



Hornsea Project Two: Supply Chain Plan (Annexes)

January 2017

CONFIDENTIAL - DO NOT CIRCULATE

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A. DONG Energy Background

GREEN, INDEPENDENT AND ECONOMICALLY VIABLE ENERGY

Company presentation

February 2016

DONG energy

DONG Energy is one of the leading energy groups in Northern Europe

DONG Energy is engaged in developing, constructing and operating offshore wind farms, generating electricity and heat from our power stations, providing energy to residential and business customers and oil and gas production. **₩** DONG Energy has 6,500 employees and is headquartered in Denmark. Wind Power Bioenergy & Thermal Power **Distribution & Customer Solutions** Oil & Gas **★**₩



Wind Power

CORE BUSINESS

 Development, construction, ownership and operation of offshore wind farms

MARKET POSITION

- Global market leader within offshore wind with a market share of 26%
- Five projects under construction and a handful of projects under development towards 2020

BUSINESS DRIVERS

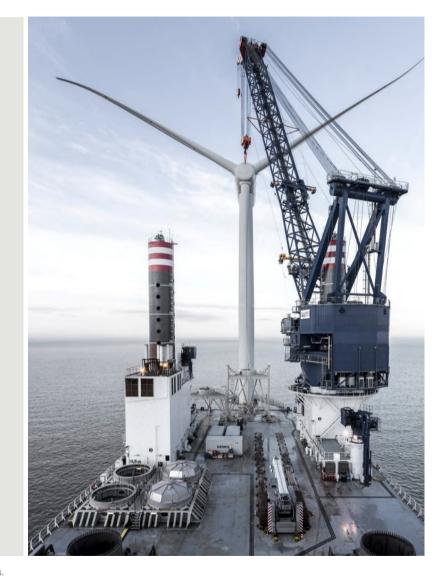
- Wind energy content and park availability
- Regulatory frameworks
- Reduction of offshore wind cost of electricity
- Partnerships with investors
- Execution of investment projects

FINANCIAL TARGETS

• ROCE: 12-14% (2020)



Revenue:	DKK 16.5 billion
EBITDA:	DKK 6.2 billion
Gross investments:	DKK 10.2 billion
Capital employed:	DKK 48.0 billion
Adjusted ROCE ² :	6.9%
LTIF:	1.9
Employees	2,358





^{2.} ROCE adjusted for impairment losses.



Bioenergy & Thermal Power

CORE BUSINESS

 Power and heat generation from CHP plants

MARKET POSITION

- Nine central CHP plants in Denmark
- Generates about one third of the district heating consumed in Denmark and one fourth of the total Danish power generation (almost half of the Danish power generation from thermal power stations)

BUSINESS DRIVERS

- Development in the price of electricity, fuels and carbon emissions as well as weather and wind conditions
- International interconnections
- Flexibility services to the market
- Regulatory frameworks
- Long-term heat contracts
- Execution of biomass conversions

FINANCIAL TARGETS

FCF: Positive from 2018



Revenue:	DKK 5.2 billion
EBITDA:	DKK 0.3 billion
Gross investments:	DKK 1.2 billion
Capital employed:	DKK 2.2 billion
Free cash flow (FCF):	DKK 1.6 billion
LTIF:	2.1
Employees	797



^{1.} The sum of the business units' key figures for 2015 does not equal the consolidated key figures due to other activities and eliminations.



Distribution & Customer Solutions

CORE BUSINESS

 Power and gas distribution and sales in the wholesale and retail markets as well as optimisation and hedging of the Group's energy portfolio

MARKET POSITION

- Largest Danish distributor of power with a market share of 26% and secondlargest Danish distributor of gas with a market share of 28%
- Active participant in the energy wholesale and trading market in Northwestern Europe Retail sales in Denmark, Sweden, Germany and the UK (DK B2C market share of 26%)

BUSINESS DRIVERS

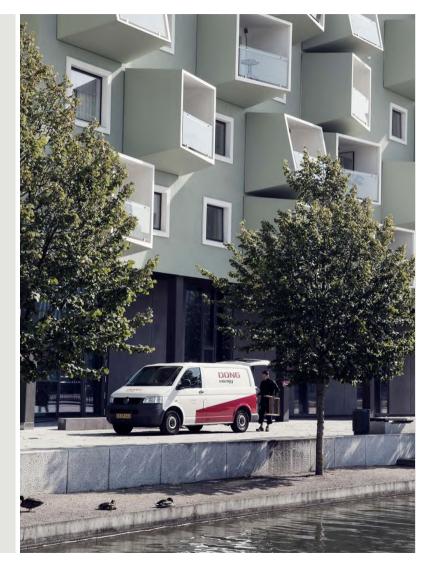
- Regulatory frameworks
- Renegotiation of long-term gas contracts
- Development in energy price
- Customer satisfaction and loyalty
- Market liquidity

FINANCIAL TARGETS

ROCE: >10% (2020)



Revenue:	DKK 49.4 billion
EBITDA:	DKK 2.2 billion
Gross investments:	DKK 1.1 billion
Capital employed:	DKK 8.7 billion
Adjusted ROCE ² :	11.5%
LTIF:	3.0
Number of employees	1,496



^{1.} The sum of the business units' key figures for 2015 does not equal the consolidated key figures due to other activities and eliminations.



^{2.} ROCE adjusted for impairment losses.

Oil & Gas

CORE BUSINESS

Oil and gas production

MARKET POSITION

- Strong market position in Northwestern Europe with a unique position in terms of reserves, production and relationships
- First-gas delivered February 2016 on strategic development Laggan-Tormore in West-of-Shetlands area

BUSINESS DRIVERS

- Execution of investment projects
- Operational delivery
- Cost optimization
- Oil and gas prices

FINANCIAL TARGETS

FCF: Positive from 2017



Revenue:	DKK 12.8 billion
EBITDA:	DKK 9.8 billion
Gross investments:	DKK 6.0 billion
Capital employed:	DKK 5.4 billion
Free cash flow (FCF):	DKK 0.7 billion
LTIF:	0.4
Number of employees	727



^{1.} The sum of the business units' key figures for 2015 does not equal the consolidated key figures due to other activities and eliminations.



Financial key figures

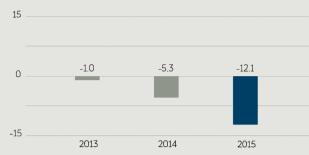
OPERATING PROFIT (EBITDA), DKK billion 20 15.0 16.4

The positive development in 2015 can mainly be attributed to higher generation from offshore wind, higher activity from wind farm construction contracts, the completed renegotiation of an oil-indexed gas purchase contract, insurance compensations and other compensations as well as lower costs in the O&G business. This was partly offset by lower gas and oil prices in 2015 and farm down divestment gains in 2014.

2014

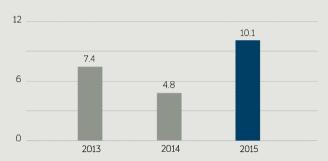
2015

NET PROFIT, DKK billion



The decrease in net profit for the year was primarily attributable to the fact that impairment losses of DKK 15.8 billion (after tax) in 2015, were higher than the year before when they amounted to DKK 6.7 billion (after tax).

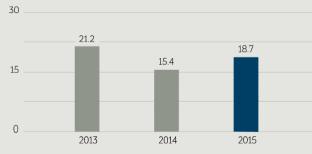
RETURN ON CAPITAL EMPLOYED (ADJUSTED ROCE1), %



The increase in ROCE adjusted for impairment losses was mainly due to the higher adjusted EBIT.

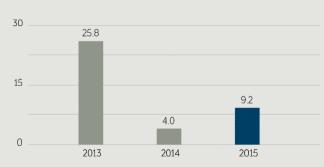
GROSS INVESTMENTS, DKK billion

2013



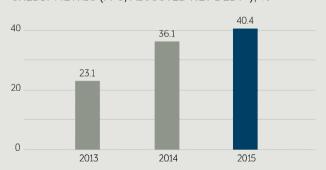
The increase in gross investments was primarily due to investments in offshore wind farms.

INTEREST-BEARING NET DEBT, DKK billion



The increase in interest-bearing net debt was primarily due to a continued high level of investments exceeding the cash flows from operating activities and divestments.

CREDIT METRIC (FFO/ADJUSTED NET DEBT2), %



The improvement of the credit metric was due to the increase in FFO having a greater positive impact than the increase in the adjusted net debt.



^{1.} Adjusted ROCE is calculated as EBIT less current hydrocarbon tax and impairment losses added back / average capital employed (with impairment losses after tax added back to ultimo capital employed). 2. Interest-bearing net debt including 50% of hybrid capital, cash and securities not available for use (with the exception of repo transactions), present value of lease obligations, and decommissioning obligations less deferred tax.

Strategic focus











Wind Power

- Global leader in offshore wind
- Ensure competitive offshore wind
- Further develop financial partnership



Bioenergy & Thermal Power

- Operational excellence
- Development of the bioenergy business



Distribution & Customer Solutions

- Satisfied and loyal customers
- High security of supply
- Optimised wholesale gas position



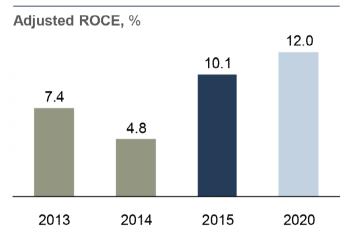
Oil & Gas

- Adapting to the new market reality
- Current development projects

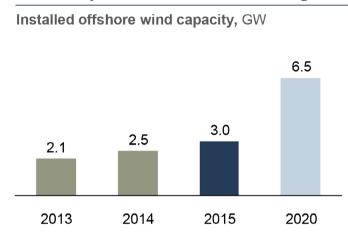


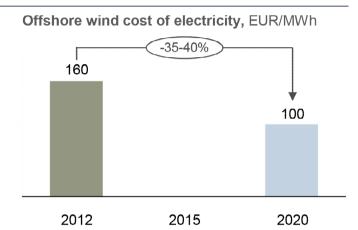
DONG Energy's Strategic Targets (1/2)

Create shareholder value



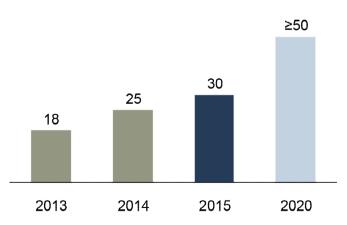
Address profound societal challenges



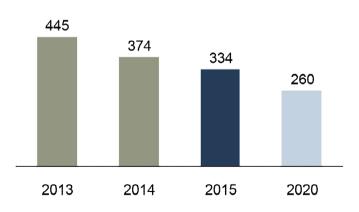


Address profound societal challenges





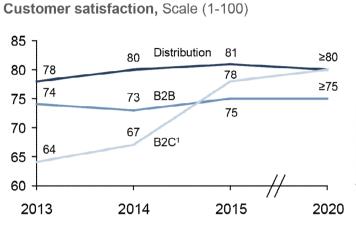
Carbon emissions, g/kWh



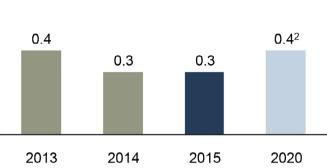


DONG Energy's Strategic Targets (2/2)

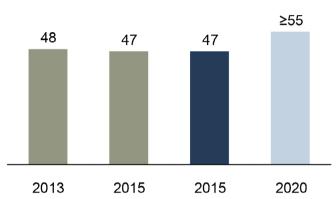
Serve the energy needs of our customers



Security of supply, power outage per customer (Danish power distribution)



Reputation index, Scale (0-100)

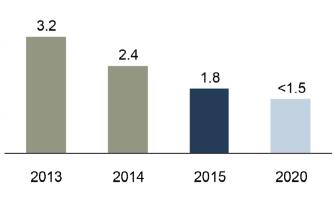


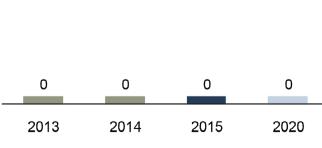
Be a great and safe place to work

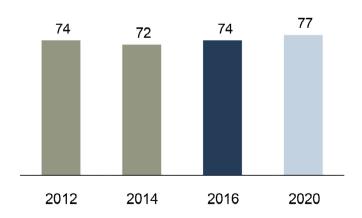
Safety, LTIF

Safety, Fatalities









- 1. The method of calculation B2C customer satisfaction has changed in 2015.
- 2. Average security of supply in Denmark in 2014. Out target is to be at or below the Danish industry average.



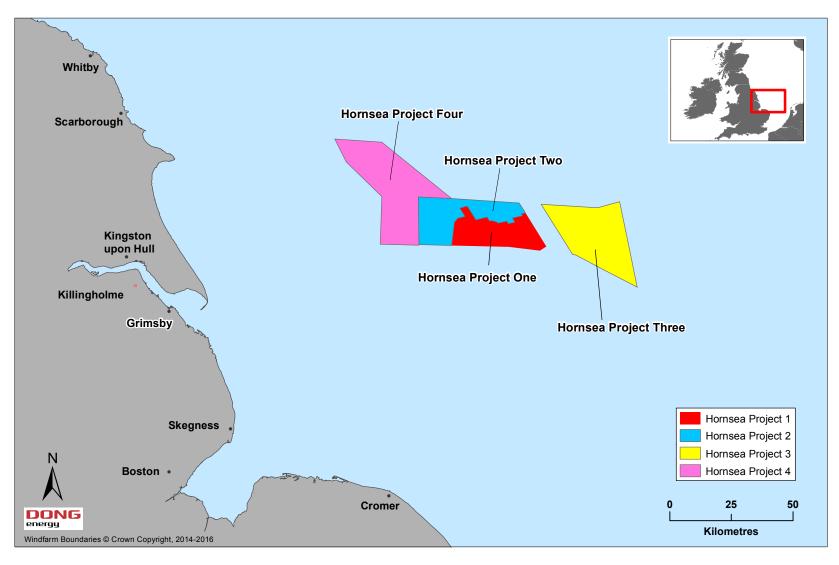
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D. Map of Hornsea Development Area



E. DONG Energy in the UK Leaflet

DONG Energy total offshore wind capacity compared to total UK capacity



Homes powered



DONG Energy's UK offshore wind farms meet the electricity needs of almost

2 million homes*.

OIT OITSHOTE WITH TATTITS

When all our current construction projects are operational, we will more than double this figure to over

4.4 million homes.



Turbine size

The turbines deployed at our wind farms vary from 3.6MW to 8MW. Larger wind turbines increase efficiency and contribute to reducing the cost of electricity. The new 8MW turbines, which will be deployed at Burbo Bank Extension, are 195m from sea level to the tip of the turbine, which is taller than the Gherkin in London.

Strengthening local communities

Everywhere that DONG Energy operates, we seek to engage with and invest in the local community.

Burbo Bank Extension Community Benefit Fund worth up to

£225,000 per year.



Walney Extension Community Benefit Fund worth up to

£600,000 per year.

In 2014, DONG Energy joined forces with Maersk to provide hands-on experience to trainee offshore wind technicians. So far we have provided work placements to twelve trainees, at a number of our wind farms off the west coast, one of whom is now working full-time at Walney Offshore Wind Farm.

In 2015, we signed a partnership with the Royal National Lifeboat Institution (RNLI) to contribute

£120,000 towards the lifeboat runnin

towards the lifeboat running costs of six of the charity's stations for a two year period.



Lifeboats

Employment



Between

250–1,000 people are involved in the construction of our projects.

Once complete, the operation and maintenance of each wind project employs between

35–100 people for the 25 year lifespan of the project.

DONG Energy Power (UK) Ltd. 5 Howick Place, Victoria, London SW1P 1WG Tel: +44 (0) 20 7811 5200



www.dongenergy.co.uk

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All graphics in this document are for illustrative purposes. Dates and figures are based on available information and are subject to change.







A summary of our UK wind activities www.dongenergy.co.uk

^{*}We have based this on a load factor of 42% and a household consumption of 4.1MWh per year. Source: DECC, 2015, Average electricity consumption per UK household in 2014 (with temperature factor applied). https://www.gov.uk/government/up-loads/system/uploads/attachment_data/file/449134/ECUK_Chapter_3 - Domestic_factsheet.pdf

About DONG Energy

DONG Energy is headquartered in Denmark and is the world leader in developing, building and operating offshore wind farms.

We have been market leaders since we built the first offshore wind farm Vindeby, in Denmark, in 1991 and now have offshore wind farms in the UK and Germany. Our largest offshore wind fleet is located in the UK. As well as being the market leader in offshore wind, we invest in the exploration of oil and gas, along with selling flexible solutions to our gas and electricity commercial customers. We are also investing in new technologies which convert household waste into energy.

Investing in the UK



We are investing heavily within the UK, with a total of

£6 billion invested to date



We are investing in people,

growing our business with over within the UK.



We are creating long term operation and maintenance jobs near our projects in areas such as the Humber, Barrow, Brightlingsea, Ramsgate and Liverpool.

DONG Energy in the UK

Walney Extension

During the operation and maintenance phase around 200 new, full-time jobs will be created regionally. 50% of the blades will be sourced from MHI Vestas' new blade facility on the Isle of Wight.

The Project will have a capacity of

660_{MW}

Burbo Bank Extension

The Project is likely to create up to 55 full-time jobs in the local supply chain during construction. A minimum of half the transition pieces will be sourced from the new Offshore Structures Britain facility in Teesside.

The Project will have a capacity of

258_{MW}

DONG Energy wind power under construction DONG Energy wind power in operation

Hornsea Project One

Once complete, it will be the world's largest offshore wind farm.

The Project will have a capacity of

Hornsea Project One

Gunfleet Sands

London Array

Westermost Rough ·····

Race Bank

1.2 GW

Walney Extension

Walney 1 + 2

Burbo Bank

Burbo Bank Extension

West of

Duddon Sands Barrow

Hartlepool based firm, JDR Cable Systems.

It will cover an area of approximately 75km²

which is equal to 10,600 Carrow Road

pitches, home of Norwich City F.C. Once

complete, it will provide enough power for

over 500.000 homes*. The subsea power

cables for Race Bank will be supplied by

The Project will have a capacity of

580_{MW}

Race Bank

Westermost Rough

This world pioneering project was the first commercial deployment of the Siemens 6MW turbine with a 154m rotor span.

Westermost Rough has a total capacity of over

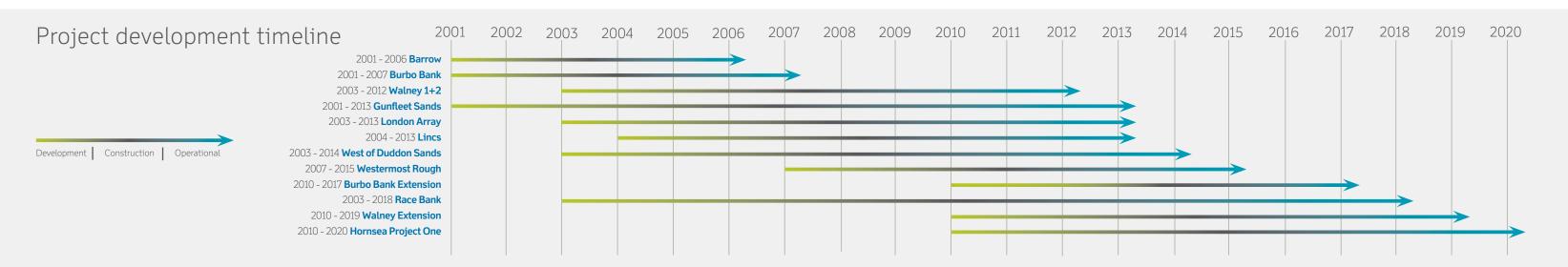
210_{MW}

London Array

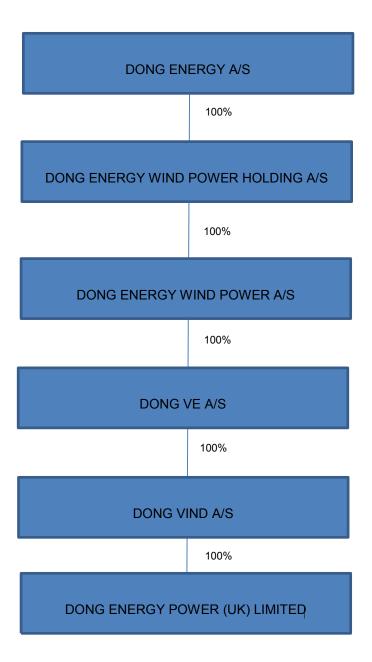
It is one of the world's largest operational offshore wind farms. Each turbine measures up to 172m from the seabed to the tip of the blade. The diameter of the blade, at 120m, is similar to that of the London Eye.

