepf	UK (RUK members only)
RenewableUK – Skills and Employment Strategy Group	The RenewableUK Skills and Employment Strategy Group aims to identify and address issues on the skills agenda, providing the means for a collaborative and concerted skills strategy for the industry and providing direct input into RenewableUK's policy work. Membership of the group includes industry employers, academia, training providers, and recruitment specialists. RenewableUK's work on the skills agenda includes: • Skills and Employment Strategy Group (SESG) • Renewables Training Network (RTN) • Working for a Green Britain and Northern Ireland employment research • Human Resources Network • Renewables Sector Salary Survey • Job / course listings and careers information • Annual RenewableUK Careers Fair • Educational resources	UK (RUK members only)

Name	Description	Coverage
Subsea UK	Subsea UK is the industry body and focal point for the British subsea industry. We act for the whole supply chain bringing together operators, contractors, suppliers and people in the industry. They provide a national forum for collaboration, diversification, commercialisation of technology and coordinated marketing in the UK and abroad. Key priorities for Subsea UK are: • Ensuring that the UK maintains its world leading position in subsea • Creating a Centre of Subsea Excellence in the UK. • Facilitating programmes that address the key skills shortages in the industry. • Bringing industry, academia and government together to accelerate the development of the next generation of subsea technologies. • Helping member companies diversify into other sectors and other geographical markets.	UK
Skills Industry Leadership Group	To ensure that skills issues across Scotland's energy sector are articulated by industry leaders, understood by the Government agencies and effectively addressed through private and public sector partnerships. To influence and support the Scottish Energy Advisory Board and its industry leadership groups (ILGs) by providing strategic direction on cross cutting energy skills issues Oversee, co-ordinate and evaluate delivery of the Skills Investment Plan for Energy Work collaboratively with ILGs to identify and address key skills issues across Scotland's energy sub-sectors	Scotland
Skills network for European wind energy (WINDSKILL)	Despite the emergence of a European market, staff qualifications are still regulated at local or national level. Windskill is designed to overcome this critical barrier, aiming to create a European Qualification Profile for on- and offshore workers. Appropriate curricula will be developed and tested on approximately 50 workers in Germany, France, Netherlands and Italy. The project will include Europe-wide recognition of the established minimum standards – a major step towards a fully functioning industry and the mobility of its workers. https://ec.europa.eu/energy/intelligent/projects/en/projects/windskill	Europe

Name	Description	Coverage
North Seas Energy Cooperation	This cooperation has two goals: • facilitating the cost-effective deployment of offshore renewable energy, in particular wind • promoting interconnection between the countries in the region Amongst their work areas is a project looking at identifying standards, technical rules and regulations in the offshore wind sector https://ec.europa.eu/energy/sites/ener/files/documents/20161003_support_group_4_strr_web_version_final.pdf) The other areas are maritime spatial planning; development and regulation of offshore grids and other offshore infrastructure; and support framework and finance for offshore wind projects. https://ec.europa.eu/energy/en/topics/infrastructure/north-seas-energy-cooperation	Europe

The following organisations, networks, fora and agencies are active in the UK offshore wind industry but do not have a specific focus on skills. However, some do, when it aligns with their primary ambitions, get involved in promoting or influencing skills provision and solutions within their area / remit.

Name	Description	Coverage
European Platform of Universities in Energy Research & Education (EUA-EPUE)	EUA-EPUE aims at being a central forum in Europe for universities to share ideas for new research and education projects and find interested partners in the field of energy. EUA-EPUE, therefore, seeks to: • Pool the richness and diversity of university expertise to direct efforts towards addressing the EU challenge for the transition to a low-carbon society. • Make visible the substantial contribution of European universities in the implementation of the SET-Plan and EU energy strategies. • Give to universities the opportunity to have a collective voice in consultations on European energy matters. • Act as a sustainable open platform that facilitates the creation of synergies between universities and fosters intra-European and multi-disciplinary collaboration. http://www.eua.be/policy-representation/research-innovation-policy/european-platform-of-universities-in-energy-research-education	Europe
European Energy Research Alliance (EERA) Joint Programme on Wind	The mission for EERA JP Wind is to provide strategic leadership for medium to long-term research and to support the European wind energy industry and societal stakeholders. The joint programme brings together all public research organisations in Europe with substantial research and innovation efforts in wind energy. EERA JP WIND aims to provide its members with the following benefits: • Support R&D managers in institutions • Influence EU strategic research priorities • Access a unique pool of knowledge, data and research facilities • Being part of globally leading network of wind energy researchers https://windeurope.org/	Europe

