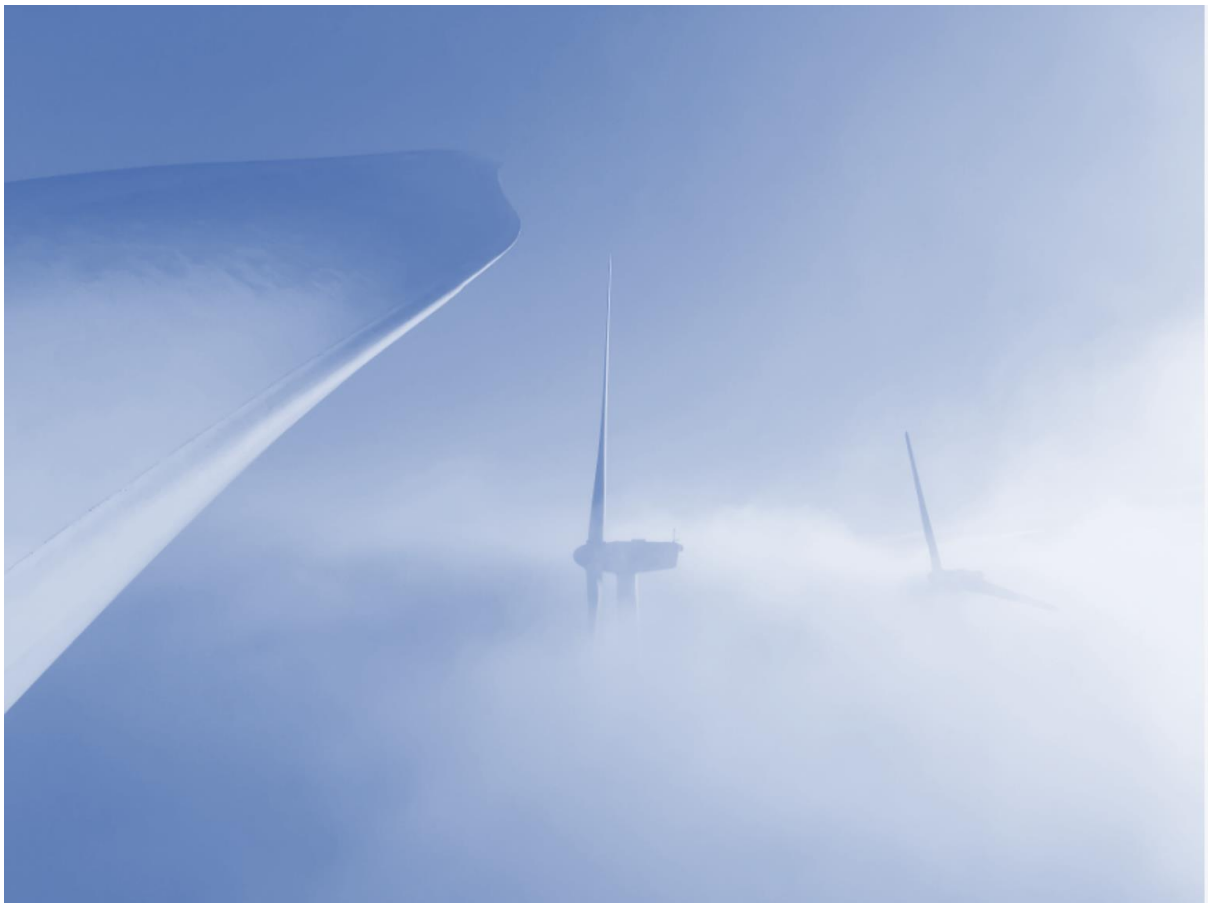
Future UK Employment in the Offshore Wind Industry



A report commissioned by the University of Hull on behalf of Aura.

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Executive Summary

- Cambridge Econometrics has produced a new projection for employment in the **UK offshore wind industry** over the period 2017 and 2032 using a proprietary employment model[1].
- The model uses the latest assumptions of UK and EU offshore wind capacity growth and the UK content of those value chains to produce employment projections.
- The projections cover direct, indirect and induced employment, as well as employment by activity type and occupational level.
- Central, low and high scenarios were developed, based on different assumptions for the development of UK and EU offshore wind capacity installation.
- The findings suggest that by 2032, the total amount of direct employment in the UK offshore wind sector could be in the region of **21,000 FTE jobs**. Currently there are ca 10,000 FTEs jobs in the sector.
- Indirect and induced employment relating to the industry could result in an additional **37,000 FTE jobs** by 2032.
- Thus, the sector is expected to support close to **60,000 FTE** jobs in the UK by 2032.
- An approximate regional breakdown of direct employment in 2025 was also calculated. This shows that the bulk of employment is expected to be along the east coast of England, with a peak concentration of employment found in the Humber area.

[1] The employment projection model was developed by Cambridge Econometrics for RenewableUK. RenewableUK's permission to use the model for this study is acknowledged with thanks. Responsibility for the projections published here lies with Cambridge Econometrics.

Introduction

The UK Offshore Wind Industry has seen a period of significant growth in the past decade, growing from 1.3GW in 2010 to 5.1GW as of 2016, an almost 400% increase in just 6 years, and is on trajectory to reach the 10GW mark as early as 2020.

Given this, it is valuable for policy makers to understand the implication of this relatively rapid market growth for employment. Cambridge Econometrics was contracted by the University of Hull, on behalf of Aura, to produce a report updating previous employment projections for the offshore wind industry. The previous report, published in 2013 in conjunction with RenewableUK, projected employment figures out to 2023.

The objectives of this exercise are:

- An update of projected employment in the **UK offshore wind industry**
- Projections of **direct and indirect employment** (as in the earlier studies for RenewableUK) out to 2032 with **updated assumptions** under **alternative scenarios** of:
    - UK deployment
    - global deployment
- A breakdown of those projections by:
    - **region -** both NUTS2 region and coastal region[2] distribution.
    - **activity** (as identified in the 2013 study)
    - **occupation** (as identified in the 2013 study[3])
    - **broad industrial group** for indirect employment

The Employment Model and Approach

Model overview

This report presents updated employment projections for the offshore wind sector using an employment model originally developed for RenewableUK. The model was last applied to develop the employment projections presented in "Working for a Green Britain & Northern Ireland 2013–23", referred to here as "the 2013 study".