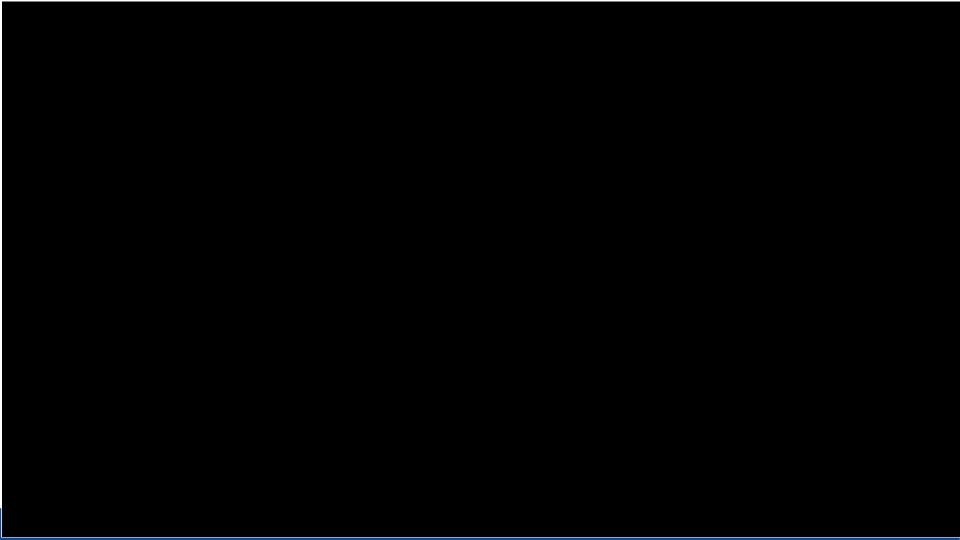
The Project has a capacity of

630_{MW}



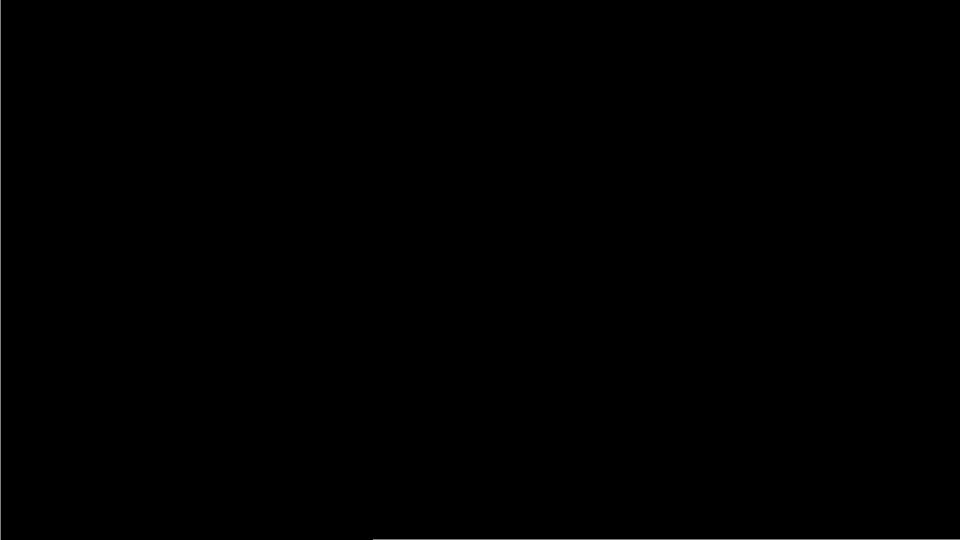
F. Hornsea Project Two Ownership Structure (CONFIDENTIAL)

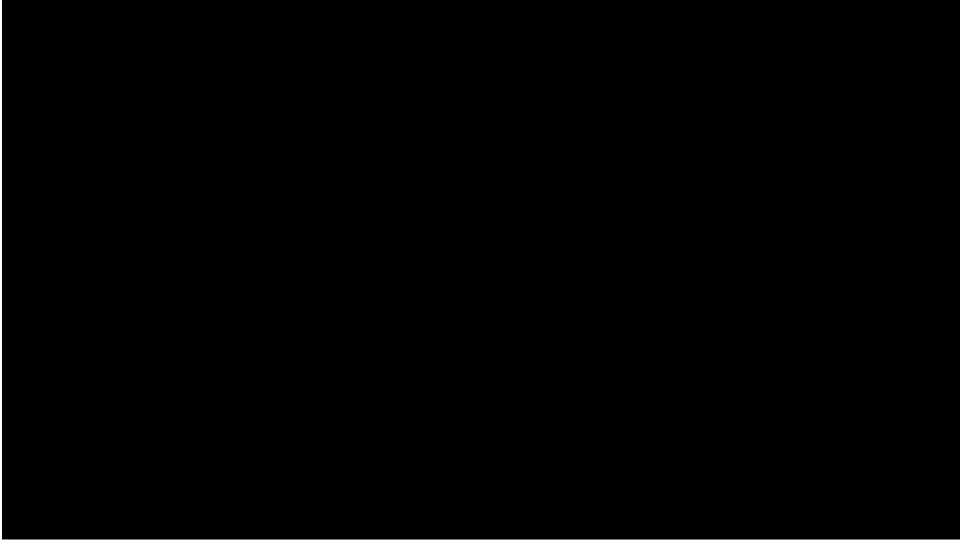


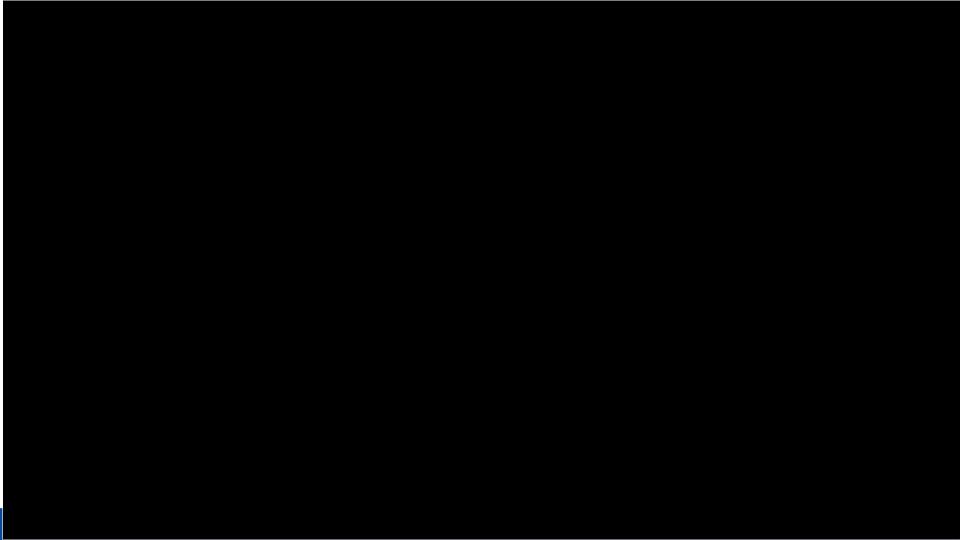


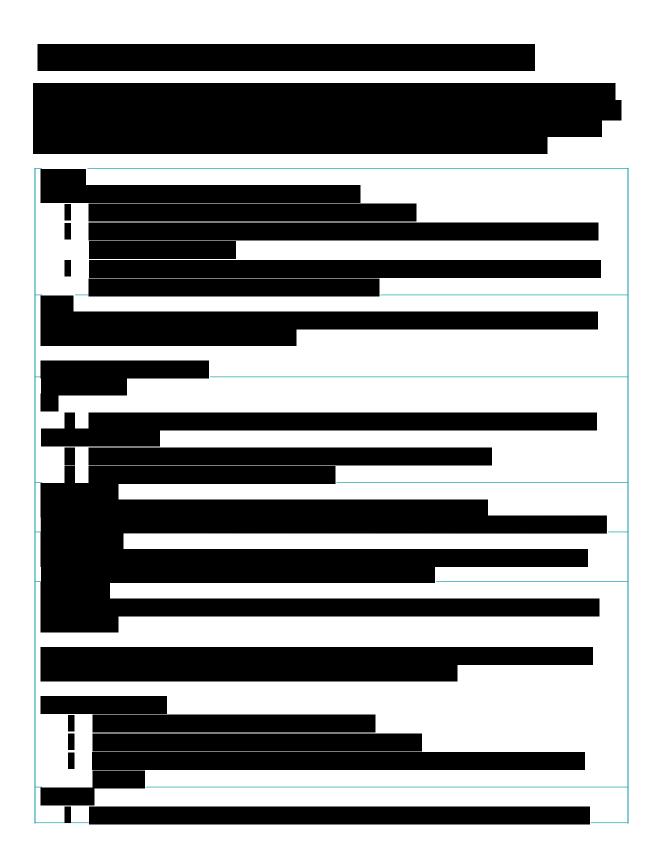




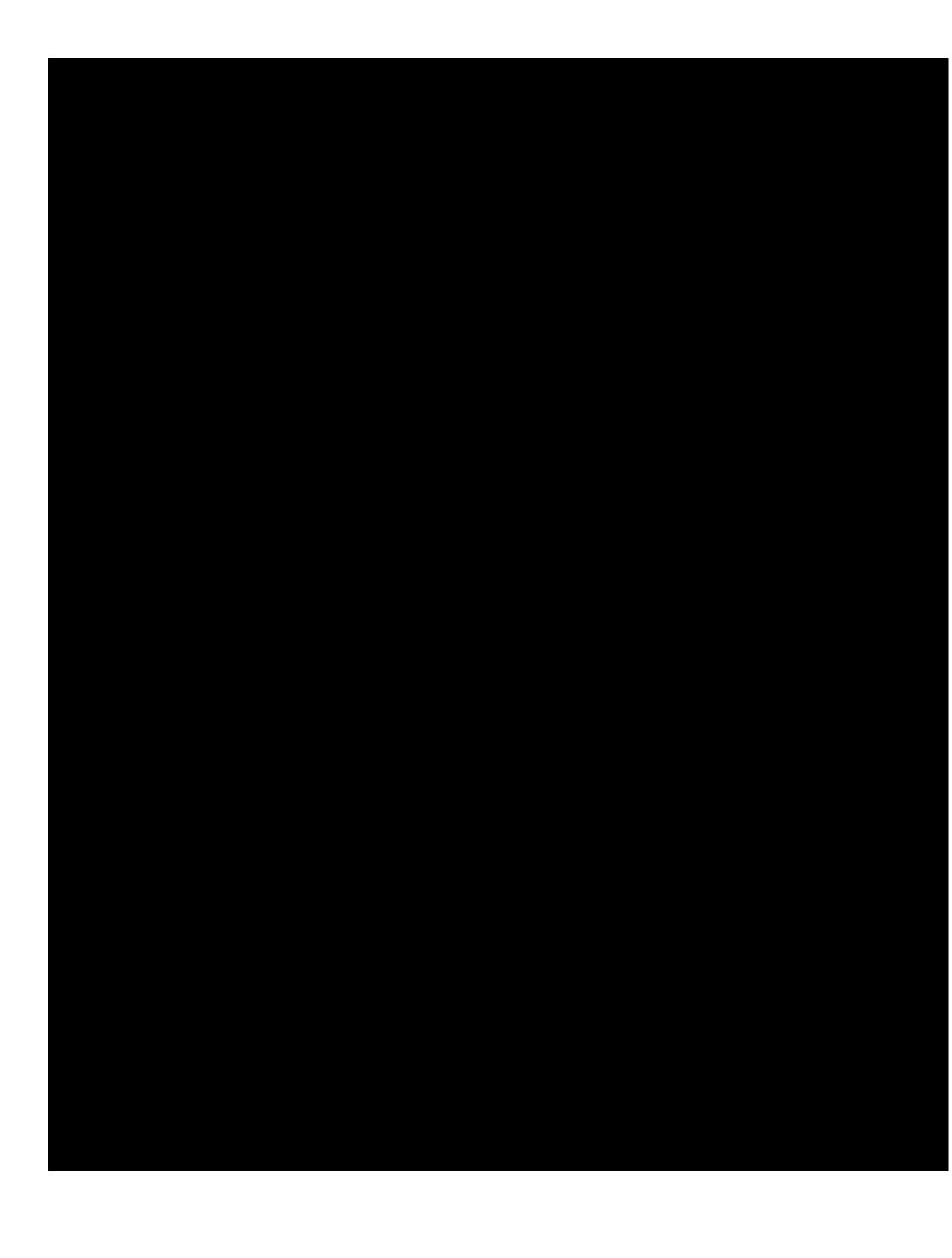






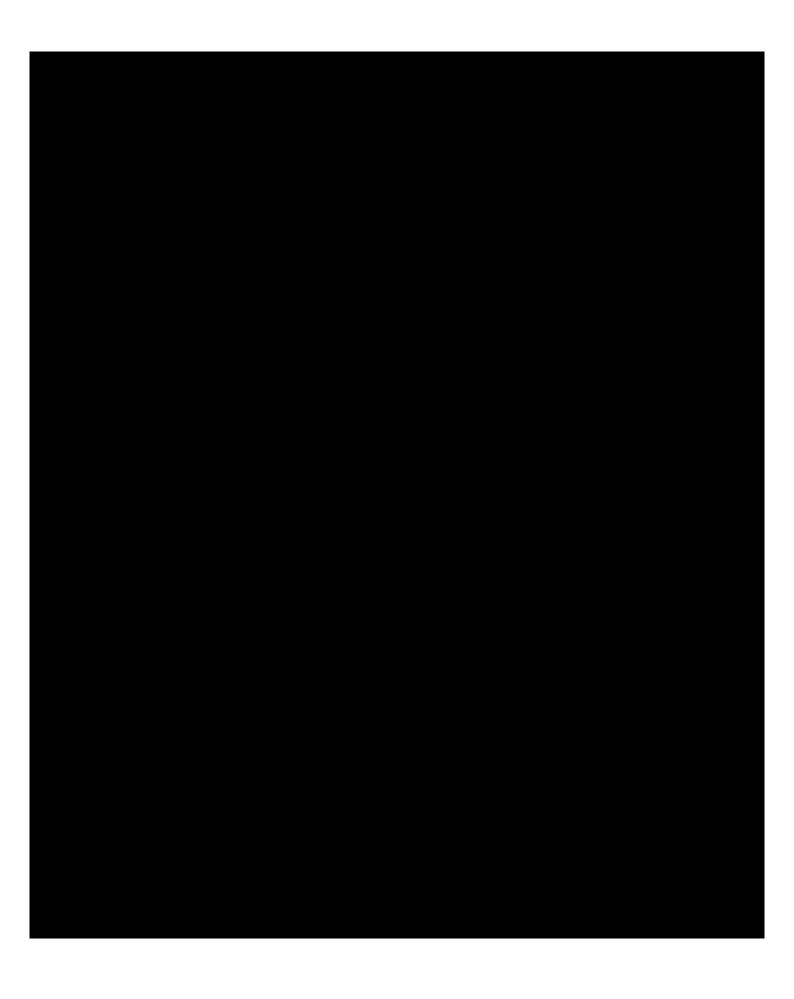






















I. Hornsea Project One Contract with JDR

DONG Energy awards UK firm cabling contract for world's biggest windfarm

01.11.2016 14:00

<u>DONG Energy</u> has awarded UK firm JDR Cables their biggest array cable contract to date, to supply subsea power cables for Hornsea Project One offshore windfarm.



With a capacity of 1.2 gigawatts (GW), when built <u>Hornsea Project One</u> will be the first windfarm in the world with over 1GW, capable of providing enough renewable energy for well over one million homes.

Duncan Clark, Hornsea Project One Programme Director, said: "Hornsea Project One is truly a pioneering project for the UK and for the electricity sector. When built it will become the world's largest offshore windfarm by a considerable margin, helping to support Government ambitions to meet carbon reduction targets."

JDR is a leading provider of technology that connects the offshore energy industry, and it has state of the art manufacturing facilities in Hartlepool, UK.

Duncan added: "We are committed to investing in the UK and it's great to award a significant contract like this to a UK-based company which we know offers high-quality design and reliable delivery in harsh offshore environments."

DONG Energy and JDR have a framework agreement in place to enhance current designs and develop new technologies and processes to improve the quality and price of subsea power cables.

The contract announced today is the largest array cable award in JDR's history and will see the company design and manufacture 242km of array cables, covering two thirds of the total wind farm capacity. JDR will also provide terminations, hang-off arrangements and additional accessories as well as services at the site.

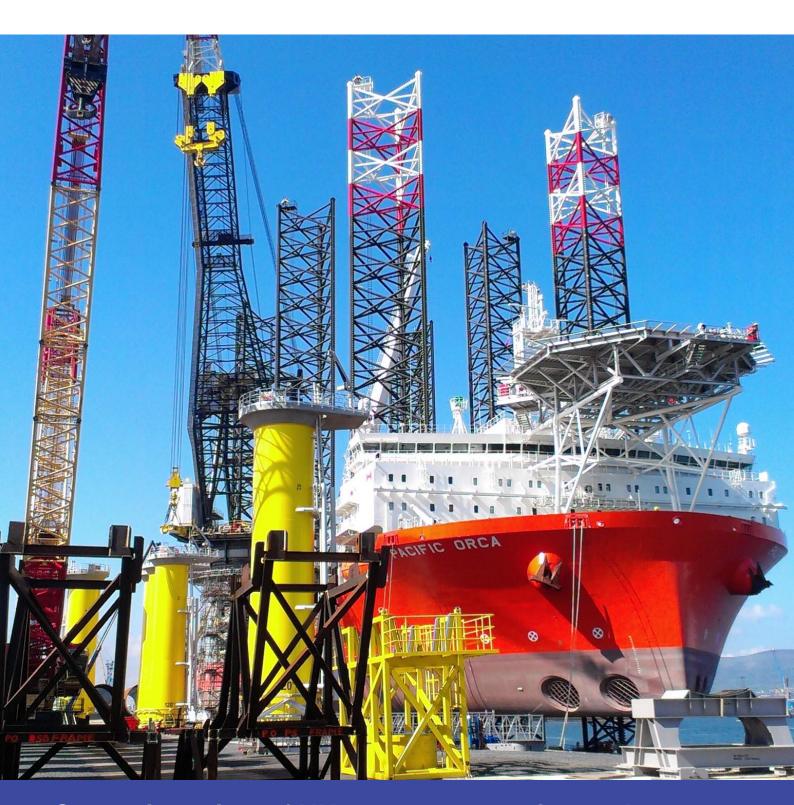
JDR CEO, David Currie, said: "This contract award demonstrates our leadership position in the array cable market and is the second award to date for JDR under our partnership agreements with DONG Energy. Our collaboration is encouraging technology development to support technical and commercial cost reduction, which is a critical element of our long-term strategy. We are proud to play a key role in this world-leading infrastructure project and continue our dedicated support to ensuring success for DONG Energy."

<u>Earlier this year</u> DONG Energy announced contracts with JDR and two other UK firms to supply and install array cables for Race Bank wind farm. Array cables connect each of the wind turbines in the offshore wind farm via the offshore substation, to the main export cable that transmits the electricity generated back to shore and into the national grid.

Energy Minister, Baroness Neville-Rolfe said: "We are building a strong, competitive UK supply chain to support our leading offshore wind industry. Businesses in the UK have greater certainty than ever before thanks to Government support.