Name	Description	Coverage
European Technology & Innovation Platform for Wind Energy (ETIPWind)	ETIPWind connects Europe's wind energy community - industry, political stakeholders and research institutions. The scope of ETIPWind is to create a virtual and physical platform via which the wind energy community can communicate, coordinate and collaborate its work and activities related to research, innovation and technology. The ambition is to define and agree on concrete research and innovation priorities and communicate these to the European institutions and other decision-making bodies in order to support the ambition of reaching the RES targets for 2020. ETIPWind thus advises policy makers in a systematic and coordinated way, facilitating collaboration and sharing information with all wind energy stakeholders. https://etipwind.eu/	Europe
National Subsea Research Initiative (NSRI)	The National Subsea Research Initiative (NSRI) is the research arm of Subsea UK. It has been set up to bring academia and industry together to collaborate on getting technology to market much more quickly. The NSRI aims to be the focal point for the co-ordination of research and development activities for the UK's subsea sector. http://www.nsri.co.uk/	UK
Offshore Renewable Energy Emergency Forum (OREEF)	The primary objective of the group is to act as a forum to improve industry knowledge and emerging good practice on the prevention and response to offshore emergencies taking account of the unique challenges encountered with the current and proposed development of Offshore Renewable Energy Installations (OREI). http://www.renewableuk.com/page/OREEF	UK
Offshore Wind Industry Group (OWIG)	The Offshore Wind Industry Group (OWIG) was formed to provide a forum for the public sector, offshore wind developers and other parties to drive the success of the industry into Scotland. The role of the Group is to identify and take forward the actions necessary to support the industry in realising the fullest economic and environmental benefits for Scotland. http://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/offshorewind	Scotland

Name	Description	Coverage
Offshore Wind Innovation Hub	The Offshore Wind Innovation Hub is the UK's primary coordinator for innovation, focusing on offshore wind energy cost reduction and maximising UK economic impact https://offshorewindinnovationhub.com/	UK
Offshore Wind Programme Board (OWPB)	The board brings together senior representatives from industry (including developers and supply chain), UK government, The Crown Estate and Statutory Nature Conservation Bodies. The board's objective will be to implement the Task Force's recommendations to drive cost reduction, to treat the UK's offshore wind sector as one business by assessing risks and barriers and tackle these by helping to find and implement solutions in partnership with the wider industry. https://ore.catapult.org.uk/work-with-us/industry/offshore-wind-programme-board/	UK
Scottish Renewables – Offshore Wind Network	Scottish Renewables is the voice of renewable energy in Scotland and is committed to realising the full economic, social and environmental benefits of renewable energy for our country. We believe that both Scotland and the UK benefit from a strong renewable energy sector in Scotland that delivers jobs and investment, while cutting our carbon emissions and securing our energy supplies. In representing our members, we aim to lead and inform the debate on how the growth of renewable energy can help sustainably heat and power Scotland's homes and businesses. http://www.scottishrenewables.com/sectors/list/offshore-wind/	Scotland
Subsea North East	Subsea North East promotes the North East of England as a world class centre for offshore technologies and solutions around subsea; encourages closer collaboration across the sector in the region; showcases the businesses, which are leading subsea developments around the world; demonstrates the importance of the sector to the region; and highlights future projects and opportunities for the sector and supply chain. https://www.nofenergy.co.uk/subsea-north-east/	North East

Name	Description	Coverage
SUPERGEN Wind Hub	The Supergen Hub brings together the underpinning research efforts in Wind Energy in the UK and links them more strongly to the development research being supported by other funding organisations. The SUPERGEN Wind Hub currently includes the Universities of Strathclyde, Durham, Loughborough, Cranfield, Manchester, Oxford, Surrey, Bristol, Imperial and Dundee alongside STFC Rutherford Appleton Laboratory, DNV GL and the Offshore Renewable Energy Catapult. The Hub is funded for five years to 2019. The aim of the Hub is to continue to develop the important academic, industrial and policy linkages that were established during the earlier phases of the SUPERGEN Wind programme (2006-2014), and to lead the technology strategy for driving forward UK wind energy research and for exploiting the research outcomes. https://www.supergen-wind.org.uk/	UK
WindEurope	WindEurope is the voice of the wind industry, actively promoting wind power in Europe and worldwide. They actively coordinate international policy, communications, research and analysis. They analyse, formulate and establish policy positions for the wind industry on key strategic sectoral issues, cooperating with industry and research institutions on several market development and technology research projects. Additionally, the lobbying activities undertaken by WindEurope help create a suitable legal framework within which members can successfully develop their businesses.	Europe