The purpose of the model is to generate projections of employment in the UK offshore wind sector under alternative assumptions about the future, including:

- future UK capacity
- future world capacity (some of which will draw on UK exports of both services and manufactured components)

The model then generates projections of:

- *direct employment*: jobs that relate specifically to offshore wind activities
- *indirect employment*: those jobs outside of the offshore wind energy sector but which are part of the supply chain to the sector
- *induced employment*: additional employment that is generated because of the wages paid to workers in direct and indirect employment associated with offshore wind - for example, helping to support industries like retail

[2] Defined by the University of Hull

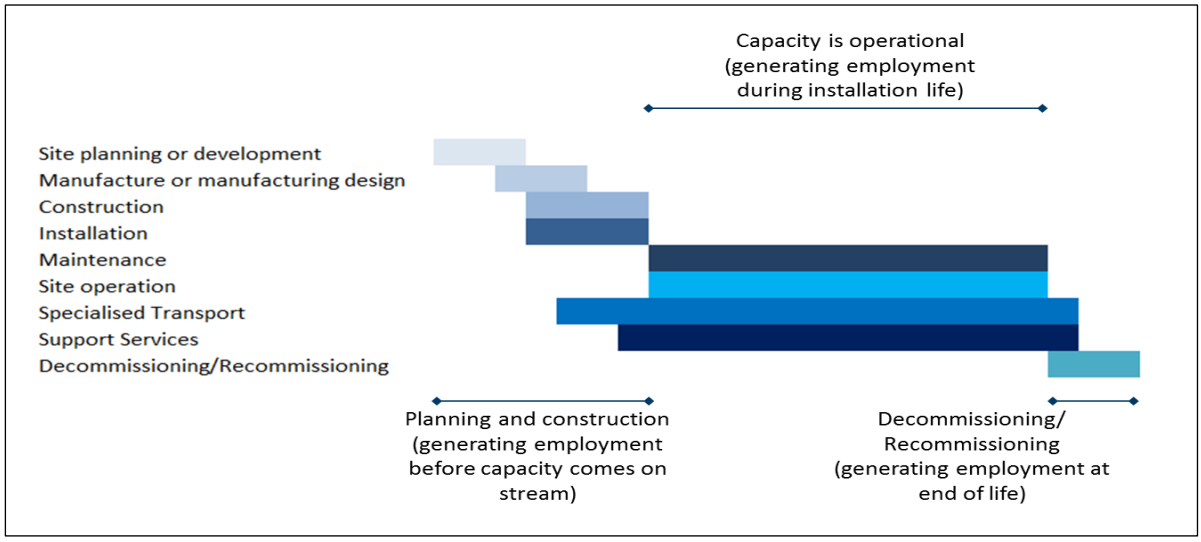
[3] Management; Technical/professional; Skilled manual / technical; Semi-skilled/operative; Other.

- total employment[4]

The model captures the entire lifecycle of offshore wind assets, such that each MW of installed capacity must, at some point prior to its operation, have required planning, development, construction, installation and manufacturing activities. Over the course of the asset life, it must then be operated and maintained (with consequent requirements for transport and maintenance services). Finally, at the end of life, the asset will either be decommissioned or recommissioned (repowered). This lifecycle is summarised in Figure 1.

The survey conducted for the 2013 study identified for each technology and activity a level of employment and output associated with MW capacity. These ratios form the starting point for the projections and, combined with assumptions on learning over time ('efficiency' or 'labour productivity', which lowers the ratio of employment to capacity), the model generates projections of direct employment, taking into account the lifecycle of offshore wind assets.

Figure 1: Lifecycle of Offshore Wind Assets



To calculate the indirect employment impacts, the model first converts employment into a common unit across industries: monetary values in £m. These are fed into an 'input-output table' that depicts transactions within an economy in a particular period (typically for one year). The input-output table shows the breakdown of each £ of output by the value of its inputs. These inputs are purchased from other sectors and those sectors in turn must purchase inputs to production. In this way, an input-output table tracks the dependencies between sectors of an economy, such that one unit of output in one sector generates requirements for output (and thus employment) elsewhere in the economy.

The model embodies a modified version of the most recent official input-output table for the UK, with the offshore wind energy sector split out from those sectors identified in the original table.

In this way, it is possible to trace the effect of an increase in offshore wind energy activity on output and employment elsewhere in the economy.

[4] The sum of direct and indirect employment is referred to, in economics, as the Type I employment impact while the sum of the direct, indirect and induced employment is known as the Type II impact.

Input Assumptions

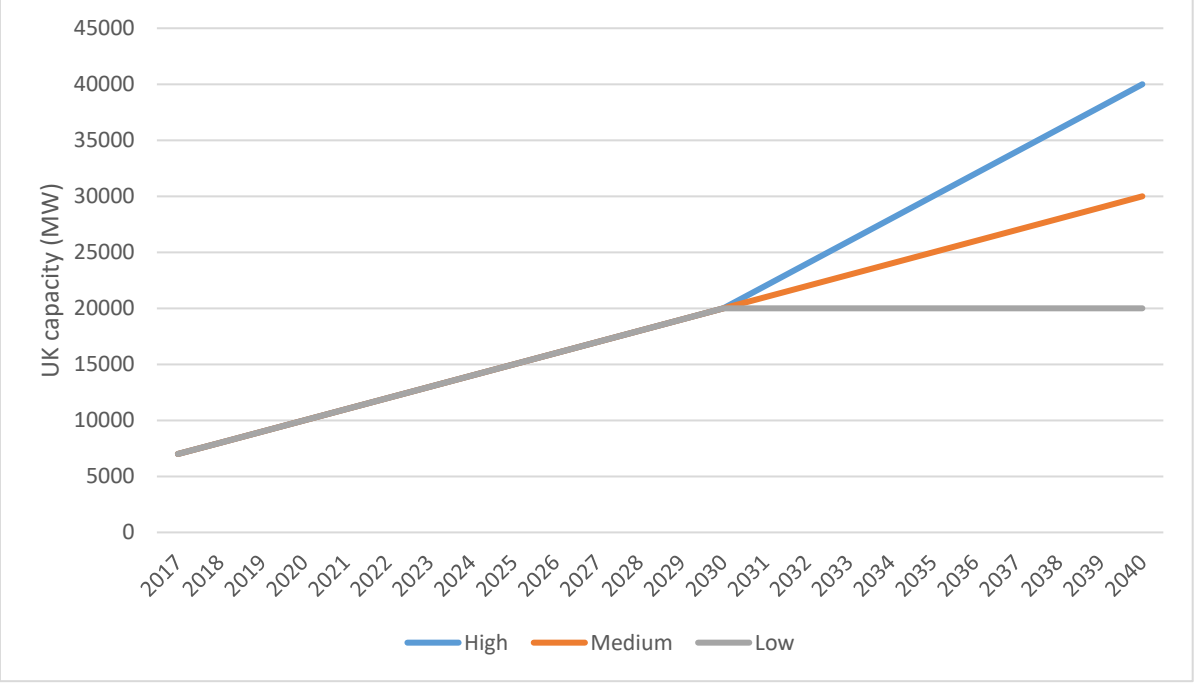
Assumptions were made about the following inputs:

- UK projected offshore wind capacity
- EU projected offshore wind capacity
- UK content of UK offshore wind investment
- UK content of EU offshore wind investment
- Prospect of future decommissioning/recommissioning activities
- Industry wide learning rates
- Average windfarm size and resulting economies of scale from this increasing over time
- Current and potential future locations of UK offshore windfarms.