"This agreement between JDR Cables and DONG Energy is a great example of how this newfound certainty can drive local jobs and growth through the UK supply chain."

J. East Coast Review



Strategic review of UK east coast staging and construction facilities

A report by BVG Associates for the Offshore Wind Industry Council August 2016



Document history

Revision	Description	Circulation classification	Authored	Checked	Approved	Date
1	For release	Client discretion	CLW	BAV	BAV	20 Jul 2016
2	For release	Client discretion	CLW	BAV	GEH	3 August 2016

BVG Associates

BVG Associates is a technical consultancy with expertise in wind and marine energy technologies. The team probably has the best independent knowledge of the supply chain and market for wind turbines in the UK. BVG Associates has over 150 man years experience in the wind industry, many of these being "hands on" with wind turbine manufacturers, leading RD&D, purchasing and production departments. BVG Associates has consistently delivered to customers in many areas of the wind energy sector, including:

- · Market leaders and new entrants in wind turbine supply and UK and EU wind farm development
- Market leaders and new entrants in wind farm component design and supply
- · New and established players within the wind industry of all sizes, in the UK and on most continents, and
- Department of Energy and Climate Change (DECC), RenewableUK, The Crown Estate, the Energy Technologies Institute, the Carbon Trust, Scottish Enterprise and other similar enabling bodies.

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The views expressed in this report are those of BVG Associates. The content of this report does not necessarily reflect the views of the Offshore Wind Industry Council.

Front cover image courtesy of DONG Energy



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Executive summary

The review

On 9th February 2016, the Minister of State for Energy Andrea Leadsom announced in the House of Commons a strategic review to identify opportunities to develop the east coast as a staging and construction hub for the UK and European offshore wind industry.¹

This review was undertaken to support the work of the Offshore Wind Industry Council (OWIC). It was undertaken by BVG Associates on behalf of the jointly-led industry and government review team that was set up to conduct this investigation. It is not a statement of Government policy. As well as providing a detailed review of UK east coast port capability, this report considers three main questions:

- Is there demand for more staging capacity in UK east coast ports?
- How has the UK Supply Chain been stimulated by offshore wind?
- What options are there for unlocking greater levels of UK supply chain industrialisation?

In this document, we refer to two separate types of activity, which have different port requirements.

- Staging: this activity covers the storage and loading of
 offshore wind farm components onto vessels before
 final delivery to site for installation. This may also
 involve a range of pre-construction activities that take
 place in the port to minimise the amount of offshore
 work. Depending on the location and strategy of the
 developer, a project may choose to install components
 directly from manufacturing facilities.
- Manufacturing: in this context, this activity refers to the production of large offshore wind farm components in or near a port. These may be turbine nacelles, blades, towers, foundations, array cables, export cables or offshore substations (topsides or foundations). This has previously been referred to as construction.

Other offshore wind-related port activities, such as those involved during the long term operation and maintenance (O&M) phase, have not been considered in this study.

https://www.gov.uk/government/publications/east-coast-review-of-construction-and-staging-terms-of-reference, last accessed July 2016.

Methodology

This report is based on extensive consultation involving interviews with more than 50 project developers, suppliers, central and regional government agencies and port owners.

We undertook structured interviews to ensure the most consistent and comprehensive dialogue. The interviews were conducted in accordance with pre-defined confidentiality principles in which all feedback was anonymised or aggregated, unless specific permission was obtained. This approach resulted in interviewees giving open and honest responses on commercially sensitive issues.

Following the consultation, we undertook a thematic analysis of consultee feedback and drafted summary findings and conclusions.

These were discussed with the review team in workshops to gather their further feedback before the preparation of this report.

What is the capability of UK east coast ports to accommodate staging and manufacturing?

As part of the study, we assessed 23 east coast port locations. This involved comparing the capability of each port against a defined set of requirements that had been validated by industry. We gathered feedback from each port owner about its current facilities and the costs and timescales of any investment needed to upgrade the port to meet a range of industry requirements.

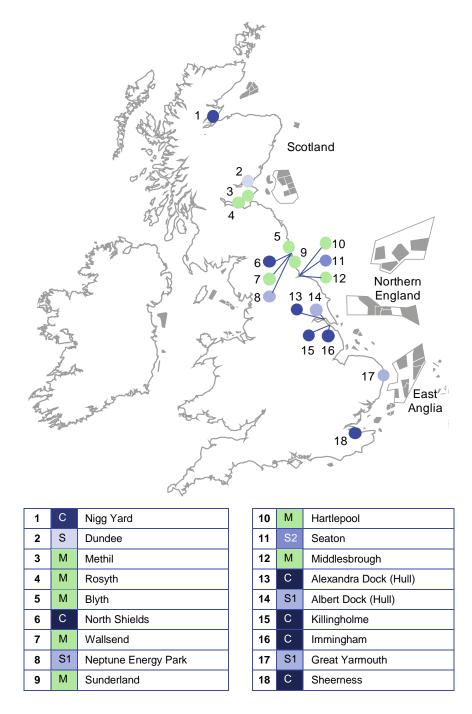
This study identified that offshore wind has already stimulated strong levels of investment in east coast ports. Over the last five years, owners of ten east coast ports have spent or committed more than £400 million on facilities that are either exclusively or partially focused on capturing offshore wind activity. This is in addition to investment that has been made in west coast staging and manufacturing facilities, such as Belfast and Mostyn, and in 23 facilities located around the UK's coastline providing O&M services.

More than half of this investment has been speculative, based on the port owners' assessment of the potential opportunity from offshore wind and other sectors. The rest has been stimulated by firm contractual commitments by offshore wind players.

¹ DECC, East Coast Review: Terms of reference, May 2016, available online at

² Based on consultation feedback from port owners.





Map of headline regions and UK east coast ports (M - Manufacturing only, S - Staging only, S1 - Staging plus one manufacturing activity, S2 - Staging plus two manufacturing activities, C - Staging/manufacturing cluster).

As shown in the map above, the study identified eleven east coast ports with the capability to accommodate turbine staging activity for one large project a year, almost half of which could be used with minimal further investment. Of these eleven, ten³ could also accommodate at least one manufacturing activity at a run rate sufficient for 100 turbines per year, and seven⁴ could accommodate two such manufacturing activities. Of these, six⁵ could accommodate a staging and manufacturing 'cluster', defined as a site with the capability to accommodate the staging activity of two large wind farm projects per year and also with enough contiguous land to support three manufacturing activities. It is noted that the staging area in Alexandra Dock at Hull (13) is under a long term lease to Siemens Wind Power so there are likely to be significant commercial challenges if a developer sought to use the facility to stage turbines from other suppliers, making this unlikely.

A further seven ports were also identified that did not meet the staging requirements defined by this study but could, however, host one or more manufacturing activities.⁶

Other ports that were reviewed but did not meet the requirements used in this study for either *Staging only* or *Manufacturing only* were Invergordon, Aberdeen, Montrose, Tees Dock and Lowestoft. This finding does not preclude these ports winning other offshore wind-related activity, which is in some cases already taking place.

Is there demand for more staging capacity in UK east coast ports?

To date, the UK has installed 5GW of offshore wind capacity and there are a further twelve projects with a total capacity of 5.2GW that are either under construction or have passed their final investment decision so that they will be built out by the end of 2020. Assuming the industry maintains its progress in reducing its levelised cost of energy (LCOE), industry expects the UK to achieve the Government's ambition of installing another 10GW of

capacity in the 2020s to reach a total installed capacity of 20GW by the end of 2030.⁷

Based on current leased sites, the large majority of this future capacity is expected to be installed in the North Sea off the UK's east coast.

In terms of turbine staging, there was clear industry feedback that developers have a strong preference for using ports that are local to the offshore wind farm site, if they have the capability and availability. This preference was based on the cost benefits of reduced transit time between the port and wind farm site and a lower risk of weather delay compared with working from a more distant staging port. This supports a shorter installation programme and lower vessel costs.

Taking into account this preference, industry feedback was that developers of Scottish and East Anglia projects were confident that their local ports would satisfy their turbine staging demand.

Similarly, industry feedback was that, notwithstanding other factors, projects in the Northern England region that use turbines from Siemens Wind Power will be able to use the port of Hull for their turbine staging should they wish to and it is available, following the significant investment that has been made in the Green Port Hull facility.

The area of industry uncertainty was about where developers of projects in the Northern England region will base turbine staging activity if they are not using turbines from Siemens Wind Power of if they choose not to use the port of Hull. Industry feedback, however, indicated that some developers have already identified other UK east coast ports that could be upgraded at a manageable additional cost to a single project. Although there are challenges with each of these alternative sites, these issues are not expected to be a major barrier to cost-effective deployment.

In terms of foundation and cable staging, industry feedback was that these components can be cost-effectively delivered to wind farm sites directly from their manufacturing sites, whether they are in the UK or elsewhere in Europe. As such, existing UK port options will be considered if they offer a cost benefit but there is no requirement for additional staging port capacity.

Developers' choice of staging facility will always be dependent on the competitive offers made by different ports, and the developer's assessment of the 'whole-life' cost of using a facility, including the lease cost, port fees, any capital contributions required for infrastructure

³ Nigg Yard, North Shields, Neptune Energy Park, Seaton, Alexandra Dock (Hull), Albert Dock (Hull), Killingholme, Immingham, Great Yarmouth and Sheerness.

⁴ Nigg Yard, North Shields, Seaton, Alexandra Dock, Killingholme, Immingham and Sheerness.

⁵ Nigg Yard, North Shields, Alexandra Dock, Killingholme, Immingham and Sheerness.

⁶ Methil, Rosyth, Blyth, Tyne (Wallsend), Sunderland, Hartlepool and Middlesbrough.

⁷ DECC, Amber Rudd's speech on a new direction for UK energy policy, November 2015, available online at https://www.gov.uk/government/speeches/amber-rudds-speechon-a-new-direction-for-uk-energy-policy, last accessed July 2016.



development or upgrades, and the transport cost due to its proximity to the wind farm site.

Summary

There is a strong industry preference for using local ports for turbine staging activity, if they have suitable infrastructure and are available, of if such capability can be developed at a competitive cost.

Based on anticipated deployment rates and, assuming the prices charged by port owners are competitive, the UK has the capability to meet the turbine staging needs for all known future UK east coast projects.

Furthermore, the investment that has already been made by east coast port owners is likely to enable lower cost offshore wind projects.

How is the UK offshore wind industry currently stimulating supply chain industrialisation through port-related activities?

Industry feedback was that offshore wind supply chain development is taking place in the UK. This progress is being driven by the Government's requirement to deliver credible supply chain plans that support increased competition, rather than significant shortfalls in European supply.

As well as the existing or announced facilities, industry feedback was that there are further UK supply chain developments in the pipeline that are being stimulated by demand from projects supported under the Final Investment Decision enabling for Renewables (FIDeR) mechanism and the first Contracts for Difference (CfD) round. As contractual negotiations are still ongoing, details of these developments are not yet public but a number of these are likely to be announced before the end of 2016. Industry has also identified further UK supply chain opportunities that could be stimulated by the demand driven by the next three CfD auctions. Overall, industry expected that the UK could secure additional production capacity for towers, blades and jacket foundations. The development of additional blade manufacturing capacity in the UK is likely to be dependent on a supplier consolidating the demand of two or more turbine suppliers or an individual turbine supplier increasing their capacity significantly. To date, there has been little explicit discussion on how these might be linked to current or upgraded staging facilities to create a cluster. Some consultees also said that array and export cables production was also feasible, although this is dependent on additional parallel sector demand.

Industry considered the probability of securing nacelle assembly in the UK to be small under the current market conditions, but the significant potential economic benefits

further down the supply chain mean it remains an important opportunity for the UK.

In some cases, a supplier may initially establish only a few elements of the total production process in the UK, with the potential for later projects to expand the scope of activities undertaken. Similarly, developers are considering splitting supply contracts into smaller packages to support new suppliers while reducing their own exposure to delivery risk.

The large majority of active plans were focused on sites with existing port infrastructure. Industry feedback generally suggested that this is because of the lower cost of development, the reduced risk of delays to the development programme of the facilities and the opportunity for synergies with existing activity.

There are other models of development, and the notable exception to this trend is the large-scale re-development of the port of Hull for Siemens Wind Power. In this case, the company was the established market leader in turbine supply. It had also been able to build up a multi-gigawatt pipeline of projects before committing to the investment and it did not have sufficient, suitably located existing production capacity to meet anticipated demand elsewhere.

Summary

The UK's offshore wind industry is stimulating industrialisation by identifying lower risk, lower cost options that can be supported on a project-by-project basis.

There is no strong evidence to suggest that the creation of new staging capacity has enabled the development of new manufacturing activity, which would otherwise not set up on the east coast.

What options are there for unlocking greater levels of UK supply chain industrialisation?

Stimulating a large cluster

There is ongoing debate in the industry about how to stimulate more UK supply chain activity, within the context of strong downward pressure on the cost of offshore wind energy. This has included the question of whether the UK could secure more activity with the development of a single port facility with enough staging and manufacturing land to accommodate the majority of east coast staging activity and most new UK industrialisation. The only comparable example of a port development of this scale is the port of Bremerhaven in Germany, which has approximately 200ha of land available.

There was mixed industry feedback about the potential positive impact of this 'large cluster' approach, both on LCOE reduction and further UK supply chain development.

Little positive evidence was provided by industry to support the large cluster approach, but this was potentially due to the industry focus on individual projects, which leads to a shorter-term focus.

Supporters of the large cluster approach said that developers can avoid the double-handling cost of transporting units from a separate manufacturing facility to a staging port. They also said that there will be synergies between tenants and that there is the potential for the site to develop a 'gravity' that means companies are attracted to the port because of the benefits of co-locating with other industry players. They also said the development of a single flexible staging facility with large amounts of high specification quayside could also allow developers to optimise their onshore activity, operate at greater efficiency than at older facilities, and minimise vessel downtime.

While acknowledging these benefits, other respondents said a challenge for this approach is how developers not already in possession of a CfD could support its initial development under the current policy framework. The CfD mechanism encourages a project-by-project approach, because CfD auctions give certainty to a developer only one project at a time. Industry feedback was that this dynamic remained even if the additional investment would reduce the LCOE of future projects in the developers' portfolios. Developers are unable to unilaterally take on any additional costs for the benefit of future projects without increasing the risk that they fail to secure a CfD. Such a facility would be more likely to be stimulated if demand arose from sufficient projects that were awarded a CfD and developers were able to align their demand and timescales with each other, or if the port owner could secure sufficient additional demand from one or more parallel sectors or find some other form of de-risking.

Other industry feedback highlighted that:

- No single staging location could efficiently service all (or the majority) of UK offshore wind farm sites
- Competition for CfDs between developers would restrict their ability to cooperate pre-CfD award, and
- The long lead times for major port developments would require speculative investment to be ready in time for start of the offshore wind activity of the first customer

Some respondents felt that the development of such a facility could displace activity that was planned to take place elsewhere in the UK, and would be unlikely to stimulate significant levels of additional manufacturing activity.

Building on existing infrastructure

Industry's current focus has been on identifying existing infrastructure that can be adapted to meet demand as cost effectively as possible.

Industry feedback was that the challenges for such an approach were that it is more likely to add some double-handling costs and may lose some of the large cluster benefits of co-locating suppliers. It was also noted, however, that synergies and reduced double-handling costs are still possible on smaller regional clusters, if activity is sensibly targeted on capable sites.

The most important benefit of this approach, however, is that the investment required can be facilitated on a project-by-project basis or even speculatively, in line with what we have seen to date.

More proactive industry involvement in industrialisation

The findings of this study have shown that there is sufficient UK east coast staging port capacity to meet anticipated demand. It has also shown that although the availability of staging ports is a benefit, it is not a dominant driver for stimulating manufacturing activity.

There has, however, been feedback from consultees about other ways that the sector could stimulate greater industrialisation in the UK. In particular, many consultees suggested that more could be done by industry to coordinate and accelerate inward investment through greater communication and information sharing. The UK Government is already playing an important role in working with developers and suppliers through the Department of Energy and Climate Change (DECC) and UK Trade and Investment (UKTI).

While consultees were unable to offer any clear suggestions about how such involvement could be structured, there was general agreement that a more engaged role for industry in this process would make it more likely that investment can be unlocked.

Conclusions

The key findings of this study are:

- Significant investment has already been made on the east coast and also in other locations across the UK.
 OWIC members agree that the current UK ports portfolio can support the anticipated pipeline, subject to the ports remaining competitive.
- Developers are driven to focus on project-by-project solutions and therefore support investment in port and supply chain facilities on an individual project basis, after government support has been obtained and a financial investment decision (FID) has been reached. Developers of offshore wind projects have tended to form strong relationships with nearby ports and industry expects this to continue.
- Given the availability of existing UK sites suitable for both staging and manufacturing activities, there is little evidence to suggest that the development of a 'large cluster' would have a significant marginal



benefit on the LCOE of the UK's portfolio of projects or on the level of UK industrialisation, compared with a vigorously pursued approach of supply chain development using existing infrastructure.

- Focusing on regional coordination of staging and manufacturing capability is likely to stimulate supply chain growth, with the potential to create regional staging and manufacturing clusters.
- Industry is motivated to support greater levels of UK industrialisation by identifying ways in which it can proactively contribute to the UK Government's work to accelerate supply chain investment and help stimulate export activity.



Recommendations

The overarching objective of these recommendations is to set out the actions that can be taken to mature the opportunities identified during this review. With the actions set out below, it is believed that the UK's current competitive staging and manufacturing offering will be enhanced.

These recommendations are made without prejudice to any other Government priorities, programmes or initiatives.

Step #1: A strategic industry solution

Reporting to OWIC, the Offshore Wind Programme Board (OWPB) will coordinate a **regional programme** of work, looking at ports and other offshore wind infrastructure for **staging activity** in **Scotland**, **Northern England** and **East Anglia** respectively. The OWPB will determine the membership of the regional discussion groups that should, as a minimum, involve the UK offshore wind farm developers most likely to use the ports in each region.

The OWPB will build on the findings of this study to prepare detailed assessments of the potential future offshore wind staging activities that could take place *within each region*, and what steps could be taken to make the ports more competitive.

The OWPB will, using much of the background from this study, examine the capability of the infrastructure in each region to meet anticipated demand and identify specific opportunities to stimulate or accelerate further supply chain

investment and industrialisation, including identifying potential suppliers, new or existing, that could invest in the region.

The OWPB, with guidance from OWIC, will consolidate key messages, identify interregional synergies and scope the most effective and appropriate ways to share information and support further progress, particularly in terms of sharing more information with ports. The OWPB will also consider how to broaden the benefits of this exercise to include companies located outside these three regions.

Step #2: Working with Government to deliver tangible results

Once specific further actions have been identified, the OWPB will engage with government bodies, including DECC, Scottish Government, UKTI and regional agencies, to share its consolidated findings and target and realise the main opportunities. The OWPB will determine the timescales for the overall programme, potentially linking future updates with the timing of future CfD auctions.

This approach is considered to offer the best opportunity for overcoming the challenges of the current project-by-project approach, by creating regional, long-term scenarios of demand. It will also focus industry and government attention on the most promising opportunities, offering a more strategic approach to UK supply chain development.



1. Introduction

On 9th February 2016, the Minister of State for Energy Andrea Leadsom announced in the House of Commons a strategic review to identify opportunities to develop the east coast as a staging and construction hub for the UK and European offshore wind industry.⁸

This review was undertaken to support the work of the Offshore Wind Industry Council (OWIC). It was undertaken by BVG Associates on behalf of the jointly-led industry and government review team that was set up to conduct this investigation. It is not a statement of Government policy. As well as providing a detailed review of UK east coast port capability, this report considers three main questions:

- Is there demand for more staging capacity in UK east coast ports?
- How is the UK offshore wind industry currently stimulating supply chain industrialisation through portrelated activities?
- What options are there for unlocking greater levels of UK supply chain industrialisation?