The following **Local Enterprise Partnerships** have recognised the importance of the offshore wind industry to their economies:

Name	Description
Coast2Capital Between Portsmouth in the east and Eastbourne in the east)	Although they have no specific priority sectors, they do recognise the potential of a growing offshore industry – particularly as Newhaven is E.ON's O&M base for the Rampion wind farm.
Cornwall and the Isles of Scilly	The wider energy sector is recognised as a significant potential opportunity, including the development and deployment of new and innovative offshore technologies. They are positioning themselves to be at the forefront of new technology developments by providing a testbed, particularly around offshore generating and establishing regional energy systems.
Greater Lincolnshire	Low carbon – There are major opportunities for growth in offshore wind as well as in the development of other low carbon goods and services. We will collaborate with our partner LEPs (Humber and New Anglia, both centres of offshore renewable excellence) to support delivery of this important activity. It will become the biggest Enterprise Zone in the UK and will position the area as one of the major hubs for the renewables sector in the UK. These developments will further unlock the economic potential of the Humber estuary, and help to stimulate growth in North Lincolnshire, North East Lincolnshire and Lincolnshire. Proposed developments will significantly increase demand for skilled engineers to support both construction and O&M and require employers to up-skill their existing workforce to meet evolving industry training standards. Ports and logistics – Our ports and logistics sector will continue to underpin growth of our key sectors as well as generating opportunities for wider economic growth.
Heart of the South West LEP	Although not a strategic strength of the area, it is recognised that they have world class offshore wind resources, including the South West Marine Energy Park, which is developing 9,200MW of marine energy and offshore wind by 2020.

Name	Description
New Anglia (LEP for Norfolk and Suffolk)	Focus on energy and ports and logistics. Norfolk & Suffolk are leading the way in delivering sustainable and low carbon energy solutions to underpin economic growth across the UK. The Southern North Sea currently plays host to over 150 offshore gas assets, together with 986 offshore wind turbines generating 3.75GW of renewable power directly off the region's coast, with an additional 1,000+ turbines generating some 14GW of offshore wind power to be installed over the next decade. The sector is driving down costs through innovation and collaboration, developing new technologies across our energy system, maximising offshore production and generation. The New Anglia LEP has commissioned an Energy Sector Skills Plan for New Anglia. This is being compiled by Skills Reach and will cover offshore wind skills, workforce supply, opportunities and challenges.
North East LEP	North East Enterprise Zone - Offering a range of sites for investment into advanced manufacturing, around the Blyth Estuary, sites build on the presence of the Offshore Renewable Energy Catapult with a focus on supporting businesses linked to offshore energy and marine engineering. Along the north bank of the Tyne three sites support the region's wider CORE (Centre for Offshore Wind and Renewable Engineering) status as a focus for business growth. Tyne Offshore Centre - The Tyne Offshore Centre, a collaboration between Newcastle University and British Engines, is a major research and hyperbaric testing facility located on the north bank of the Tyne sitting in close proximity to offshore manufacturing and production businesses located on Tyneside. Business support - The oil and gas sector is fluctuating as a result of changes in oil price, but our businesses have significant opportunities for diversification, in particular into other energy sectors. New manufacturing support services will help diversification and growth. National Centre for Energy Systems Integration - The creation of the £20m National Centre for Energy Systems Integration (CESI) at Newcastle Science Central will bring together energy expertise from across the world to work collaboratively on future networks for the supply and demand for energy.