UK projected offshore wind capacity

The employment projections are driven by information on the expected rate at which additional OSW capacity comes onstream in the future. The capacity data we have used is sourced from RenewableUK's OSW tracker database on actual and planned windfarm developments. This predicts that by 2030 installed capacity will have reached 20 GW. Although any projection of the future is uncertain, there seems to be a large degree of consensus around this rate of deployment within the industry, so no alternative scenarios have been considered for the period to 2030. From 2030, we have modelled three scenarios of capacity growth to 2040 - low growth (20 GW), medium growth (30GW) and high growth (40 GW) scenarios. These align to the low, medium and high estimates of UK OSW capacity predicted by the TINA report[5] to 2050.

Figure 2: UK capacity assumptions

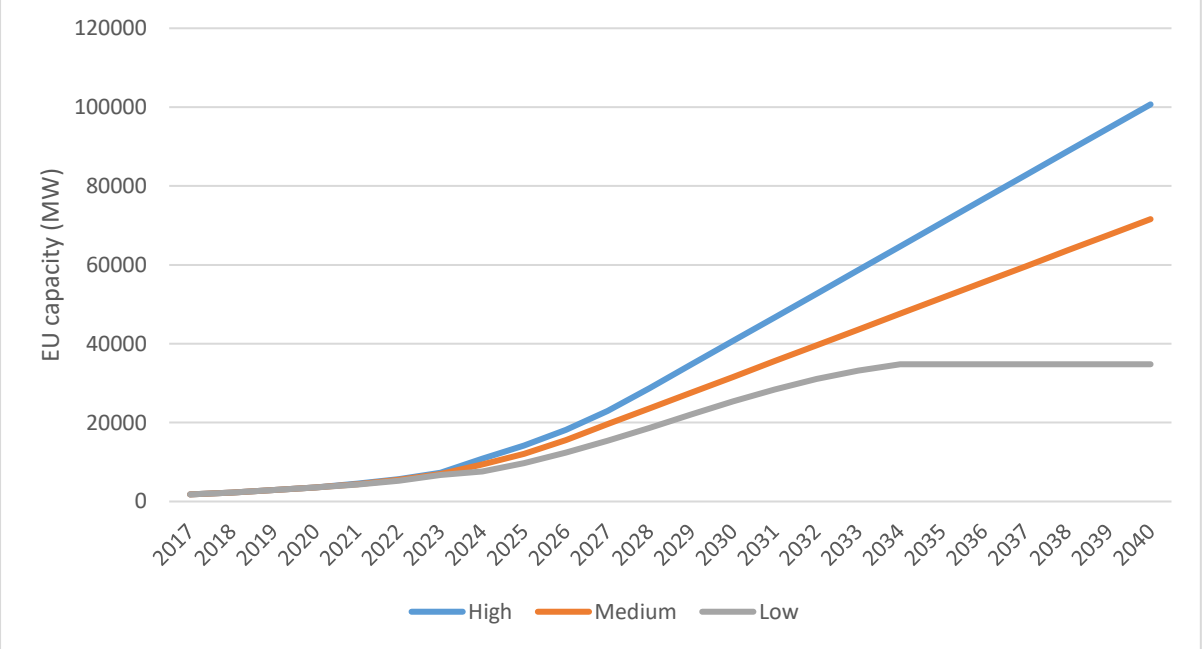


[5] Technology Innovation Needs Assessment (TINA) Offshore Wind Power Summary Report February 2016.

EU projected offshore wind capacity

The EU projections were taken from WindEurope[6] projections for 2030. The period 2017 to 2023 was anticipated to follow a single path, with divergence happening between 2023 and 2030. Between 2030 and 2040, future growth scenarios were developed that tied in with UK scenarios, in which the central and high scenarios continued at the same rate as the 2023-2030 period, and the low scenario plateaued at the 2030 capacity.

Figure 3: EU offshore wind capacity deployment



UK content of UK and EU offshore wind investment

UK content refers to the proportion of the value chain that is met by UK suppliers. The 2017 figures are based on two sources: the central estimates in the BVG Associates report '*UK Content of Operating Offshore Windfarms 2015*'[7], and the OREC report of March 2017[8]. Since then, we have seen further developments such as the Siemens Manufacturing plant on the Humber, so further adjustments to the BVG data have been made to allow for this.

Future projections of UK content assume steady growth towards the upper bounds of projections as the UK industry develops, in line with the assumptions in the Statkraft report[9], which suggests an overall UK content rate approaching 60% by 2030. The OREC report is marginally more bullish, suggesting 65% UK content by the same point.

The overall projections of UK content of EU deployment (excluding the UK) are aligned with the figures from the Statkraft report (referenced above), with the distribution between activity types taken from the RUK report.[10] This sees the UK content of (non-UK) EU projects rise to 20% by 2030.