1.1. Methodology

This report is based on an extensive consultation involving interviews with more than 50 project developers, suppliers, central and regional government agencies and port owners. The names of the organisations are listed in Appendix A at the end of this report

We undertook structured interviews to ensure the most consistent and comprehensive dialogue. The interviews were conducted in accordance with pre-defined confidentiality principles in which all feedback was anonymised or aggregated, unless specific permission was obtained. This approach resulted in interviewees giving open and honest responses on commercially sensitive issues.

Following the consultation, we undertook a thematic analysis of consultee feedback and drafted summary findings and conclusions.

These were discussed with the review team in workshops to gather their further feedback before the preparation of this report.

⁸ DECC, East Coast Review: Terms of reference, May 2016, available online at

1.2. Terminology

In this document, we refer to two separate types of activity, which have different port requirements.

- Staging: this activity covers the storage and loading of
 offshore wind farm components onto vessels before final
 delivery to site for installation. This may also involve a
 range of pre-construction activities that take place in the
 port to minimise the amount of offshore work. Depending
 on the location and strategy of the developer, a project
 may choose to install components directly from
 manufacturing facilities.
- Manufacturing: in this context, this activity refers to the
 production of large offshore wind farm components in or
 near a port. These may be turbine nacelles, blades,
 towers, foundations, array cables, export cables or
 offshore substations (topsides or foundations). This has
 previously been referred to as construction.

Other offshore wind-related port activities, such as those involved during the long term operation and maintenance (O&M) phase, have not been considered in this study.

https://www.gov.uk/government/publications/east-coast-review-of-construction-and-staging-terms-of-reference, last accessed July 2016.



2. Requirements for offshore wind ports

2.1. Port capability requirements

We assessed the capability of 23 UK east coast ports to meet the needs of offshore wind staging and manufacturing activity against a baseline set of requirements. These requirements were derived from industry consultation and reflect the realistic minimum that would be acceptable to an offshore wind port user, rather than the optimum requirement for maximum operational flexibility. In some cases, however, we have noted where potential port users provided details of higher specification infrastructure.

We have defined five levels of capability: staging only, staging plus one manufacturing activity, staging plus two manufacturing activities, a staging and manufacturing cluster and manufacturing only. We have not made any judgement about the location of the port relative to wind farm projects or the costs charged by the owner or operator.

Staging only (S in the port capability assessment)

The following are the baseline characteristics of a port capable of supporting the turbine staging activity for one large offshore wind farm per year (approximately 100 complete 8MW turbines per year). In total, a minimum land area of 12ha with 150m of staging quay is required.

Table 1 Baseline requirements for a port facility capable of support 'Staging only'.

Requirement	Baseline	Justification	Notes
Horizontal clearance for a vessel carrying turbine blades transverse across its hull	110m	Based on an 80m blade with an uneven overhang on one side of the vessel, plus 15m clearance at either end	A site that was future-proofed against increases in blade length up to 100m would have a clearance of 130m
Vessel beam	45m	The majority of the current installation fleet have a beam of 45m or less	A site capable of accommodating the largest installation vessels currently in use would be able to accept vessels with a beam of 50m, while future vessels may have beams of up to 60m
Air draft	Unrestricted	A jack-up vessel must be able to access or leave the port with its legs raised and, potentially, carrying fully assembled towers	
Water depth at the quay	9m LAT	The majority of the current installation fleet have a draft of 6m to 7m and an operator will require an under-keel clearance of at least 2m	A site capable of accommodating the largest installation vessels currently in use would have a water depth at the quay of 13m LAT
Water depth in the approach channel	Access for a vessel with a draft of 7m for 90% of the time	The charter cost of installation vessels means that developers want to minimise waiting times	For full operational flexibility and the ability to accommodate the largest installation vessels currently in use, the port will offer access for a vessel with a draft of 11m for 100% of the time
Potential for vessels to repeatedly jack-up at the quayside	Yes	Installation vessels must be able to jack-up alongside the quay before using their onboard cranes to load components	There should be no risk of repeated jack-up operations undermining the quay wall or causing damage to the vessel



Staging quayside length	150m with exclusive access	The majority of the current installation fleet have a length of up to 150m. The charter cost of installation vessels means that developers want to minimise waiting time	Industry feedback indicated a preference for quay length of up to 200m per project to allow greater operational flexibility
Staging land area	12ha of contiguous land with direct access to the quayside	Based on industry feedback about the minimum area needed to store and move components	Industry feedback indicated a preference for staging area of up to 20ha per project to allow greater operational flexibility
Heavy lift quayside area (included within staging area)	3,000sqm	Based on an assumed quay length of 150m and a width of 20m from the quay edge	Industry feedback indicated a preference for a width of up to 30m from the quay edge to allow greater operational flexibility to give a total area of 4,500sqm
Ground bearing pressure (storage area)	6t/sqm uniformly distributed load (UDL)	Based on industry feedback about the minimum needed to store and move components around the site using self-propelled modular transporters.	Industry feedback indicated a preference for ground bearing pressure of up to 10t/sqm UDL to allow greater operational flexibility
Ground bearing pressure (heavy lift quayside)	15t/sqm UDL	Based on industry feedback about the minimum needed to store components safely at the quay and allow onshore cranes allow to operate	Industry feedback indicated a preference for a ground bearing pressure of up to 20t/sqm UDL to allow greater operational flexibility

Staging plus one manufacturing activity (S1)

As well as the requirements above, additional manufacturing land area is required. This will cater for a facility producing 100 units per year, whether they are nacelles, towers, blade sets, jackets or monopiles. In total, this site needs a minimum land area of 20ha with 150m of staging quay.

Table 2 Additional requirements for a port facility capable of support 'Staging plus one manufacturing activity'.

Variation from Staging only	Baseline	Justification	Notes
Additional manufacturing land area	A contiguous area of at least 8ha that can be leased on a long term basis that has direct access to the staging facility without using public roads	Industry feedback on minimum requirement for producing 100 units per year, whether they are nacelles, towers, blade sets, jackets or monopiles	Industry feedback indicated a preference for land area of 10ha for some manufacturing activities to give greater operational flexibility

Staging plus two manufacturing activities (S2)

As above, but with enough available land to accommodate two manufacturing activities. In total, this site needs a minimum land area of 28ha with 150m of staging quay.

Table 3 Additional requirements for a port facility capable of support 'Staging plus two manufacturing activities'.

Variation from <i>Staging</i> only	Baseline	Justification	Notes
Additional manufacturing land area	A contiguous area of at least 16ha that can be leased on a long term basis that has direct access to the staging facility without using public road	Two manufacturing sites, each of 8ha (16ha in total)	Industry feedback indicated a preference for land area of 10ha for some manufacturing activities to give greater operational flexibility. In this case, the land requirement would increase to 20ha

Staging and manufacturing cluster (C)

The following are the requirements to provide the capability to accommodate the turbine staging activity of two large wind farm projects per year (approximately 200 complete 8MW turbines per year) with enough additional available land to also accommodate three manufacturing activities. This site has the same horizontal clearance, vessel beam, air draft, water depth, jack-up and ground bearing pressure requirements as Table 1 above. In total, this site needs a land area of at least 48ha with at least 300m of staging quay.

Table 4 Additional requirements for a port facility capable of support a 'Staging and manufacturing cluster'.

Requirements	Baseline	Justification	Notes
Staging quayside length	300m with exclusive access	Two quay lengths of 150m (300m in total)	Industry feedback indicated a preference for quay length of up to 200m per project to allow greater operational flexibility. In this case the quay length requirement would increase to 400m
Staging land area	24ha of contiguous land with direct access to the quayside	Two sites of 12ha (24ha in total)	Industry feedback indicated a preference for a staging area of up to 20ha per project to allow greater operational flexibility. In this case, the land requirement would increase to 40ha
Heavy lift quayside area (included within staging area)	6,000sqm	Based on two quay lengths of 150m (300m in total) and a width of 20m from the quay edge	Industry feedback indicated a preference for a width of up to 30m from the quay edge to allow greater operational flexibility. In this case, the land requirement would increase to 9,000sqm



A contiguous area of at le 24ha that can be leased of long term basis that has a access to the staging factivithout using public roads	Three sites of 8ha (24ha in total)	Industry feedback indicated a preference for land area of 10ha for some manufacturing activities to give greater operational flexibility. In this case, the land requirement would increase to 30ha
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Manufacturing only (M)

Where a port facility does not meet the requirements set out in Table 1 but industry feedback suggests it is still being targeted for offshore wind-related manufacturing activity (covering nacelles, towers, blade sets, jackets, monopiles, array or export cables), we have included it as a *Manufacturing only* site.

Table 5 Baseline requirements for a port facility capable of support 'Manufacturing only'.

Requirement	Baseline	Justification	Notes
Vessel beam	30m	A standard North Sea barge has a beam of 27.4m	Larger North Sea barges may have beams of up to 36m
Water depth at the quay	5m LAT	A standard North Sea barge has a maximum draft of 4.7m	Larger North Sea barges may have drafts of up to 6.5m. Non-jack-up heavy lift crane vessels may have a draft of up to 7.5m
Manufacturing land area	A contiguous area of at least 8ha that can be leased on a long term basis that has direct access to the heavy lift quayside without using public road	Industry feedback on minimum requirement for producing 100 units per year, whether they are nacelles, towers, blade sets, jackets or monopiles	Industry feedback indicated a preference for land area of 10ha for some manufacturing activities to give greater operational flexibility
Heavy lift quayside area (included within staging area)	900sqm	Based on an assumed heavy lift pad of length of 45m and a width of 20m from the quay edge	
Ground bearing pressure (storage area)	6t/sqm UDL	Based on industry feedback about the minimum needed to store and move components around the site using self-propelled modular transporters.	Industry feedback indicated a preference for a ground bearing pressure of up to 10t/sqm UDL to allow greater operational flexibility
Ground bearing pressure (heavy lift quayside)	15t/sqm UDL	Based on industry feedback about the minimum needed to store components safely at the quay and allow onshore cranes allow to operate	Industry feedback indicated a preference for a ground bearing pressure of up to 20t/sqm UDL to allow greater operational flexibility

2.2. Port readiness

To assess the relative readiness of each port site against the different requirements for staging and manufacturing discussed above, we have graded it using the following scale.

Table 6 Port readiness grading definitions.

Grade	Definition
G	The site meets all requirements and is available immediately or investment has already been committed that means it will meet all requirements listed in the future.
Y	The site has the potential to meet all requirements listed and the port owner has provided plans with an investment budget of £15 million or less that includes land and quay design and considers capital costs and consenting requirements. This may require speculative early investment to be ready for project use, depending on the relative timescales of the port development and project build out.
A	The site has the potential to meet all requirements listed and the port owner has provided plans with an investment budget of more than £15 million that includes land and quay design and considers capital costs and consenting requirements. This may require speculative early investment to be ready for project use, depending on the relative timescales of the port development and project build out.
R	The site is unsuitable for the activity due to not meeting one or more of the requirements used in this review, and the port owner has provided no plans that address the shortfall.

2.3. Port assessment

This assessment is based on feedback from port owners about what land and quayside is commercially available for offshore wind port users, rather than from a simple assessment of the port's total estate. No detailed site inspections or engineering assessments have been undertaken to audit the feedback of the port owners. The sites have been listed according to their geographic location, running north to south along the UK's east coast. We have only noted that a site is suitable for *Manufacturing only* if there is industry feedback indicating interest in the site and if it is not suitable for *Staging only*, but meets the requirements set out in Table 5. The owner of Harwich and Thamesport has declined the opportunity to be included in this assessment.

Table 7 East coast port capability assessment.

Port (and owner)	Score		Notes
	S	G	The port owner has speculatively invested £45 million in the site to upgrade existing
	S1	G	quayside, construct new quayside and resurface the main 30ha site. This investment was
Nigg Yard	S2	G	completed in 2015.
(Global Energy Group)	С	Υ	The port does not currently have enough suitable land to accommodate this level of additional activity. It has plans in place to develop an additional 20ha of greenfield land that is zoned for industrial use and is adjacent to the existing site. This site could be prepared for use for £9 million.
Invergordon (Cromarty Firth Port Authority)	S	R	The port does not have enough available land to accommodate turbine staging activity and the port owner has provided no plans that address this issue. The port has, however, already accommodated offshore renewable projects (including wind) and has invested £25 million in the development of an additional 3.6ha site with 154m of heavy lift quayside at its Invergordon service base
Aberdeen (Aberdeen Harbour Trust)	S	R	The port currently does not have enough available land or quayside to accommodate this activity. Subject to a £400 million multi-user port extension targeted at a broadening of ports activity and diversification from the oil and gas industry that is expected to proceed in Q4 2016, the port could collaborate with the city council to secure additional land to meet the requirements but these plans have not been developed.



Dundee	S	G	The port currently does not currently have enough suitable land or quayside to accommodate turbine staging activity but is speculatively investing £10 million to upgrade the existing Prince Charles Wharf at the eastern end of the port to meet these requirements, with an anticipated completion date of mid-2017.
(Forth Ports)	S1	R	The port currently has no plans to allocate enough additional land to accommodate this additional activity, although there are contiguous land areas adjacent to the Prince Charles Wharf site that could be made available in the longer term.
Montrose (Montrose Port Authority)	S	R	The port does not have enough available land or sufficient water depth in its approach channel to accommodate turbine staging activity and the port owner has provided no plans that address these issues.
	S	R	The port does not have sufficient water depth alongside its quay or in its approach channel to accommodate turbine staging activity and the port owner has provided no plans that address these issues.
Methil (Scottish Enterprise and Fife Council)	М	G	Industry feedback is that this site is being considered for manufacturing. The port owners have speculatively invested £20 million in land and quayside improvements and the port is already being used for the production of offshore wind jacket foundations. There is 20ha of brownfield land available at the site to accommodate manufacturing activity, with direct access to heavy lift quayside. The owners have also undertaken site investigation and survey work looking to improve marine access and there is a future funding package of approximately £25 million in place for onshore infrastructure works.
Rosyth	S	R	The air draft restriction of the Forth Bridge means this site could not accommodate turbine staging and the port owner has provided no plans that address this issue.
(Babcock International, Forth Ports, Scarborough Muir)	М	G	Industry feedback is that this site is being considered for manufacturing. The port is already used for offshore manufacturing activity and there is 28ha of remediated brownfield land that could be made available to accommodate manufacturing activity, with direct access to heavy lift quayside.
Blyth	S	R	The port does not have the water depth or horizontal clearance in its approach channel to accommodate turbine staging activity and the port owner has provided no plans that address these issues.
Blyth (Blyth Harbour Commission)	М	G	Industry feedback is that this site is being considered for manufacturing activity. In collaboration with Arch (Northumberland County Council's wholly-owned property development company), the port owner is investing £22 million to redevelop a 35ha brownfield site adjacent to the port estate and to upgrade an existing quayside to offer deep water, heavy lift capacity.
	S	А	The port does not currently have enough suitable quayside or land to accommodate these activities. The port has developed plans to upgrade 470m of existing quayside and
North Shields (Port of Tyne)	S1	Α	to resurface a 59ha site, of which approximately a third is brownfield. The plans are currently unconsented but the port owner estimates it would have a 12 month consenting
	S2	A	period and a build time of up to 16 months with a cost of approximately £25 million for the quayside infrastructure. The port has plans to speculatively invest £12 million in land
	С	Α	remediation on the brownfield site.
Wallsend	S	R	The port does not have sufficient water depth at the quayside to accommodate turbine staging activity. The port owner has provided no plans that address this issue.
(OGN)	М	G	Industry feedback is that this site is being considered for manufacturing. There is 30ha of land that could be made available to accommodate manufacturing activity, with direct access to heavy lift quayside.

	S	Υ	The port currently does not have enough air draft due to an overhead power line to accommodate turbine staging activity. The port owner says that there are plans for the regional transmission systems operator to remove this restriction, if required, at a cost of approximately £1 million. To date, the port owner has speculatively invested approximately £40 million in land and quayside improvements, targeting offshore wind and other offshore sectors.
Neptune Energy Park (Shepherd Offshore)	S1	Υ	The port currently does not have enough suitable land to accommodate this activity but has existing investment plans to upgrade additional areas of the site for less than £15 million.
Onanore)	S2	R	The port currently does not have enough available land to accommodate this level of additional activity. The port owner does have a joint venture in place with Newcastle City Council to develop additional areas of land behind the existing site that are currently being remediated. There is also an additional quayside area adjacent to the existing site that is under separate ownership but could be combined with the main site. These plans are currently at an early stage of development.
Sunderland	S	R	The port does not have enough suitable quayside or sufficient water depth in its approach channel to accommodate turbine staging activity and the port owner has provided no plans that address these issues.
(Sunderland City Council)	М	G	Industry feedback is that this site is being considered for manufacturing. The port owner has speculatively invested approximately £3 million pounds in land and quayside improvements and there is 20ha of brownfield land available at the site to accommodate manufacturing activity, with direct access to heavy lift quayside.
Hartlepool	S	R	The port does not have the capacity to accommodate the beam or draft of current installation vessels and the port owner has provided no plans that address these issues. It is noted that the port can accommodate installation vessels with a maximum beam of 40m.
(PD Ports)	М	G	Industry feedback is that this site is being considered for manufacturing. There are large areas of brownfield land available at the site to accommodate manufacturing activity, with direct access to existing heavy lift quayside.
	S	G	The port owner has speculatively invested £75 million in the site to upgrade existing
Seaton	S1	G	quayside and resurface the 51ha site (of which 10ha is a dry dock). This investment was
(Able)	S2	G	completed in 2015.
	С	R	The port does not have enough available land to accommodate this level of additional activity and the port owner has provided no plans that address this issue.
Middlesbrough (Able)	S	R	The port has an air draft restriction due to an overhead power line and does not have the water depth in its approach channel to accommodate turbine staging activity and the port owner has provided no plans that address these issues.
	М	G	Industry feedback is that this site is being considered for manufacturing. There is 16ha of land that could be made available for manufacturing activity, with direct access to heavy lift quayside. A significant area of the site (4.2ha) has a concrete surface providing a ground load bearing capacity of 50t/sqm UDL.
Tees Dock (PD Ports)	S	R	The port does not have enough available land to accommodate turbine staging activity and the port owner has provided no plans that address this issue.