Name	Description
Solent LEP	Solent has strengths in emerging sectors and technologies, such as composite manufacturing, marine autonomous systems, offshore wind and tidal energy; sectors in which our skills and innovation assets can give us first to market advantage. The Isle of Wight is now a major site for the development of composite materials, used by GKN (Airbus), GURIT (Automobile and Marine), BAE systems (warships), local boat-builders and Vestas' wind turbine blade research and testing facility. In August 2017 they held an Offshore Wind Sector Deal Roundtable -
South East LEP	Low carbon environmental goods and services , including SE LEP status as a nationally designated Centre for Offshore Renewable Engineering.
Tees Valley LEP	Tees Valley is leading developments in the renewable sector. It boasts a growing cluster of biomass, biofuel, bioethanol and energy from waste plants. It also has plans to develop Europe's first Industrial Carbon Capture and Storage (ICCS) equipped industrial zone. There is an increasing demand to build renewable energy assets, in particular offshore wind, and Tees Valley has been awarded UK Government CORE status as a Centre for Offshore Renewable Engineering. This is in recognition of the area's existing port infrastructure, available skills and supply chain and will enable rapid growth in the offshore wind sector. The region benefits from good access to supply chains and from 16.5GWE of wind farm development within easy reach of port sites. Its main advantage over rival locations is its proximity to the northern North Sea, which experiences higher than average wind speeds than anywhere else in Europe.
York, North Yorkshire and East Riding Enterprise Partnership	While they have no specific focus on offshore wind, they do recognise and support the development of the offshore wind industry.

Annex 4 – Potential Apprenticeship Frameworks and Standards

The following Apprenticeship frameworks and standards have been identified as being potentially relevant to employers in the offshore wind industry:

Level 2
Construction Civil Engineering: Steelfixing
Construction Civil Engineering: Steelfixing Occupations Major Projects
Construction Steel Fixer
Engineering Manufacture: Engineering Maintenance and Installation
Engineering Manufacture: Fabrication and Welding
Engineering Manufacture: Marine (Ship, Yacht, Boatbuilding, Maintenance and Repair)
Logistics Operations: Logistics Operative
Logistics Operations: Logistics Support Operative
Management: Team Leading
Maritime Occupations: Able Seafarer / tug rating - engine room
Maritime Occupations: Port Operations
Maritime Occupations: Workboat Operation
Supply Chain Management: Supply Chain Operations

Level 3
Civil Engineering Technician
Engineering Construction: Electrical Installation
Engineering Construction: Electrical Maintenance
Engineering Construction: Instrument and Control
Engineering Construction: Mechanical Fitting
Engineering Construction: Mechanical Maintenance
Engineering Construction: Project Control
Engineering Construction: Steel Erecting
Engineering Manufacture: Electrical and Electronic Engineering
Engineering Manufacture: Engineering Maintenance
Engineering Manufacture: Engineering Leadership
Engineering Manufacture: Installation and Commissioning
Engineering Manufacture: Marine (Ship Building, Maintenance and Repair)
Engineering Technician
Construction Technical and Professional: Geomatics Data Analysis
Logistics Operations: Logistics Operations Team Leader / Section Supervisor
Maintenance and Operations Engineering Technician
Marine Engineer

Level 3

Maritime Occupations: Officer of the watch on merchant vessels of less than 500 gross tonnage - near coastal

Maritime Occupations: Officer of the watch on merchant vessels of less than 3,000 gross tonnage - near coastal

Maritime Occupations: Merchant Navy (Deck)

Maritime Occupations: Merchant Navy (Engineering)

Power network craftsperson

Project Controls Technician

Supply Chain Management

Surveying technician

Team leader / supervisor

Utilities engineering technician

Warehousing and Storage: Senior Warehouse Person / Team Leader

Level 4

Associate project manager

Electrical Power Networks Engineer

Electrical power protection and plant commissioning engineer

Manufacturing Engineering: Electrical / Electronics

Manufacturing Engineering: Maintenance

Manufacturing Engineering: Marine

Manufacturing Engineering: Mechanical

Manufacturing Engineering: Wind Generation

Project Management

Level 5

Supply Chain Management: Supply Chain Specialist

Supply Chain Management: International Supply Chain Manager

Level 6

Chartered manager degree apprenticeship

Chartered surveyor

Civil Engineer

Construction Management: Construction Site Management

Construction Management: Management Quantity Surveying and Commercial Management

Control / technical support engineer

Electrical / electronic technical support engineer

Level 7
Power Engineer
Postgraduate Engineer

Energy & Utility Skills

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