[6] Wind energy scenarios for 2030, Wind Europe, 2016

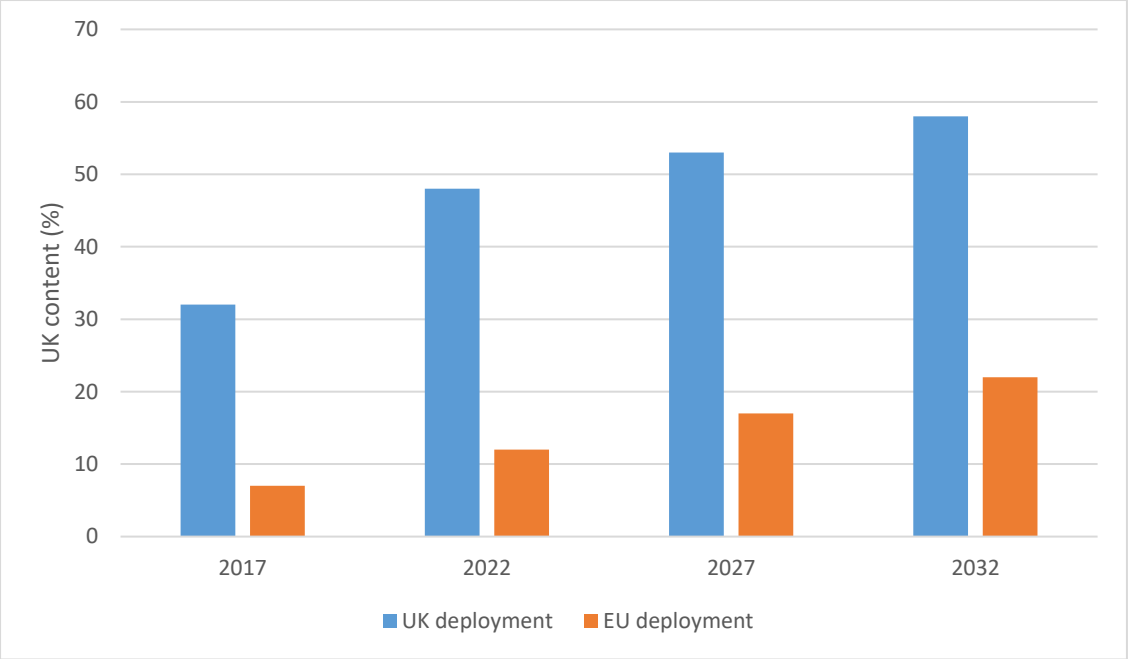
[7] The UK content of operating offshore wind farms, BVG Associates, November 2015

[8] The Economic Value of Offshore Wind, ORE Catapult, March 2017

[9] Offshore wind: delivering more for less: an independent analysis commissioned by Statkraft UK, BVG Associates, July 2015

[10] Exporting Offshore Wind, Renewables UK, October 2016

Figure 4: UK content of UK and EU offshore wind value chain



Prospect of future decommissioning/recommissioning activities

In 2013, it was projected that employment in this area would stay flat at around 50 FTE jobs. As no offshore wind farms are likely to go offline for the next 15 years, this is unlikely to change significantly. Around 2025, we may see some increased activity in this area.

Industry-wide learning rates

Industry-wide learning rate is an efficiency measure based on the premise that, over time, the industry should become more experienced and therefore productive. A 9% learning rate was assumed for the 2013 study - representing an increase in efficiency of 9% for every doubling of total capacity deployed in the UK. The same learning rate has been used for the 2017 study. There is not much data in this area, but similar figures[11] from IRENA suggest the learning rate could be as high as 16% (including R&D). Therefore 9% is a relatively conservative estimate: a higher rate would reduce the employment projections, since slower learning represents slower gains from productivity improvements.

Average site size and resulting economies of scale

The site-size adjustment was used in the 2013 report and captures the trend that the average size of an offshore wind site is growing over time, and in doing so bring increasing returns to scale. Estimates are taken from the offshore wind TINA[12], and corresponds to wind farm size growth from 300MW in 2015 to 1000MW 2030.

[11] Innovation Outlook: Offshore Wind, International Renewable Energy Agency, 2016

[12] Technology Innovation Needs Assessment (TINA) Offshore Wind Power Summary Report February 2016

Findings

Currently, given assumptions to 2040, the model generates 15-year employment projections (2017-2032) for:

- **Direct employment**, broken down by:
  - technology
  - activity
  - region
- **Indirect employment** in industries that are part of the OSW supply chain such as generic manufactured goods (ie. tools) but also, say, office supplies and business services (ie. accounting and other business services). As such, the location (region) of these activities cannot be known or reasonably assumed without detailed knowledge of the contractual relationships with suppliers.

The difference in time horizon between the assumptions (to 2040) and the results (to 2032) reflects the nature of the lifecycle for offshore wind assets. Employment in offshore-wind planning and development activities in 2032 depends on the scale of offshore wind deployment that is expected out to 2040, because of the considerable lead-in period for projects of this kind[13].

Between 2017 and 2022 direct employment follows a single trajectory. Between 2023 and 2032, the different scenario assumptions relating to UK and EU future MW capacity begin to be reflected in the employment impacts measured in Full-Time Equivalent (FTE) units[14].

The *central scenario* projects steady growth throughout the next 15 years, reaching a figure of approximately 21,000 FTE jobs by 2032.

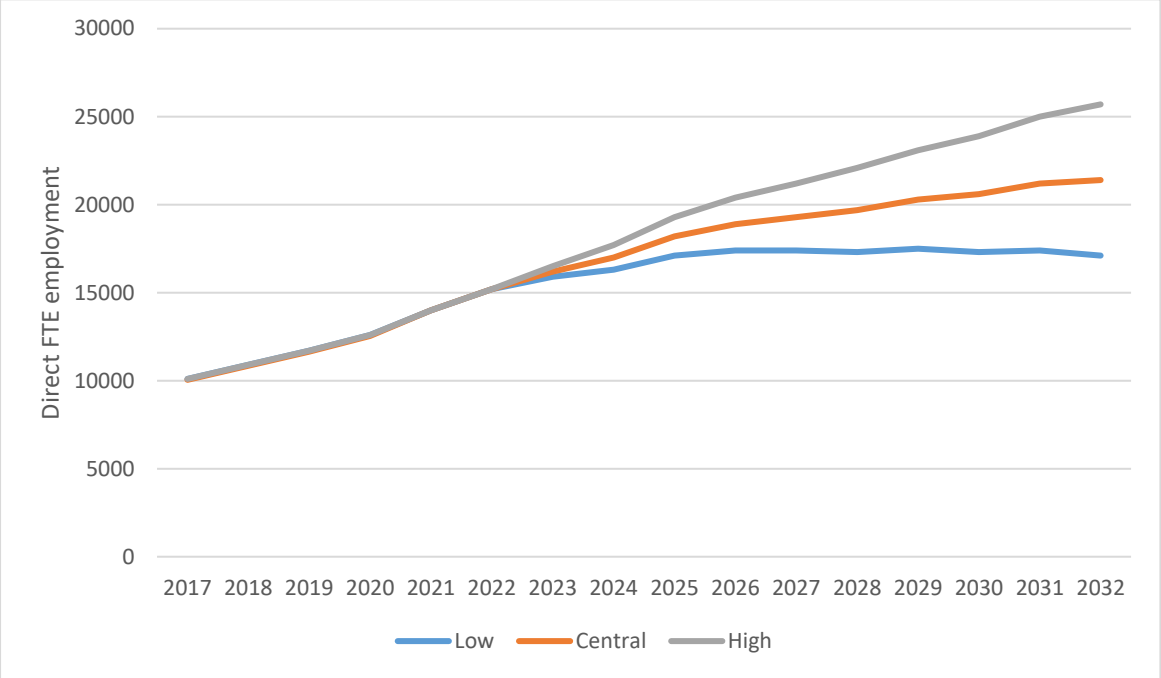
The *low* scenario reaches a figure of around 17,500 FTEs by 2025 and then plateaus. This scenario represents a future with lower demand for offshore wind electricity, for example because of high efficiency levels in demand sectors, or high degrees of penetrations of alternate technologies.