	S	G	The port is investing £150 million to create a 54ha site and 636m of staging quayside for Siemens Wind Power's Green Port Hull development. The site will be under the exclusive
	S1	G	control of Siemens Wind Power and used for blade manufacture, turbine staging and other offshore wind-related support services.
Alexandra Docks (Hull) (Associated British Ports)	S2	А	The port currently does not have enough available land with suitable ground bearing pressure that is not directly controlled by Siemens to accommodate further manufacturing activity. The port has proposed plans to prepare up to 257ha of greenfield and brownfield
. 3.3,	С	A	land that lies within the port estate and to construct an internal connecting road to allow large components to be transported to the Alexandra Dock staging quayside and other lock-restricted quays in the port. The port owner has speculatively invested £2 million to secure outline planning consent for manufacturing activity and completing environmental mitigation measures for 80ha of the greenfield land.
	S	А	The port currently does not have enough available land or suitable quayside to accommodate turbine staging activity. The port owner has plans to infill the existing dock
Albert Dock (Hull) (Associated British Ports)	S1	А	to create a 22ha site and build a deepwater riverside quay. These plans are currently unconsented but the port owner estimates it would have an 18 month consenting period and an 18 month build time with a total cost of approximately £60 million.
	S2	R	The port does not have enough available land or suitable quayside to accommodate this additional activity, even with the proposed development.
	S	Α	The port currently does not have enough quayside to accommodate this activity. The port
Killingholme	S1	Α	owner has full planning consent in place to develop a 360ha site with up to 1,288m of staging quayside. The port owner has already speculatively invested £37.5 million in early
(Able)	S2	Α	enabling measures, including surfacing large areas of the site. The port owner estimate the cost of the first phase of quay development (550m) would be approximately £150 million and that it could be operational within 24 months of FID.
	С	А	
	S	А	The port currently does not have enough suitable land or quayside to accommodate this activity. The port owner has proposed plans to create a staging quay up to 200m at its existing bulk handling jetty by infilling behind the existing quay, which could then be extended up to 400m. The 25ha site behind this quayside is currently being used for coa storage but could be resurfaced. There is also another 40ha site adjacent to this site that could be made available but there is an operational railway line between them so a crossing would need to be established. These plans are currently unconsented but the port owner estimates it would have a six month consenting period and a 12 month build
Immingham (Associated British	S1	Α	
Ports)	S2	А	
	С	А	time with a total cost of approximately £80 million for the site improvements and the first 200m of quayside.
	S	G	The port has a 12.5ha area that will be used for the turbine staging activity for Galloper and East Anglia ONE. As part of this contract, the port is investing £6 million to increase
Great Yarmouth (Peel Ports)	S1	G	the load bearing capacity of the site and install a RoRo linkspan to import components. There is also an 8ha brownfield site suitable for manufacturing activity within the port estate.
	S2	R	The port has proposed plans to develop additional land parcels in the port but these are not large enough to accommodate this additional activity.
Lowestoft (Associated British Ports)	S	R	The port does not have enough available land or quayside to accommodate staging activity and the port owner has provided no plans that address these issues.
	S	А	The port does not currently hours are used suitable surgicide to account of the control of the c
Sheerness	S1	Α	The port does not currently have enough suitable quayside to accommodate staging activity. The port owner had proposed plans for a 70ha manufacturing and staging facility
(Peel Ports)	S2	Α	that were developed in 2012. The port is currently being used for other activities but the
	С	Α	port owner says the 2012 plans could be fully or partial used.
l			ı

2.4. Summary of findings

This study identified that offshore wind has already stimulated strong levels of investment in east coast ports. Over the last five years, owners of ten east coast ports have spent or committed more than £400 million on land and quayside infrastructure that is either exclusively or partially focused on capturing offshore wind activity. This is in addition to investment that has been made in west coast staging and manufacturing facilities, such as Belfast and Mostyn, and in 23 facilities located around the UK's coastline providing operations and maintenance services. More than half of this investment has been speculative, based on the port owners' assessment of the potential opportunity from offshore wind and other sectors. The rest has been stimulated by firm contractual commitments by offshore wind players.

As shown in Table 8 and Figure 1, the study identified 11 east coast ports with the capability to accommodate turbine staging activity for one large project a year, almost half of which could be used with minimal further investment. Of these 11, ten of the ports could also accommodate at least one manufacturing activity at a run rate sufficient for 100 turbines per year. 9 Seven of the ports could accommodate two such manufacturing activities. 10 Six ports could accommodate a staging and manufacturing 'cluster', defined as a site with the capability to accommodate the staging activity of two large wind farm projects per year and also with enough contiguous land to support three manufacturing activities. 11 It is noted that the staging area in Alexandra Dock at Hull is under a long term lease to Siemens Wind Power so there are likely to be significant commercial challenges if a developer sought to use the facility to stage turbines from other suppliers, making this unlikely.

A further seven ports were also identified that could not meet the staging requirements defined by this study but could, however, host one or more manufacturing activities. 12

Other ports that were reviewed but did not meet the requirements used in this study for either Staging only or Manufacturing only were Invergordon, Aberdeen,

Montrose, Tees Dock and Lowestoft. This finding does not

preclude these ports winning other offshore wind-related activity, which is in some cases already taking place.

⁹ Nigg Yard, North Shields, Neptune Energy Park, Seaton, Alexandra Dock (Hull), Albert Dock (Hull), Killingholme, Immingham, Great Yarmouth and Sheerness.

¹⁰ Nigg Yard, North Shields, Seaton, Alexandra Dock, Killingholme, Immingham and Sheerness.

¹¹ Nigg Yard, North Shields, Alexandra Dock, Killingholme, Immingham and Sheerness.

¹² Methil, Rosyth, Blyth, Wallsend, Sunderland, Hartlepool and Middlesbrough.



Table 8 Summary of east coast port assessment.

	Staging activity (S)	Staging plus one manufacturing activity (S1)	Staging plus two manufacturing activities (S2)	Staging/ construction cluster (C)	Manufacturing only (M)
Nigg Yard	G	G	G	Y	N/A
Dundee	G	R	R	R	N/A
Methil	R	R	R	R	G
Rosyth	R	R	R	R	G
Blyth	R	R	R	R	G
North Shields	А	А	А	А	N/A
Wallsend	R	R	R	R	G
Neptune Energy Park	Y	Y	R	R	N/A
Sunderland	R	R	R	R	G
Hartlepool	R	R	R	R	G
Seaton	G	G	G	R	N/A
Middlesbrough	R	R	R	R	G
Alexandra Dock (Hull)*	G	G	А	А	N/A
Albert Dock (Hull)	А	Α	R	R	N/A
Killingholme	А	А	А	А	N/A
Immingham	А	А	А	А	N/A
Great Yarmouth	G	G	R	R	N/A
Sheerness	А	А	А	А	N/A
Number of ports	11	10	7	6	7

^{*} The staging area in Alexandra Dock at Hull is under a long term lease to Siemens Wind Power so there are likely to be commercial challenges if a developer sought to use the facility to stage turbines from other suppliers.

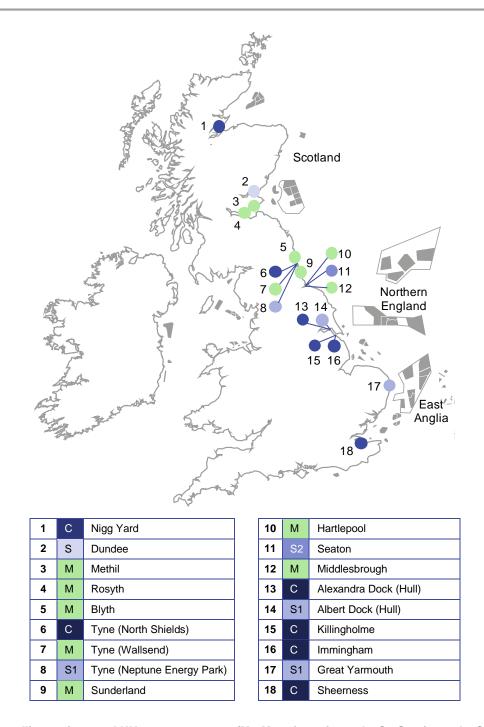


Figure 1 Map of headline regions and UK east coast ports (M - Manufacturing only, S - Staging only, S1 - Staging plus one manufacturing activity, S2 - Staging plus two manufacturing activities, C - Staging/manufacturing cluster).



3. Is there demand for more staging capacity in UK east coast ports?

3.1. Market demand

To date, the UK has installed 5.1GW of offshore wind capacity and there are a further 12 projects with a total capacity of 5.2GW that are either under construction or have passed their final investment decision (FID) so that they will be built out by the end of 2020.¹³

Assuming the industry maintains its progress in reducing the levelised cost of energy (LCOE), the Government has stated its ambition of supporting another 10GW of capacity in the 2020s to give a total installed capacity of approximately 20GW by the end of 2030.¹⁴

Most consultees said that this level of deployment in the 2020s was achievable and a pragmatic level on which to plan future levels of supply chain and port development.

"If 10GW can be realised, then this is good and healthy. It can't really be less if the Government wants to see ongoing strong cost reduction." (Developer)

Many consultees said the biggest factor affecting levels of deployment in the short-to-medium term was Government funding as it decides how much budget to allocate to the CfD process, and hence the amount of capacity that can secure funding. In March 2016, the Government set out a £730 million budget for less established technologies in the next three CfD auctions and said it expects this to deliver up to 4GW of offshore wind capacity. It has also announced the price trajectory it expects the offshore industry to target over that timeframe.

A few consultees said that if the cost of offshore wind energy continued to come down, the UK could potentially exceed this ambition of 10GW in the 2020s if the Government decides to ramp up deployment. This may be because there is slower than expected progress with other generation technologies, particularly nuclear.

"Sticking to an assumption of 10GW in the 2020s is sensible and there will be the opportunity to do more if other sectors go slow." (Developer)

It is likely to be more than 10GW because it will be relatively inexpensive for the Government to support more. (Supplier)

Whereas offshore wind deployment to date has been spread around the UK's coastline, based on sites that are currently leased the large majority of future deployment will take place in the North Sea off the UK's east coast.

As shown in Figure 2, almost a third of all capacity that is installed or post-FID is located in the Irish Sea or the English Channel. In terms of future activity, there are 19 projects (or zone phases) with a total potential capacity of 18.4GW where the developer has either secured planning consent or is actively investing to secure consent. ¹⁵ Of this potential future capacity, the only project not in the North Sea is the 700MW Isle of Man project.

¹³ Analysis by BVG Associates. Projects under construction or post-FID are: Beatrice, Blyth Offshore Demonstrator, Burbo Bank Extension, Dudgeon, East Anglia ONE, Galloper, Hornsea Project One, Hywind Scotland Pilot Park, Race Bank, Rampion and Walney extension 1 and 2.

¹⁴ DECC, Amber Rudd's speech on a new direction for UK energy policy, November 2015, available online at https://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy, last accessed July 2016.

¹⁵ Analysis by BVG Associates. Projects are: Dogger Bank Creyke Beck A, Dogger Bank Creyke Beck B, Dogger Bank Teesside A, Dogger Bank Teesside B, East Anglia ONE NORTH, East Anglia TWO, East Anglia THREE, European Offshore Wind Deployment Centre (Aberdeen), Hornsea Project Two, Hornsea Project Three, Inch Cape, Isle of Man, Moray Firth, Neart Na Gaoithe, Norfolk Boreas. Norfolk Vanguard, Seagreen Alpha, Seagreen Bravo and Triton Knoll

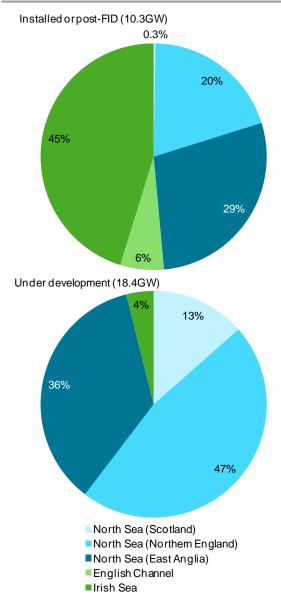


Figure 2 Geographic distribution of offshore wind capacity around the UK coastline.

Despite this east coast focus for future activity, industry feedback is that it is not possible to predict with confidence specifically where or when the activity will happen within different areas of the North Sea. This is because, to drive better value for consumers, the CfD auction mechanism allocates support based on the price bid by developers. The price at which a developer can bid is heavily influenced by the physical characteristics of its wind farm site (such as water depth and distance from shore) but is also affected by other issues, such as supply chain choices and the developer's appetite for risk. As such, while some consultees acknowledged that projects in deeper waters and farther from shore may be have more challenging conditions, no one believed it was possible to accurately predict the order in which projects are likely to secure support.

In addition to this UK activity, France, Belgium, the Netherlands, Germany and Denmark all have active offshore wind programmes in the North Sea. In each case, there is varying levels of political pressure to source components and services domestically but UK companies will still have the opportunity to compete for activity.

3.2. Supply and demand for UK turbine staging facilities

For turbine staging, there was clear industry feedback that developers have a strong preference for using ports that are local to the offshore wind farm site, if they have or can develop the capability and availability.

This preference was based on the cost benefits of reduced transit time between the port and wind farm site and a lower risk of weather delay compared to working from a more distant staging port. Given the high charter costs of the state-of-the-art jack-up vessels, this reduction in the installation programme has a significant cost benefit.

Consultees agreed that a developer would choose its port by assessing the 'whole-life' cost of using a facility, including the lease cost, port fees, any capital contributions required for infrastructure development or upgrades and the transport cost due to its proximity to the wind farm site.

"There is no sense in us investing in ports further away because the proximity of the port to the wind farm site is the biggest LCOE differentiator for a port. Other factors, such as the size or layout of the site, are less important."

(Developer)

"Local ports will become increasingly important as larger turbine size means fewer units can be loaded onto a vessel and more trips are needed. It won't be feasible to shuttle across the North Sea." (Developer)

Taking into account this preference, industry feedback was that developers of Scottish and East Anglia projects were confident that local ports would satisfy their turbine staging demand during the 2020s. Most of these consultees also said they expected the ports in those regions to be able to cope with any future peaks in local deployment. Assuming an average annual deployment of 1GW per year in the 2020s (consistent with the Government's ambition described in Section 3.1), this feedback correlates with our port assessment in Section 2 that suggests Nigg Yard and Dundee are well place to deliver Scottish projects and Great Yarmouth will be available for projects in the East Anglia region.



"The Scottish Government should be recognised for supporting the development of port capacity through the NRIP process." (Developer of a project in the Scottish region)

There was also industry feedback that projects in the Northern England region that use turbines from Siemens Wind Power (Siemens) will be able to use the port of Hull for their turbine staging should they choose to and it is available, following the significant investment that has been made in the Green Port Hull facility.

"We would only use Hull for turbine supply if we were going with Siemens - we couldn't justify the double handling on a cost or health and safety basis otherwise." (Developer of a project in the Northern England region)

The area of industry uncertainty was about where developers of projects in the Northern England region will base turbine staging activity if they are not using turbines from Siemens or if they choose not to use the port of Hull.

Industry feedback is that developers have identified other UK east coast ports that could accommodate staging activity although there were different issues affecting each of them that would need to be resolved.

- There is a risk that concurrent Scottish or East Anglia projects or parallel sector activity (particularly oil and gas decommissioning) could absorb the capacity of ports with infrastructure already in place, such as Great Yarmouth or Seaton.
- The staging area in Alexandra Dock at Hull is controlled by Siemens. While it is feasible that they could make this facility available to developers that are using turbines from other suppliers, there are likely to be additional commercial tensions in this situation. For example, they may choose not to offer the facility at a price that allows their rivals to bid competitively. Even if they do offer the facility at a competitive rate, they are unlikely to commit port capacity to others while there are still commercial opportunities to use the port themselves.
- The staging facilities proposed by a number of the Northern England port sites are currently unconsented.¹⁶ In these cases, the port owner would need to obtain the relevant consents speculatively to

- secure contractual commitment from potential port users.
- A number of the Northern England port sites require an investment of more than £15 million to develop the necessary infrastructure for staging activity.¹⁷ In these cases, the port owner would not be able to recoup all of the investment in a single contract. As such, they would need to take account of the post-contract residual value when making a business case. The same ports also have anticipated construction programmes of 12 to 24 months. As such, the port owner may need to start investing before the project developer has reached FID to be ready for the start of offshore works.

Industry feedback is that developers are aware of these issues but do not expect them to be a major barrier to cost-effective deployment.

Many consultees said that Continental port facilities would still be considered when selecting a turbine staging port, particularly the Danish port of Esbjerg. Overall, however, most believed that the investment that has taken place in UK port facilities means that local ports would be more competitive than Continental ports when considering whole-life cost.

As well as the financial factors that affected port choice, many consultees also said that locating turbine staging in a UK port had important political benefits, as it is a highly visible activity. All of these consultees also said, however, that staging activity alone accounted for a relatively small amount of the overall project expenditure so would not significantly increase levels of UK content.

3.3. Supply and demand for UK balance of plant staging facilities

For foundation and cable staging activity, most consultees said that these components can be cost effectively delivered to wind farm sites directly from their manufacturing sites, whether they are in the UK or elsewhere in Europe.

For example, many consultees said that foundations produced in the North Sea or the Baltic Sea would be installed using a just-in-time feeder solution. This eliminates the need for a separate staging port as units are loaded onto barges at the manufacturing site and shipped directly to an installation vessel that is stationed at the wind farm site.

¹⁶ Albert Dock (Hull), Immingham and North Shields.

¹⁷ Albert Dock (Hull), Killingholme, Immingham and North Shields.

"When moving components like foundations, it is critical to avoid double handling so you don't want to insert another step if you can avoid it. This just adds more cost and increases the risk of damage." (Developer)

"Staging ports for foundations do not add value and there is an industry drive to avoid staging activity if possible. There is no case for bringing a monopile to a separate port, putting it down and then picking it up again to install." (Installation contractor)

Consultees said that staging ports may be required if the foundations are produced further afield. Consultees said that, in this case (potentially with the exception of Scottish projects), they expected this demand would be met by Continental ports. In particular, consultees highlighted the ports of Ostend (BE), Vlissingen (NL) and Sif Group's planned monopile manufacturing and staging facility at Maasvlakte 2 in Rotterdam (NL).

"Publicly owned Continental ports have infrastructure in place with vast amounts of quayside." (Developer)

These ports, and others mentioned by consultees, are shown in Figure 3. Most consultees noted that all of these Continental port developments are either fully or partially publicly owned and have benefited from substantial public investment. This is in contrast to the UK, where the majority of ports are privately owned.

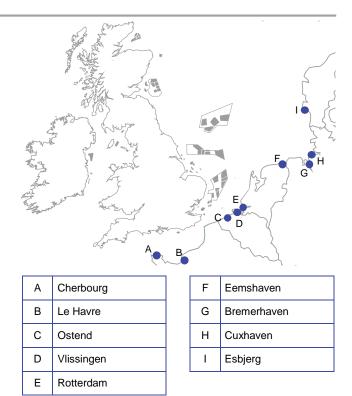


Figure 3 Map of Continental port location with existing or planned capability to accommodate offshore wind staging activity.

Consultees said developers would still consider UK ports when selecting a foundation installation strategy (particularly if they were using a strategy using a jack-up vessel) but the availability of suitable Continental facilities meant that UK ports would face strong competition. As such, consultees said the likelihood of investment in new infrastructure purely for this activity may be low.

For array and export cable installation, the majority of consultees expected that separate staging ports would not be required if a developer is using a UK or Continental supplier. This is because the cable would be loaded onto the installation vessel at the manufacturing facility and taken directly to site.

Consultees said that a cable staging facility would be required if a developer selects a non-European supplier, but that this would probably only account for a small minority of activity.



"For cable installation, the vessel will go directly to the cable production facility most of the time. This is increasingly the case as next generation vessels come on line that have the capacity to carry more cable, go faster and load cable more quickly."

(Installation contractor)

No staging facilities are required for the installation of offshore substation topside and foundations, which are likely always be delivered directly to site from the manufacturing facility.

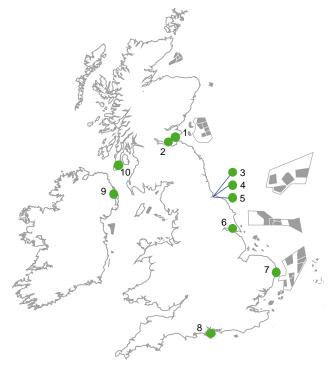
4. How has the UK Supply Chain been stimulated by offshore wind?

The opportunity to stimulate the development of manufacturing facilities (and hence jobs) has been an important factor in the UK and Scottish governments' long standing support for offshore wind.

Feedback from consultees was that the UK offshore wind industry recognises this political priority and is already committing a lot of effort to maximise the economic impact of projects.

It is estimated are that there are more than 600 UK companies already active in the offshore wind industry. ¹⁸ Of these, there are eight coastal manufacturing facilities that are already producing large scale components that cannot be cost-effectively transported by road. A further two (Siemens and CS Wind) have also committed investment that will mean they will start production within 18 months.

As shown in Figure 4, this activity is largely focused on the UK's east coast and covers blades, towers, turbine foundations, transition pieces and substation topsides and foundations. Consultees said that these UK-based facilities had strong capability and were competitive in the European market.



1	Burntisland Fabrication (BiFab)	Turbine foundations, substation foundations	
2	Babcock International	Substation topsides	
3	JDR Cables	Array cables	
4	Heerema Fabrication Group	Substation topsides	
5	Offshore Structures (Britain)	Transition pieces	
6	Siemens Wind Power	Blades	
7	SLP Sembmarine	Substation topsides and foundations	
8	MHI Vestas	Blades	
9	Harland and Wolff	Substation topsides and foundations	
10	CS Wind (Wind Towers Scotland)	Towers	

Figure 4 UK coastal manufacturing facilities for large offshore wind components.