Finally, the *high* scenario forecasts growth to over 25,000 FTEs by 2032. The high scenario might correspond to a future with very high electricity demand, for example due to success in electricity storage and strong electric vehicle take-up, in which offshore wind becomes a major part of a low carbon electricity mix for the UK.

[13] This is an assumption built into the model.

[14] Full-Time Equivalent (FTE) employment is a measure of the number of employees in a firm or sector. Employees who regularly work more than 30 hours per week are counted as one FTE, while those that work part-time (less than 30 hours per week) are counted as half a FTE. This is in order to measure the 'effective' number of full-time employees.

Figure 5: Direct FTE employment in the offshore wind sector under three scenarios



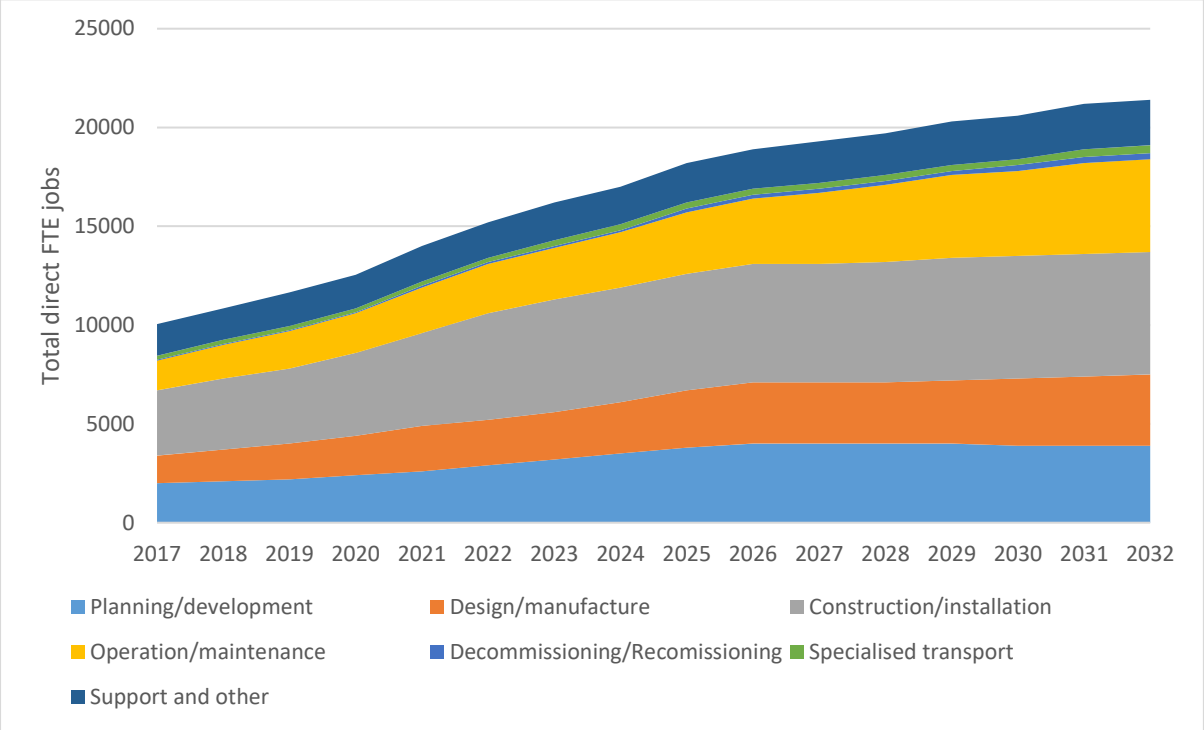
Direct Employment by Activity

Direct Employment has also been disaggregated by activity. This study identifies the following activities within the offshore UK wind energy sector, covering the entire asset lifecycle:

- **Site planning and development** refers to all activities that relate to the planning and development of offshore wind energy sites;
- **Manufacturing and design** covers activities that relate directly to the design and manufacture of offshore wind energy components. It excludes the manufacture of generic components (which would be classified as an indirect economic activity).
- **Construction** refers to the construction of civil/maritime industry-specific components of offshore wind farms, including 'balance of plant' (but excluding general infrastructure, such as roads leading to sites);
- **Installation**, covering the installation of offshore wind turbines and electrical components of devices specific to 'balance of plant';
- **Operations and maintenance**, covering activities related to the operation and running of offshore wind sites, as well as servicing of devices on those sites, electrical components and 'balance of plant';
- **Specialist transport** covers transport activities that relate specifically to transport of employees and components to and from offshore wind sites, possibly requiring specialist transport equipment to specifically service sites;
- **Decommissioning/ recommissioning** concerns offshore wind energy sites that have reached the end of their operational life and are either dismantled or repowered;
- **Specialist support services and other** covers the wide range of offshore wind energy-specific activities not covered by any of the above.

Different activities have different relationships with overall offshore wind capacity, with some activities correlating with total capacity or number of sites, and other activities with increases in capacity. Figure 6 shows the disaggregation of direct employment by activity for the central scenario, for each year in the next 15 years.

Figure 6: Total direct FTE jobs by activity type (central scenario)

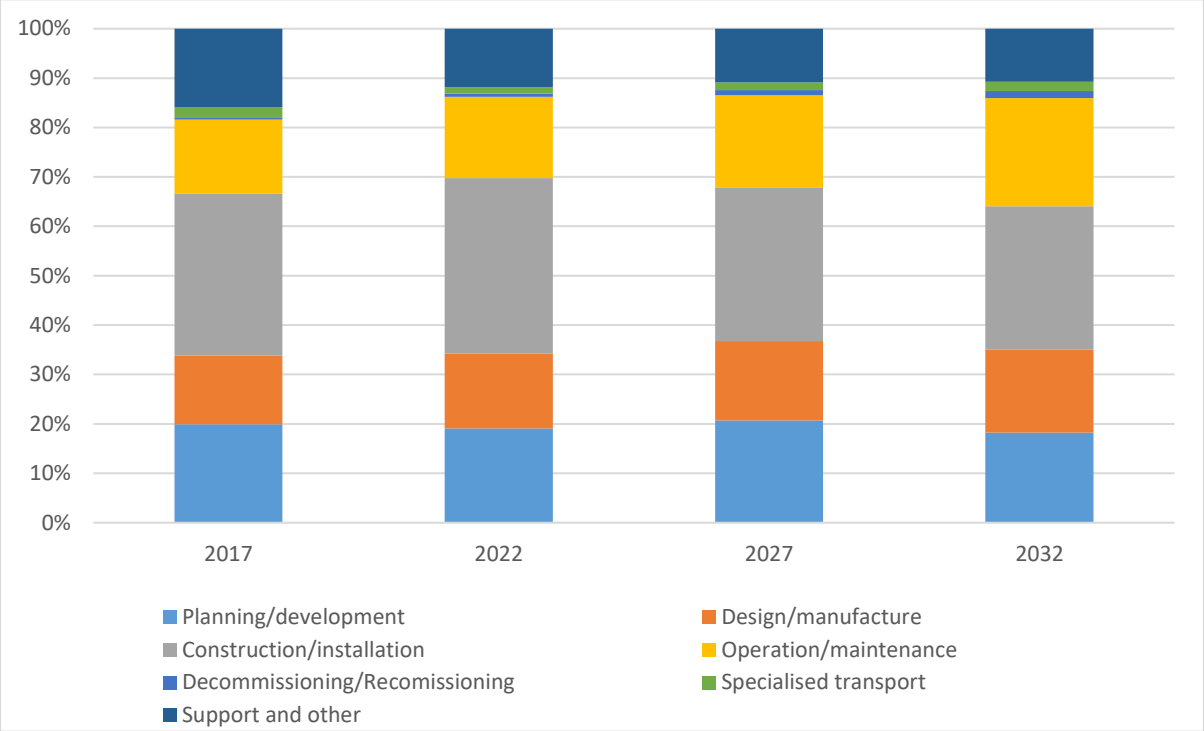


The key results are as follows:

- **Site planning and development, and manufacturing and design, construction and installation** are driven by *increases* in capacity, but with varying lead-in times of up to 7 years. Employment in these activities can be seen to grow steadily until the middle of the next decade, and remaining steady thereafter, as the positive employment effects of increased UK content are offset by increased levels of efficiency in the sector.
- **Operations and maintenance** employment is driven by *total* operational capacity and the number of sites. As total capacity continues to increase year-on-year, this activity can be seen to continue to grow through to 2030 and beyond.
- **Specialist transport** and **Specialist support services and Other** grow with industry wide employment across the four main activities. It shows a steady increase in employment throughout the period.
- In line with the assumption outlined above, employment in **decommissioning/ recommissioning** remains flat until towards the end of the next decade, when the end of lifetime of several existing sites moves into view.

Figure 7 below shows the distribution of employment by activity as a % of total direct employment.

Figure 7: Total direct employment by activity type (%)



Direct Employment by Occupation

The 2013 study also measured the percentage of employees engaged in each activity who fell into one of five defined occupational groups. These groups are tailored aggregates of the ONS SOC code major groupings.[15]

Management

- Major Group 1: Managers, Directors and Senior Officials

Technical Professional

- Major Group 2: Professional Occupations
- Major Group 3: Associate Professional and Technical Occupations

Skilled Manual

- Major Group 5: Skilled Trades Occupations

Semi-Skilled

- Major Group 8: Process, Plant and Machine Operatives
- Major Group 9: Elementary Occupations

Support

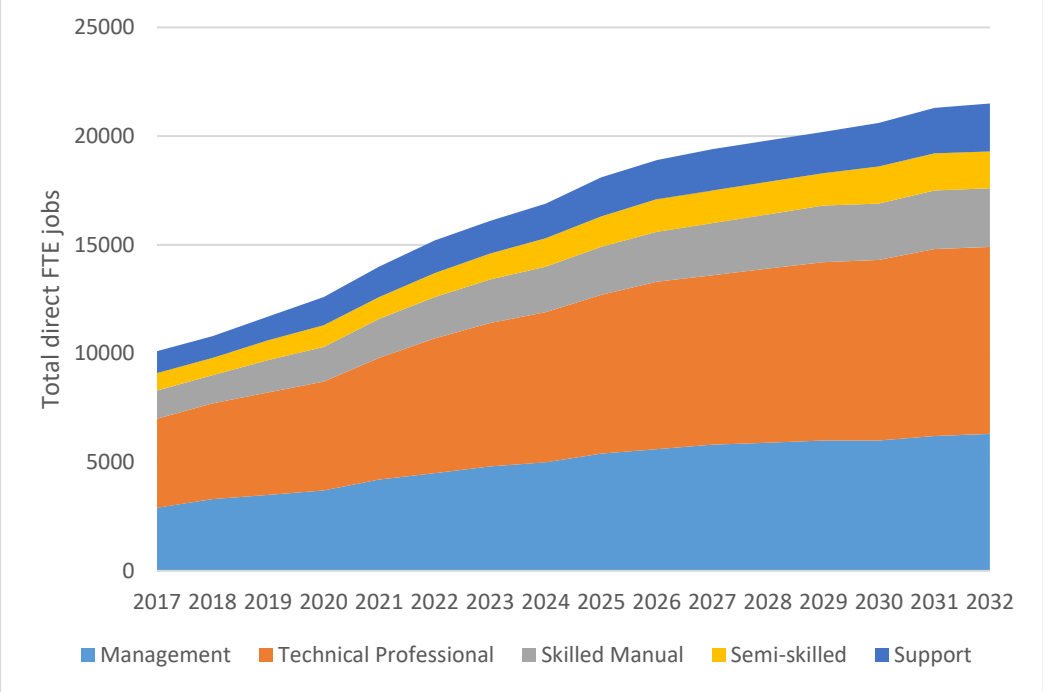
- Major Group 4: Administrative and Secretarial Occupations
- Major Group 6: Caring, Leisure and Other Service Occupations
- Major Group 7: Sales and Customer Service Occupations

It is assumed that, for the majority of activities, the distribution of occupations in each activity would likely follow that seen in the 2013 (with primary data derived from a large-scale survey of employers in the sector at this time). The exception is the manufacturing activity which

[15] ONS Standard Occupational Classification (SOC) Hierarchy 2010

has changed significantly since 2013 with the opening of the Siemens blade plant. Thus, for this activity, a more general industry-wide occupational distribution has been assumed.[16]