As well as these existing or announced facilities, industry feedback was that there are further UK supply chain developments in the pipeline that are being stimulated by demand from the projects that already have secured support under the Final Investment Decision enabling for Renewables (FIDeR) mechanism and the first Contracts for Difference (CfD) round. As contractual negotiations are still ongoing, details of these developments are not yet public but a number of these are likely to be announced before the end of 2016.

 $\underline{\text{http://www.renewableuk.com/Page/SupplyChainMap}}\text{ . Last accessed July 2016}$

¹⁸ Based on RenewableUK's estimate of UK supply chain activity. For more information, see



Taking into account the progress in supply chain development described above, and the demand that will be stimulated by the next three CfD auctions, industry feedback is that there are some areas of supply where the UK is more likely to see further investment and industrialisation.

- Towers. Consultees said that the high cost of transporting completed tower sections means domestic supply is logical. In addition, the investment required for a new facility is lower than for many other large components.
- Jackets and other non-monopile steel foundations.
 Due to the legacy of North Sea oil and gas, the UK has a number of waterside manufacturing facilities that would be suitable for jacket production. Furthermore, demand for jackets from UK projects is expected to grow in the future as projects in deeper water are built out.
- Blades. Consultees said that the development of additional blade manufacturing capacity in the UK is likely to be dependent on a supplier consolidating the demand of two or more turbine suppliers or an individual turbine supplier increasing their capacity significantly.
- Concrete gravity base foundations. The Blyth Offshore
 Demonstrator project will be the first UK project to use
 this technology with five units being built at the
 Neptune Energy Park on the Tyne. Consultees said
 that there were also other suitable east coast facilities
 but industry feedback is that UK developers are not
 currently progressing with this technology on
 commercial scale projects.
- Export cables. A small minority of consultees said there was the potential for a non-European supplier to set up a new HVDC cable production facility in the UK if it could consolidate enough demand from the offshore wind market and northern European interconnector projects.
- Array cables. As with export cables, a minority of consultees thought a new UK facility could be possible if a company could consolidate demand from offshore wind and a parallel sector, like offshore oil and gas.

Most consultees said the probability of securing nacelle assembly in the UK to be low, as they believe that the leading turbine suppliers already have enough capacity to meet existing and future demand. For example, GE Renewable Energy has an operational facility in Saint-Nazaire (FR), MHI Vestas has an operational facility in Lindø (DK), Senvion and Adwen have operational facilities in Bremerhaven (DE), and Siemens is investing €200 million in a facility in Cuxhaven (DE) with production expected to start in mid-2017. Despite this situation, a few consultees said the UK should continue to pursue opportunities with suppliers because of the significant

economic benefits that could be stimulated by such a facility.

No consultees thought that monopile fabrication would take place in the UK due to the existing Continental supply chain, particularly EEW Special Pipe Constructions (DE), Sif Group (NL) and Steelwind Nordenham (DE).

Similarly, no consultees thought that any new facilities would be established to assemble substation topsides or foundations. The UK already has five players with a track record in delivery and there is strong capability in the rest of northern Europe as well.

Importantly, for all types of manufacturing activity where there was an opportunity for a UK facility, some consultees said the existing supply chain (located predominately on the Continent), either has the capacity to meet anticipated Europe-wide demand already, or can increase capacity at a relatively low cost. Although some consultees indicated that this might create some barriers to market entry, it was generally acknowledged that internationally-competitive UK supply chains can nevertheless be developed. In some cases, consultees said that a supplier may reduce its risk by initially establishing only a few elements of the total production process in the UK. This then establishes a 'beachhead' on which the supplier can work with subsequent projects to expand the scope of activities undertaken.

Similarly, consultees said developers are in some cases splitting supply contracts into smaller packages to support new suppliers to enter the market while reducing their own exposure to delivery risk. For example, the supply of jacket foundations for the Beatrice wind farm has been broken into three separate packages, of which one has been allocated to Scottish fabricator BiFab.

Where suppliers were progressing plans to develop new facilities in the UK, industry feedback suggested there has been little explicit discussion about how activity might be coordinated to be co-located or linked with an existing or planned staging facility to create a cluster. Consultees said this is because such activity adds complexity and risk to a commercially-sensitive process with only a marginal benefit compared with proceeding independently.

Furthermore, the large majority of active supplier plans were focused on adapting existing sites rather than greenfield developments. Industry feedback suggested that this is due to a number of factors.

- Lower cost of development. Given the commercial risk involved in a new facility, including limited market visibility and established competition, consultees said suppliers were seeking to minimise expenditure. As such, a greenfield development might offer optimal infrastructure but the added cost would be factored against that.
- Reduced risk of delays to the development programme. As developers are only able to commit on

a project-by-project basis, any new supplier must either invest speculatively or be able to build their facility and start production in the time between the developer's FID and the point at which the components are required. As such, consultees said suppliers do not want to take on the additional risk that the port infrastructure also needs to be ready on time.

Opportunity for synergies with existing activity. A
number of consultees said that the opportunity to take
advantage of the equipment, skills (both technical and
managerial) and port infrastructure of operational
neighbours would reduce the costs and risks of setting
up a new facility.

"The more it is possible for a new facility to share with an existing facility, then the easier it is to make the business case. They can share some operational activities, connect to existing supply chain partners, benefit from the existing labour pool and share quayside activities."

(Supplier)

One notable exception to this trend is the large-scale re-development of Alexandra Dock in the port of Hull for Siemens Wind Power. In this case, however, the company was the established market leader in turbine supply. It had also been able to build up a multigigawatt pipeline of projects before committing to the investment and it did not have sufficient, suitably located existing blade production capacity to meet anticipated demand.



5. What options are there for unlocking greater levels of UK supply chain industrialisation?

Stimulating a large cluster

There is ongoing debate in the industry about how to stimulate more UK supply chain activity, within the context of strong competitive pressure on the short term cost of offshore wind energy.

This debate has included the question of whether the UK could secure more industrialisation with the development of a single large port facility with enough land to accommodate the majority of east coast staging activity and new UK manufacturing.

The only comparable example of a port development of this scale is the port of Bremerhaven in Germany, which has approximately 200ha of land available. The only UK locations being considered by the industry that could make this amount of land available in the UK are the Able Marine Energy Park at Killingholme and Alexandra Dock (and environs) in Hull.

There was mixed industry feedback about the potential positive impact of this 'large cluster' approach, both on LCOE reduction and further UK supply chain development. Although little positive evidence was provided by industry to support the large cluster approach, we perceived this to be due to the industry focus on individual projects, which leads to a shorter-term focus.

The main benefits stated by consultees supporting the development of a large cluster approach were:

- Reduced double-handling. Consultees said that a
 supplier that is manufacturing components in a port
 facility with staging capacity would not need to
 transport the components to a separate staging site,
 thereby avoiding unnecessary costs and risks and
 reducing the project's carbon impact. In a large cluster,
 there is the potential that all major components could
 be manufactured and staged from the same facility.
- Synergies between tenants. Consultees said that it
 was likely that tenants co-located on a single site could
 achieve cost reductions through shared solutions to
 overlapping procurement and logistics requirements.
 For example, most suppliers of large components will
 require SPMTs, heavy lift cranes and storage space. A
 large cluster could create enough shared demand for a
 third party provider to have a pool of equipment that
 tenants could draw upon as required.
- Creating a 'gravity' to attract companies. Consultees said that a grouping of suppliers of large components in a single location would encourage their subsuppliers to set up alongside them, particularly if it means they can serve multiple customers and further reduce logistics costs. Consultees said this concentration of activity would also focus political

- attention and public funding for research and development activity and training facilities.
- Higher specification staging infrastructure. Consultees said that the cumulative demand of multiple port users in a large cluster would justify the development of higher specification staging infrastructure that would give port users greater operational flexibility and be more future-proofed against technology and market developments. Consultees said that this would help reduce the cost of energy of offshore wind projects by allowing developers to optimise their onshore activity and minimise vessel downtime.

Whilst acknowledging these benefits, other consultees said there were significant challenges with this approach:

- Cost of development. Consultees said it would be extremely difficult for a single developer to support the development of such a large facility under the current policy framework. The contracted spend required to trigger the port owner to invest in an individual port is commercially sensitive. Industry feedback, however, was that it would be significantly more than a developer would anticipate spending for a single project. Developers take a "project by project approach" under the CfD mechanism. The award of a CfD means that they can give their supply chains certainty on that specific project, but not beyond it as they do not know if they will win any subsequent auction. This also means suppliers setting up a new facility either have to cover their investment on a single project, coordinate with other projects that have won CfDs, or accept commercial risk about securing future contracts (some have been prepared to do this). Industry feedback was that even if additional investment by a developer in a port would reduce the LCOE of future projects in its portfolio, the company would be unable to unilaterally impose the necessary cost on the budget of its current project.
- Market volume. Given the feedback above, it follows
 that a large cluster is only likely to be stimulated by the
 offshore wind industry alone if enough projects are
 awarded CfDs at the same time and are able to
 coordinate their demand and timescales with each
 other. Industry feedback is that the anticipated
 average annual deployment of 1GW per year in the
 2020s (consistent with the Government's ambition
 described in Section 3.1) would not provide the critical
 mass of project capacity required.
- Developer cooperation. As noted above, the competitive nature of the CfD auction, whilst driving costs down, means that pre-CfD award developers are unlikely to collaborate.

"There is no reason for developers to cooperate with each other on port development as they are in competition for CfDs" (Supplier)

 Geographic distribution of North Sea projects. As set out in Section 3, there is no certainty about the order in which UK projects will be built out and developers have a preference for using local ports for turbine staging.

> "The fact that there are options in north and south undermines the case for a big hub. A central massive hub is going to be difficult to realise." (Supplier)

Port construction lead times. Consultees said it is extremely challenging for a developer to commit to using a port before it had reached FID for its wind farm project. Consultees said that this was because the availability of other UK and Continental ports meant the development of new port infrastructure was not an important enough issue to drive at-risk commitments or to risk late delivery of a port upgrade that would delay the project. Consultees said that the lead time between FID and first offshore works is typically 12 to 18 months so the port owner would almost certainly need to invest before getting firm commitment from a developer to provide sufficient certainty about being ready in time to avoid delaying the construction programme of the project.

"Pre-FID investment is extremely difficult. It can only really be relatively small, the activity would need to be on the critical path and it should have a significant impact. Port reservation fees may be possible but the impact needs to be compelling and ports are not considered a high risk issue."

"Ports were looking for reservation or termination feeds but these were strongly resisted as it is difficult to justify pre-FID investment unless it is absolutely necessary." (Developer)

Consultees said that the only other ways for such a facility to progress would be to secure sufficient additional demand from one or more parallel sectors or find some other form of de-risking support. In Bremerhaven, these issues were avoided by the regional government speculatively investing €180 million of public money in the development of deep water, heavy lift staging quayside based on the logic of capturing long-term value for its local economy. This level of public investment was only possible because the port is in public ownership.

A few consultees also said that, because supply chain development was taking place in existing east coast sites already (as described in Section 4), there was a risk that a large cluster could displace activity that may take place elsewhere in the UK anyway. Consultees also said that, given the level of supply chain development that has already taken place across Europe, it was unlikely that there were enough suppliers without efficient coastal facilities for the 'gravity' of a large cluster to stimulate significant levels of additional manufacturing activity in the UK.

Building on existing infrastructure

Industry's current focus is on identifying existing infrastructure that can be adapted to meet demand as cost effectively as possible.

Industry feedback was that the challenges for such an approach were that it is more likely to add some double-handling costs and may lose some of the large cluster benefits of co-locating suppliers. Consultees said, however, that synergies and reduced double-handling costs would still be possible with regional clusters, if activity is sensibly targeted on suitable sites.

The most important benefit of this approach, however, is that the investment required can be facilitated on a projectby-project basis or even speculatively, in line with what we have seen to date.

> "A one-stop shop is not the best solution. The UK needs three or four staging ports." (Developer)

More proactive industry involvement in industrialisation

The findings of this study have shown that there is sufficient UK east coast staging port capacity to meet anticipated demand. It has also shown that although the availability of staging facilities is a benefit, it is not a dominant driver for stimulating industrialisation.

There has, however, been feedback from consultees about other ways that the sector could stimulate greater industrialisation in the UK. In particular, many consultees suggested that more could be done by industry to coordinate and accelerate inward investment through greater communication and information sharing. The UK Government is already playing an important role in working with developers and suppliers through the Department of Energy and Climate Change (DECC) and UK Trade and Investment (UKTI).



While consultees were unable to offer any clear suggestions about how such involvement could be structured, there was general agreement that a more engaged role for industry in this process would make it more likely that investment can be unlocked and an openness to support any new initiatives.

"Some method for sharing opportunities for helping to build up the pipeline for a potential new UK supplier would make a difference. Suppliers must be at the heart of the solution."

"If the industry is going to have a long term future with UK content, it has to look at the way it shares relevant information to maximise opportunities for UK supply chain opportunities." (Developer)

Appendix A: Consultees

Name	Туре
Department for Business, Innovation and Skills	Central Government
Department for Communities and Local Government	Central Government
Department for Energy and Climate Change	Central Government
Department for Transport	Central Government
HM Treasury	Central Government
UK Trade and Investment	Central Government
Highlands and Islands Enterprise	Regional government
Humber Local Enterprise Partnership	Regional government
New Anglia Local Enterprise Partnership	Regional government
Scottish Enterprise	Regional government
The Scottish Government	Regional government
North East Local Enterprise Partnership	Regional government
DONG Energy	Developer
E.ON Climate & Renewables	Developer
EdF Energy Renewable	Developer
EDP Renewables	Developer
Iberdrola Renewables Offshore	Developer
Mainstream Renewable Power	Developer
RWE Innogy	Developer
SSE	Developer
Statkraft	Developer
Statoil	Developer
Vattenfall	Developer
Adwen	Supply chain
Babcock International	Supply chain
Bilfinger Mars Offshore	Supply chain
Boskalis	Supply chain
Burntisland Fabrications	Supply chain
GE Renewable Energy	Supply chain
Jan De Nul	Supply chain
MHI Vestas Offshore Wind	Supply chain



MPI Offshore	Supply chain
Seaway Heavy Lifting	Supply chain
Sembmarine SLP	Supply chain
Siemens Wind Power	Supply chain
Smulders Projects	Supply chain
Aberdeen Harbour	Port owner/operator
Able UK	Port owner/operator
Associated British Ports	Port owner/operator
Cromarty Firth Port Authority	Port owner/operator
Fife Council/Scottish Enterprise	Port owner/operator
Forth Ports	Port owner/operator
Global Energy Group	Port owner/operator
Hutchinson Port Holdings	Port owner/operator
Montrose Port Authority	Port owner/operator
PD Ports	Port owner/operator
Peel Ports	Port owner/operator
Port of Blyth	Port owner/operator
Port of Tyne	Port owner/operator
Shepherd Offshore	Port owner/operator
Sunderland City Council	Port owner/operator

K. DONG Energy Supply Chain Event details

DONG Energy Project	Event Location	Date
Burbo Extension	The Beaches Hotel, Beach Road East, Prestatyn, Denbighshire	May 2014
Burbo Extension	Floral Pavilion, Marine Promenade, New Brighton, Wirral, CH45 2JS	May 2014
Burbo Extension	Floral Pavilion, New Brighton, Wirral	June 2015
Walney Extension	The Forum, Barrow-in-Furness, Cumbria	February 2016
Hornsea Project One	Grimsby Town Hall, Grimsby	November 2016



Figure 1 - Burbo Extension Supplier Event June 2015

L. Conference Participation

Organisation	Details	Date
European Wind Energy Association (EWEA)	Programme Director for Burbo Bank Extension spoke at EWEA conference in Copenhagen	March 2015
NOF Energy	UK Country Chairman spoke at NOF Energy "Energy a Balanced Future" conference	March 2015
LCCC	Speakers at MDD event	[June 2015]
Hull and Humber Chamber of Commerce	Lead Stakeholder Advisor presented to morning briefing session	July 2015
NOF Energy	UK Country Asset Manager presented at Networking Lunch with DONG Energy	September 2015
Society of Maritime Industries	Head of Operations and Maintenance at Westermost Rough spoke at annual SMI event	February 2016
All Energy	UK Country Asset Manager spoke at All Energy conference in Glasgow	May 2016
Renewable UK (R-UK)	Head of Construction for Race Bank spoke at R-UK Offshore Wind Connections Conference	May 2016
UKTI at International Festival of Business	UK Country Chairman and Hornsea Project One Programme Director spoke at events organised by UKTI at IFB2016	June 2016
R-UK	Asset Manager for Walney Extension spoke at Renewables Marketplace	October 2016

M. Regional Business Networks

Organisation	Location	Website
Mersey Maritime	Liverpool	http://www.merseymaritime.co.uk/
The Bondholders	Hull	http://www.marketinghumber.com/
North West Business Leadership Team (NWBLT)	Manchester	http://www.nwblt.com/
Grimsby Renewables Partnership	Grimsby	http://investnel.co.uk/grp
Hull Business Leadership Team	The Humber	TBC
Team Humber Marine Alliance	The Humber	http://www.thma.co.uk/
Hull and Humber Chamber of Commerce	The Humber	https://www.hull-humber- chamber.co.uk/

N. DONG Energy competitive tendering process

The procurement of goods and services related to the development, construction and operation of DONG Energy wind farms is managed by specialised employees from the DONG Energy Wind Power ('DEWP') Procurement function. The primary task of this team is to ensure the best possible value is achieved for individual project to which they have been assigned, whilst also considering the wider impacts on a portfolio level.

The procurement function in DEWP is split into two departments: 1) CAPEX Procurement and 2) OPEX Procurement¹. This is done to ensure the specific business requirements over the lifetime of a wind farm are met. Close dialogue and, where possible, shared processes between the two procurement departments ensures synergies and lessons learned across the supply chain are captured. Other internal support departments (e.g. legal counsel) are organised so as to provide optimum levels of support during the procurement process

Characterised as a utility company, DONG Energy is governed by the EU Directive for Procurement in Utility Companies. Specific exemptions, local legislation and partner agreements apply to certain business units and geographical locations.

DEWP strives to build relationships with capable, competitive and innovative suppliers, who are able to support our journey towards delivering a lower Cost of Electricity without compromising on safety or quality. Furthermore, DEWP seeks to engage with local suppliers who are established in the proximity of each wind farm. This is achieved through specific procurement events in these areas as well as focused workshops. A detailed calculation of local and national content percentages is also undertaken for each wind farm project.

Ensuring integrity across our supply chain is vital for DONG Energy. Our 'Code of Conduct for Business Partners' provides the foundation for our continuous engagement with suppliers and dialogue in good faith on their ethical, social, and environmental performance. The Code of Conduct for Business Partners outlines our expectations regarding compliance with applicable law, respect for labour and human rights, environmental management, and anti-corruption. DONG Energy consider the content of the document as an integral part of our business relationship with individual suppliers.

DONG Energy Procurement Policy

The Procurement Policy covers all business units in the DONG Energy group.

The purpose of the Procurement Policy is to set out directions for DONG Energy Procurement activities, in order to secure compliance with principles and applicable rules whilst allowing DONG Energy to meet it business objectives.

The Procurement Policy outlines four basic principles to which all procurement in DONG Energy shall be based upon. The principles are:

- Best Value
- Competition
- Fair Treatment of Suppliers
- Responsible Sourcing

All DEWP procurement tools and processes are developed to meet these principles.

DONG Energy Wind Power Sourcing Processes

¹ DEVEX Procurement is handled by Contract Mangers in the OPEX Procurement organisation

DEWP has developed and implemented a number of procurement processes to secure business objectives; best practice, legal requirements (including relevant procurement directives and acceptable contractual terms and conditions), credit and insurance policies can be met.

The full DEWP sourcing process is illustrated below and consists of a total of 6 phases each concluded at a milestone/gate passage.



Variations from the full sourcing process (e.g. direct award or direct invitation) may be agreed as a procurement approach in the sourcing strategy whenever the market/business situation and legal environment gives the option.

The sourcing strategies are developed by the Contract Managers based on the current supply base and project specific requirements. At procurement Gate A portfolio considerations is included to identify if cross project procurement activities makes sense.

Gate D is where the result of the tender process is presented to the management for award decision. Final approval and signing of the contract is performed by the authorised people from the specific wind farm project which will award the contract in question.

The procurement milestones (B,C,E,F) are reporting and sign-off is performed by line and project management.

Supporting tools, contract templates and relevant databases are linked to the specific phase of the Sourcing process in order to secure a lean flow. e.g. Achilles Systems' supplier databases (Sellihca, UVDB, Connexio) are used as primary tools to identify and prequalify (where necessary) suppliers for a given tender in the Supplier Prequalification phase.

O. Hornsea Project One Bladt / OSB – Press Release January 2017

Big boost for Teesside firm as DONG Energy places orders for world's biggest windfarm

05.01.2017 14:00

- DONG Energy's <u>Hornsea Project One.</u> off Yorkshire coast, will be biggest windfarm in the world
- Multi-million pound contract signed today safeguards 200 jobs in Teesside
- Follows contracts for other major components to be manufactured in UK

DONG Energy has today signed a contract with Bladt Industries for 96 transition pieces for its Hornsea Project One offshore windfarm.

Over 50 transition pieces (56), which link the monopile foundation of offshore wind turbines with the towers, will be manufactured at the Offshore Structures Britain (OSB) facility in Haverton Hill near Billingham, Teesside. The remaining transition pieces (40) will be manufactured at the Bladt Aalborg facility in Denmark.

With a capacity of 1.2 gigawatts (GW) Hornsea Project One will be the first windfarm in the world over 1GW, capable of providing enough environmentally friendly electricity for well over one million homes.

Duncan Clark, Hornsea Project One Programme Director, said: "As well as making a significant contribution towards decarbonising the UK power system, Hornsea Project One is a huge infrastructure project which is providing a real boost to regional UK firms."

The Teesside facility, previously owned by TAG Energy solutions, was reported as insolvent in 2014 losing around 100 jobs. In 2015 it was taken over by Bladt Industries and EEW who formed Offshore Structures Britain (OSB). Their first order, for 16 transition pieces, came from DONG Energy's Burbo Bank Extension and one year later, DONG Energy ordered 40 for its Walney Extension project. This order for Hornsea Project One will load the facility to full capacity for around one year and safeguard around 200 jobs in Teesside.

Duncan added: "We're delighted to be working with OSB once more and proud to play a part in bringing life into factories like this. It's great to see the figures increasing – this order is three and a half times the size of our initial order with OSB in 2015. The suppliers we've worked with on Hornsea Project One are building their capabilities to support more UK projects, and can look forward to further opportunities including the potential for export."

Brent Cheshire, UK Country Manager at DONG Energy, said: "With eight operational wind farms in the UK and four under construction, DONG Energy is clearly invested in the UK. Last month we announced <u>our investment in the UK's first offshore wind tower factory</u> which will enable us, and all UK developers, to use UK manufactured towers for the first time.

"Substantial contracts like this are giving suppliers all over the UK the opportunity to grow and compete in the offshore wind industry, not just for Hornsea Project One but for future UK offshore wind farms too."

Jan Kjærsgaard, CEO, Bladt Industries said: "We are very pleased to take part in the Hornsea Project One and we are particularly happy to receive yet another order for our OSB facility in Teesside. Since the decision to invest in OSB in 2015, we have undertaken a full upgrade of the facility and have employed close to 200 employees. This order will follow our two first orders for Burbo Bank Extension and Walney Extension and will secure our capacity utilization for approximately one full year."

Additional information – Hornsea Project One UK contracts

In July 2015, it was announced that the turbine blades would be manufactured by Siemens from their recently opened factory in Hull, and in December 2015 a £25 million contract for construction of the onshore substation was awarded to UK firm Balfour Beatty.

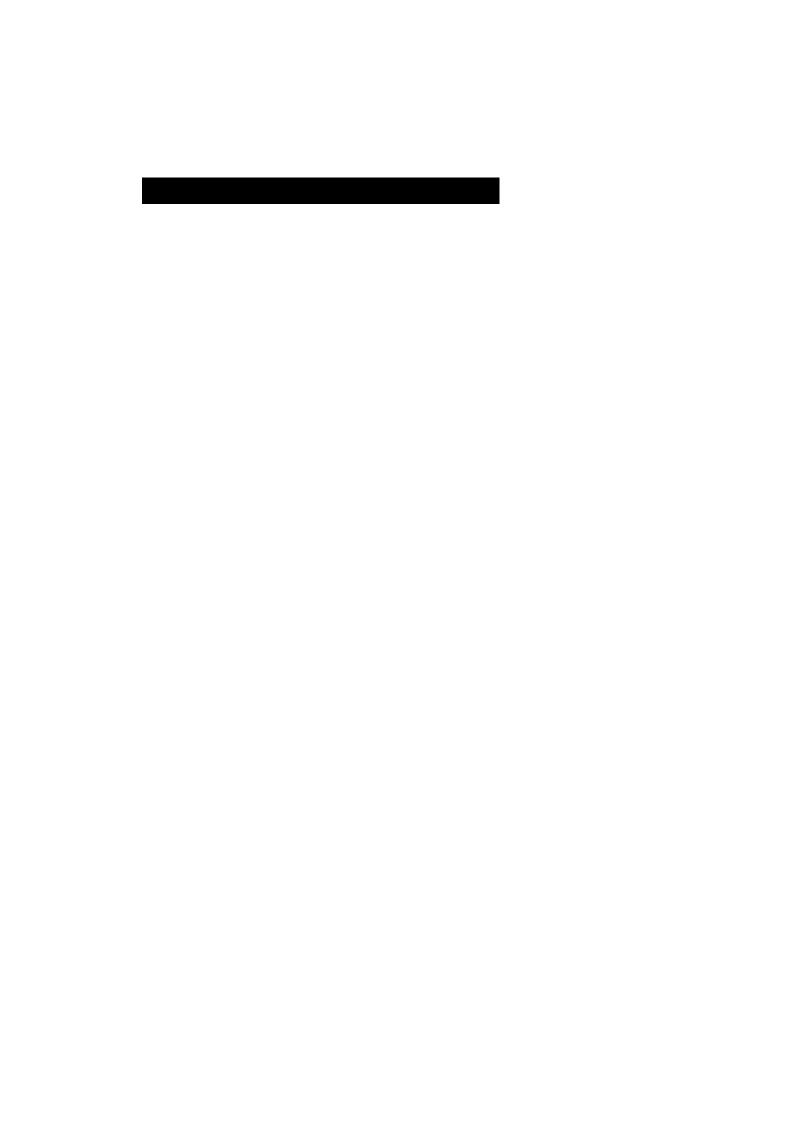
DONG Energy then awarded a multi-million pound contract to Babcock for the world's first offshore reactive compensation station, a contract that has helped to secure around 100 jobs at their facility in Rosyth, Scotland.

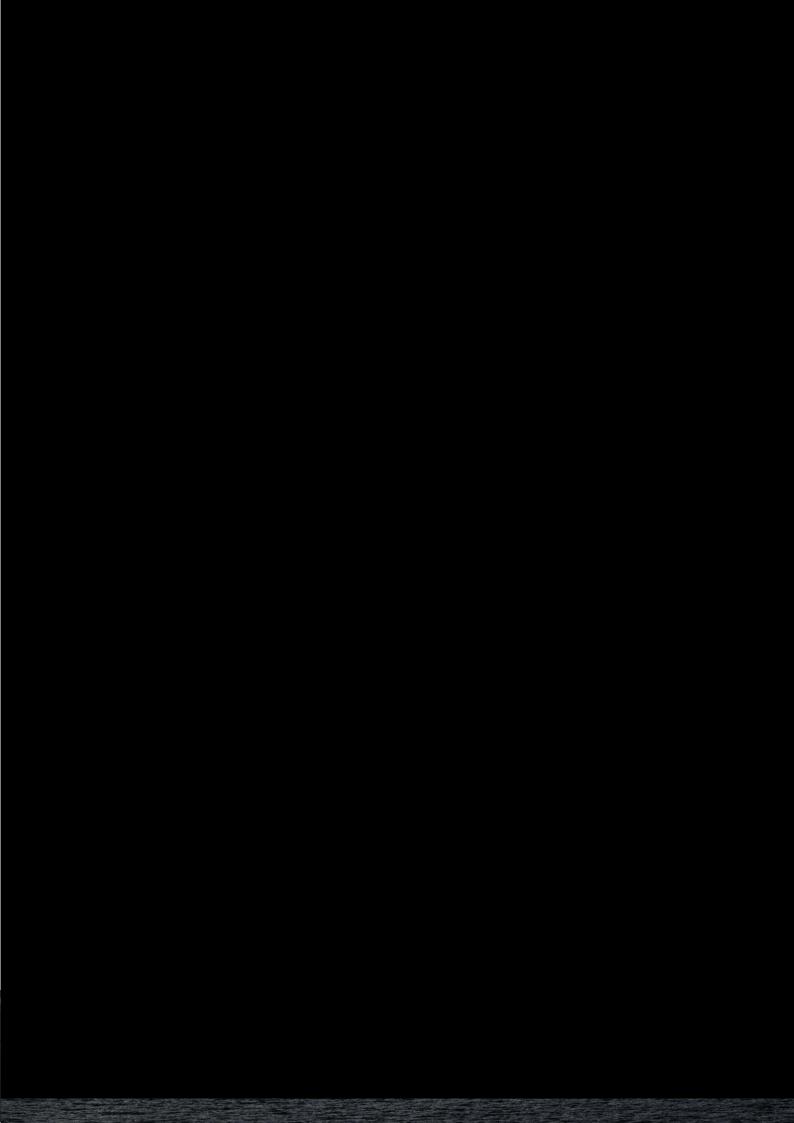
Hartlepool-based JDR cables <u>will provide 242km of array cables</u>, the largest contract in JDR's history, whilst J. Murphy & Sons Limited (Murphy), headquartered in London will <u>lay over 350,000m of onshore cable</u> along a 38km route, connecting to the national grid at a new onshore substation being built by Balfour Beatty.

In November 2016 DONG Energy announced that <u>DeepOcean</u>, a <u>Darlington based firm will transport and install the array cables</u>. This contract has safeguarded 150 jobs in Darlington and the surrounding area as well as enabling DeepOcean to offer significant opportunities to the UK supply chain.

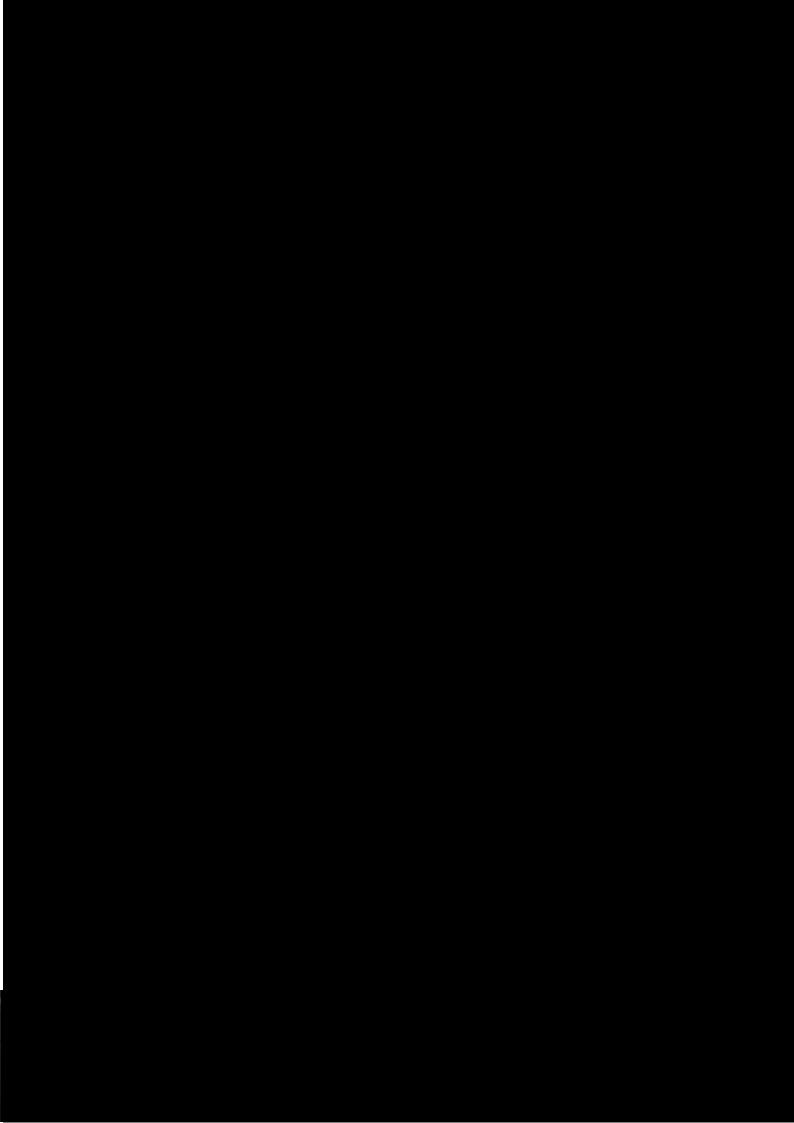
And just last month (December) the company announced a multimillion pound <u>contract with Rochdale-based firm Granada</u> to provide davit cranes for the project.

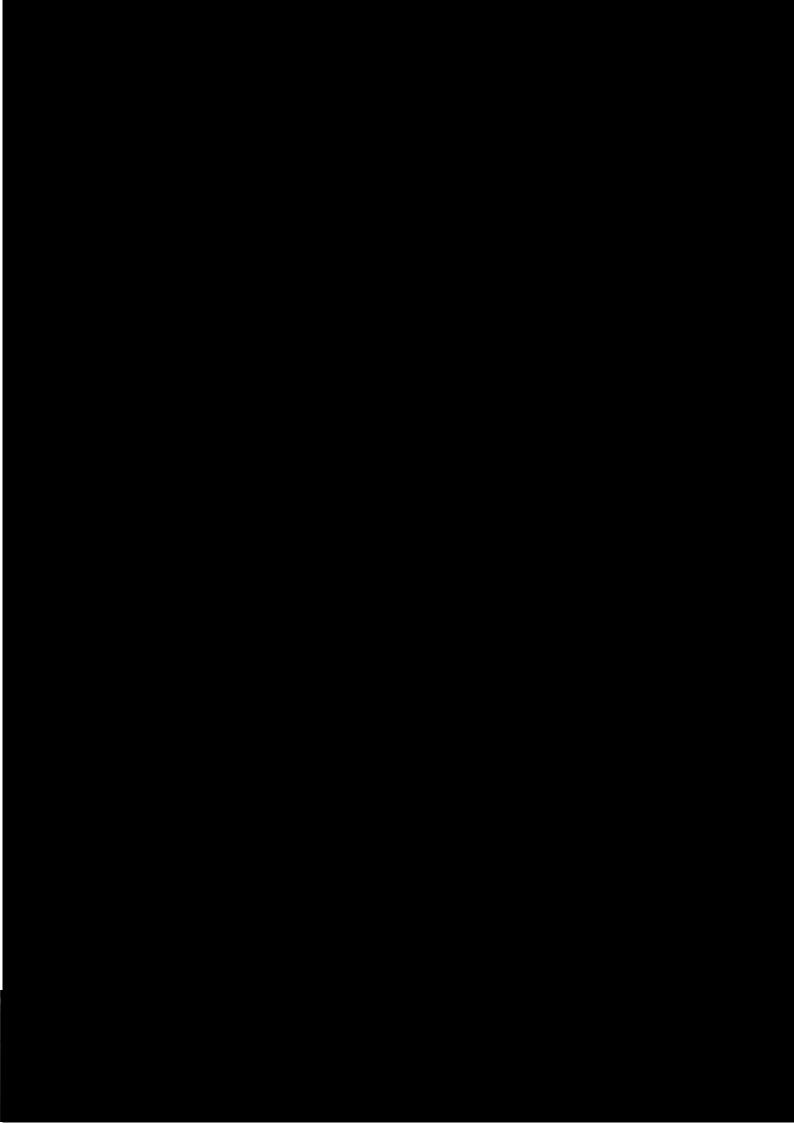
http://www.dongenergy.co.uk/news/press-releases/articles/big-boost-for-teesside-firm-as-dong-energy-places-orders-for-world%E2%80%99s-biggest-windfarm