Figure 8: Total FTE direct jobs by occupation type



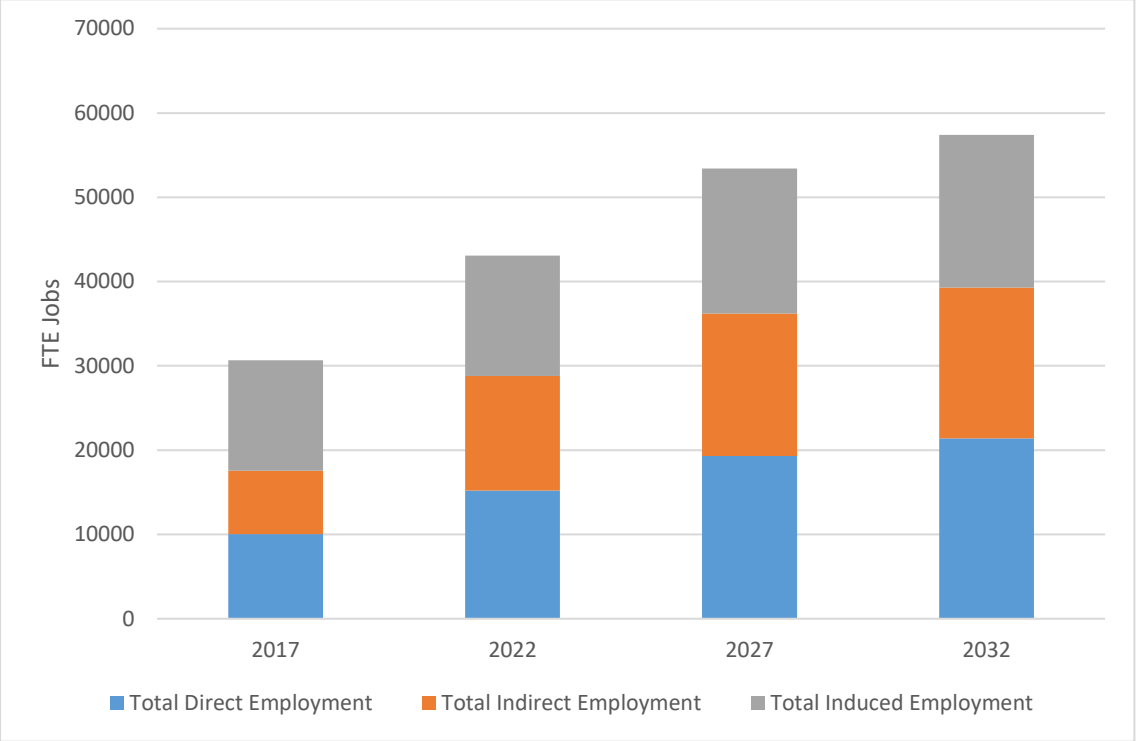
The projections shown above, consistent with the central employment scenario, suggest that most occupational categories will experience similar levels of relative growth. As the current largest occupational category, the technical / professional occupational category is projected to see the greatest absolute growth in jobs over the next 15 years.

Indirect and Induced Employment

Indirect and induced employment projections were also produced. Indirect employment is projected to increase from approximately 7,500 FTE jobs in 2017 to 18,000 FTE jobs by 2032, whilst induced employment, which is the measure of employment associated with spending out of higher incomes, is projected to increase at a slower rate, from approximately 13,000 FTE jobs to approximately 18,000 FTE jobs by 2032.

[16] No specific occupational data for the Siemens blade plant has been provided to date which would enable further refinement

Figure 9: Total FTE jobs supported by the UK offshore wind industry



Taking the sum total of direct, indirect and induced employment, we see the total number of FTE jobs associated with the offshore wind industry, **increases from approximately 30,000 in 2017, to approximately 58,000 by 2032**. Restricting ourselves to only direct and indirect employment, we see 18,000 jobs in 2017 and a projected 39,000 by 2032.

Indirect Employment by Broad Industrial Sector

Using industry input/output relationships, we disaggregated indirect employment to broad industrial sectors. These are tailored aggregations of the ONS *broad industrial groups.* [17] We define five categories:

Extraction and Utilities

- Agriculture, Forestry & Fishing
- Mining, Quarrying & Utilities

Construction

- Construction

Manufacturing

- Manufacturing

Professional and Business Services

- Information & Communication
- Finance & Insurance
- Property
- Professional, Scientific & Technical
- Business Administration and Support Services

[17] UK Standard Industrial Classification of Economic Activities 2007

Other Services

- Motor Trades
- Wholesale
- Retail
- Transport & Storage (inc Postal)
- Accommodation & Food Services
- Education
- Health
- Public Administration

Figure 10: Indirect FTE jobs by industry group

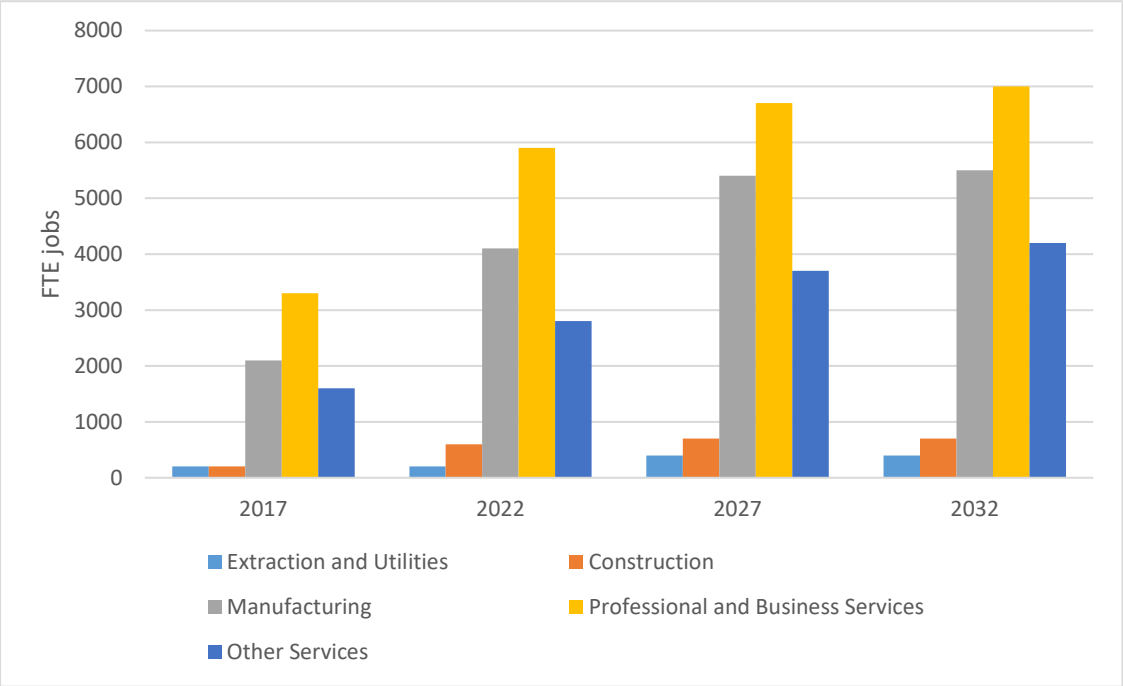


Figure 10 shows the growth in indirect employment for the central scenario. All five categories see growth. Most significantly, indirect employment in the manufacturing sector grows from approximately 2,000 in 2017 to 5,500 in 2032, in professional and business services from just over 3,000 in 2017 to 7,000 in 2032, and finally other services from 1,500 to over 4,000.

Manufacturing and professional and business services are likely to be sourced regionally or even nationally, whilst other services, which may include transport, food or accommodation, are more likely to be sourced from the local area.

Comparisons with 2013 Study

CE has undertaken two previous studies for RenewableUK to gauge current and potential future employment in UK renewables (onshore and offshore wind, and marine energy) and to identify barriers that might hinder future growth. The first study was published in 2011[18] and reported the size of the industry in 2010. This formed the basis for employment

[18] *Working for a Green Britain*:

Volume 1: http://www.renewableuk.com/news/309146/Working-for-a-Green-Britain---Volume-1.htm

Volume 2: http://www.renewableuk.com/news/309147/Working-for-a-Green-Britain---Volume-2.htm

projections to 2021 under alternative assumptions about future renewables deployment. The second study was an update to the first, with an assessment of the industry in 2013 and projections to 2023[19].

Each study comprised a survey of UK renewables firms, to establish the (then-current) characteristics of the industry in terms of output, business activity, employment, occupation profile etc); and its supply-chain relationships with the wider economy, as well as assessing the demand for skills and the nature of any skills shortages.

A modelling exercise to project future employment was then conducted. The table below summarises the predictions of the 2013 study and this current 2017 study for i) UK capacity deployment ii) UK direct OSW FTE jobs iii) UK OSW indirect FTE jobs.

Table 1: Comparison of employment projections

	2013 study			2017 study		
	Low	Central	High	Low	Central	High
UK Capacity in 2023	10 GW	14.6 GW	26.7 GW	13 GW	13 GW	13 GW
UK Direct FTE in 2023	6,600	9,900	23,500	15,900	16,200	16,500
UK Indirect FTE in 2023	4,100	6,600	21,200	13,400	13,700	14,000

All three of the 2017 projections for jobs for 2023 lie between the central and high scenario of the 2013 study. The narrower range is reflective of the decreased distance-in-time to 2023 from 2017 and resulting narrowing of confidence bands.

It is difficult to compare employment projections in single years, because they are dependent on a wide range of factors. However, we see a relative increase in the *ratio* of UK employment to UK capacity. This is due to two factors:

- The 2017 study expects higher continued UK and EU development both during and beyond 2023, resulting in an increase in development, manufacturing, construction and installation employment in advance of that
- The increased UK content of both UK and EU capacity in the 2017 study compared to the 2013 research means that the UK is capturing a higher % of offshore wind jobs

Regional Distribution of Future UK Direct Employment in OSW

The regional distribution of direct employment is shown in the two figures below. Employment by region for 2017 is shown on the left, with projected employment by region in 2032 shown on the right. The capacity projections used for regional distributions are necessarily more detailed than the national projections used to project total direct employment. Site-specific plans have been analysed in order to construct the likely regional distribution of employment. The time lag between initial planning application and operation is between five and ten years; therefore, we have identified 2025 as the year in which the majority of currently planned and under-construction sites will most likely be online.

[19] *Working for a Green Britain & Northern Ireland 2013-23*:

http://www.renewableuk.com/news/293536/Working-for-a-Green-Britain--Northern-Ireland.htm

Figure 11 shows the employment distribution in 2017 and 2032 by NUTS2 region. Growth is seen down the east coast of Britain, with particularly strong growth in the North East and Yorkshire and the Humber. Although employment in most regions is expected to grow, in some it is projected to fall slightly, as existing under-construction sites are completed and the increase in operations and maintenance staff do not fully offset the reduction of installation and construction employees.

Figure 11: Offshore wind direct FTE jobs by region

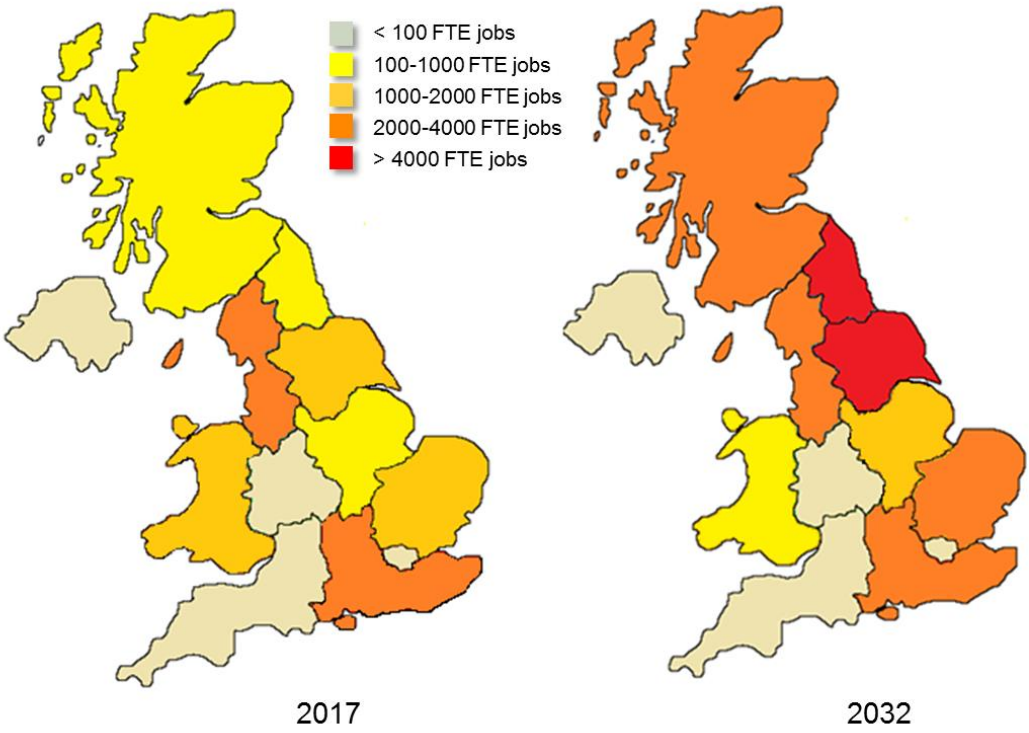


Figure 12 shows the same employment figures for 2032 distributed across six broad coastal regions that more closely map to the clustering of current and planned wind farms.

Figure 12: Offshore wind direct FTE jobs by coastal region