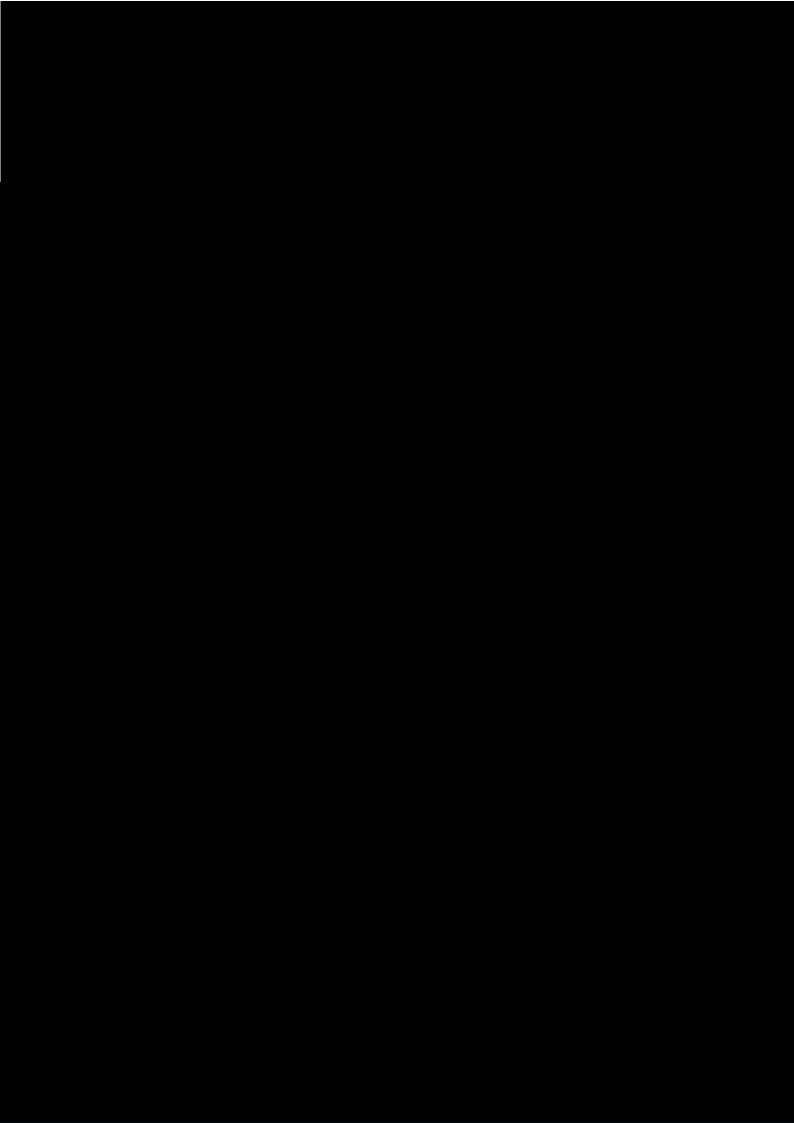


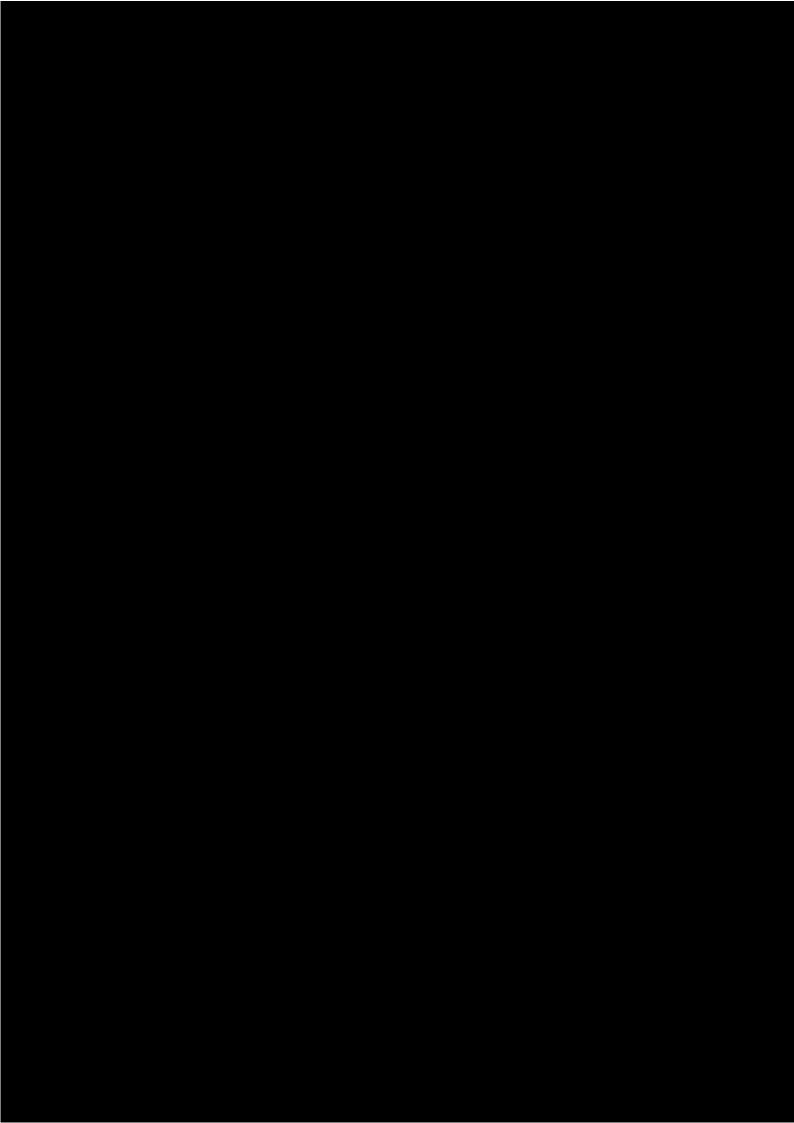


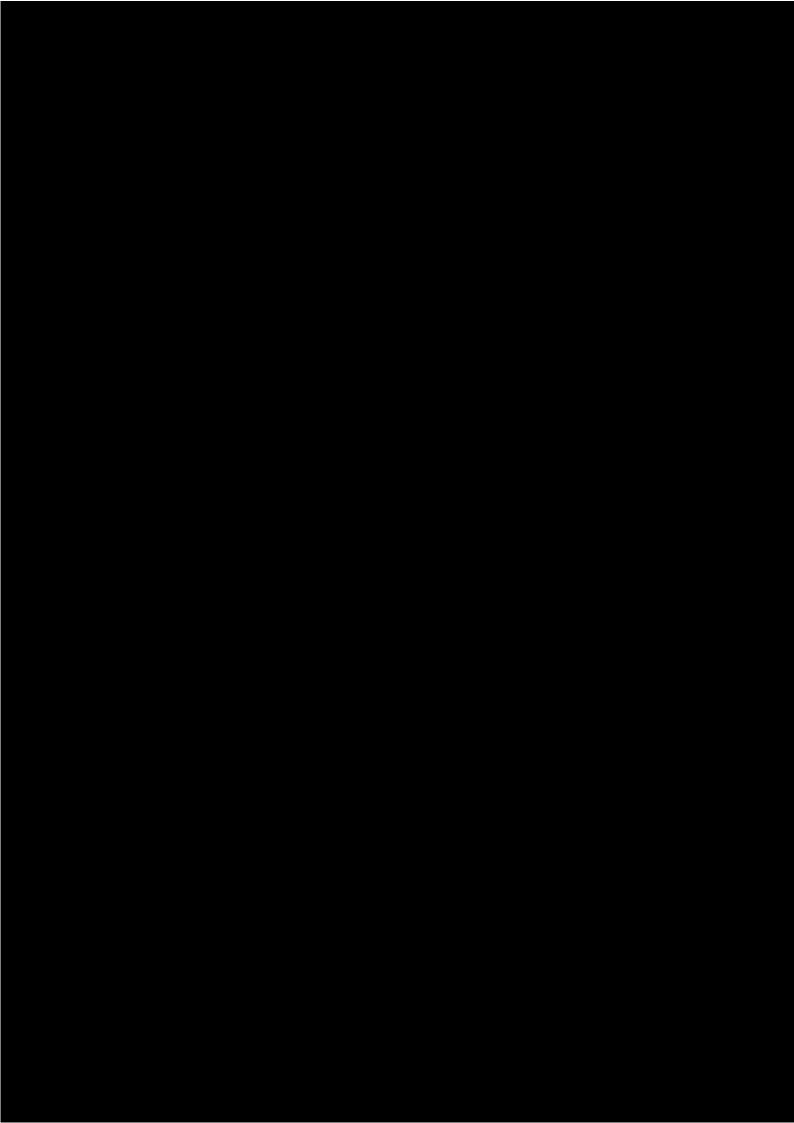






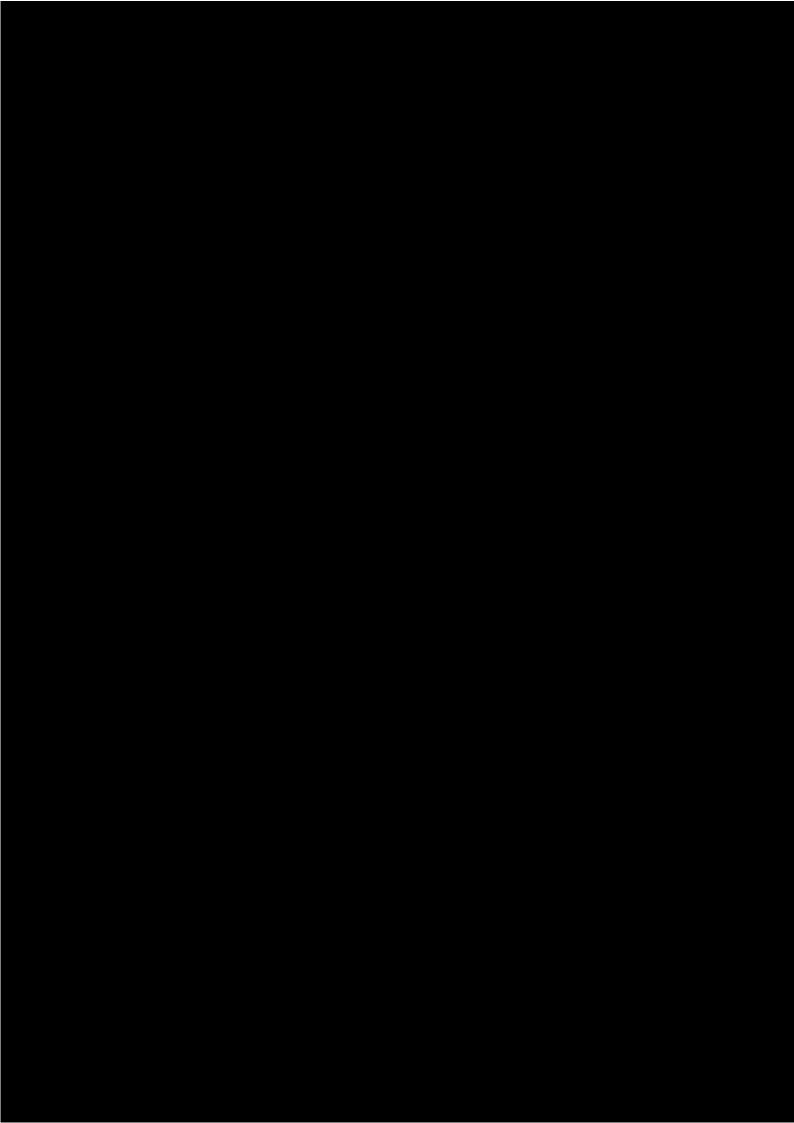




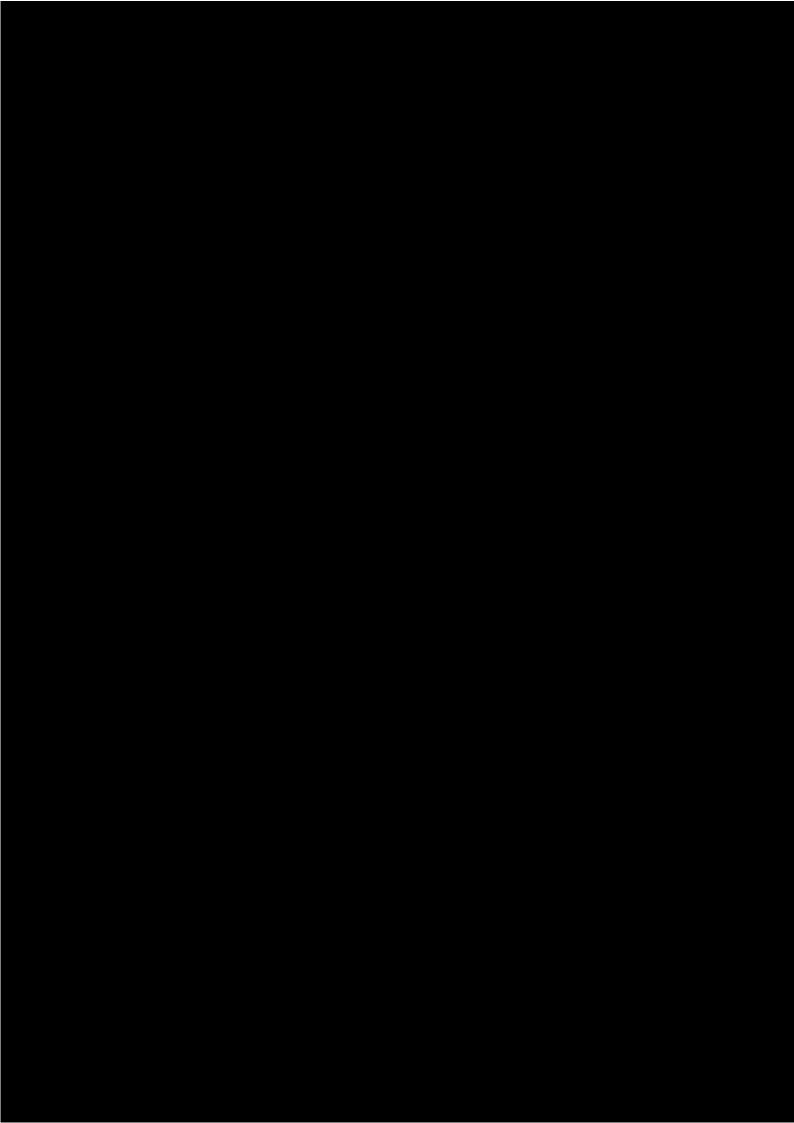














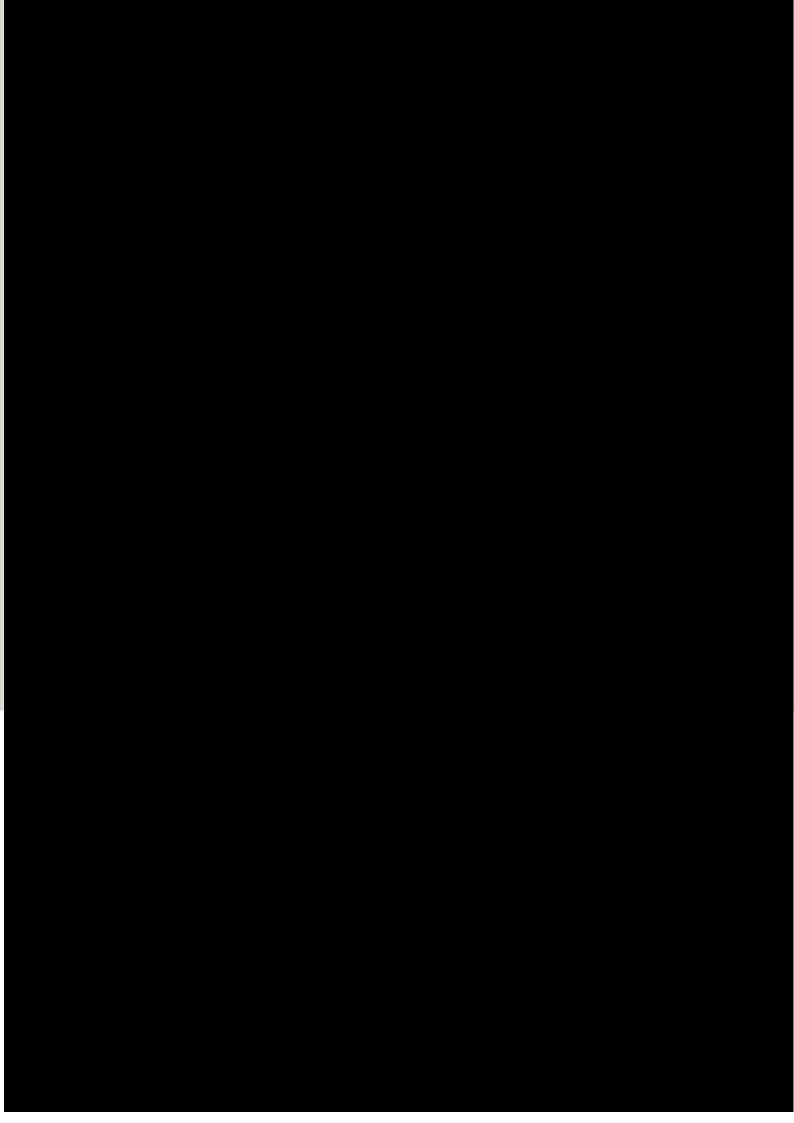






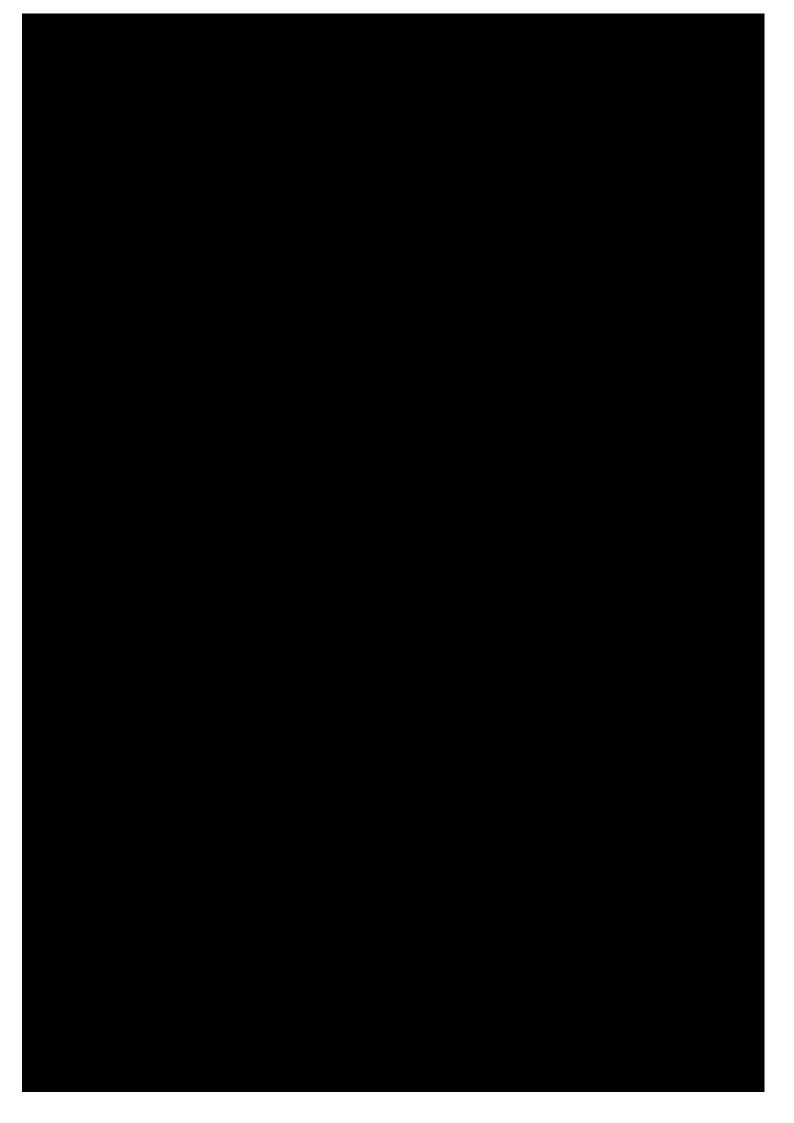




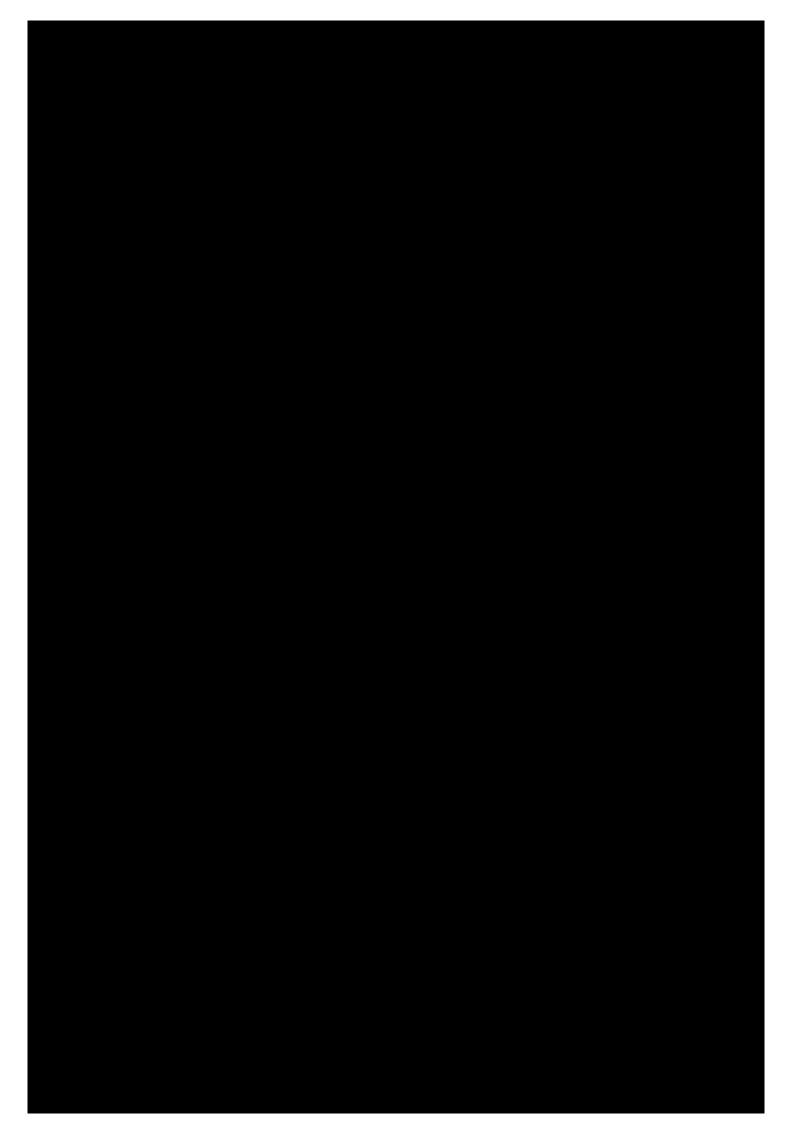


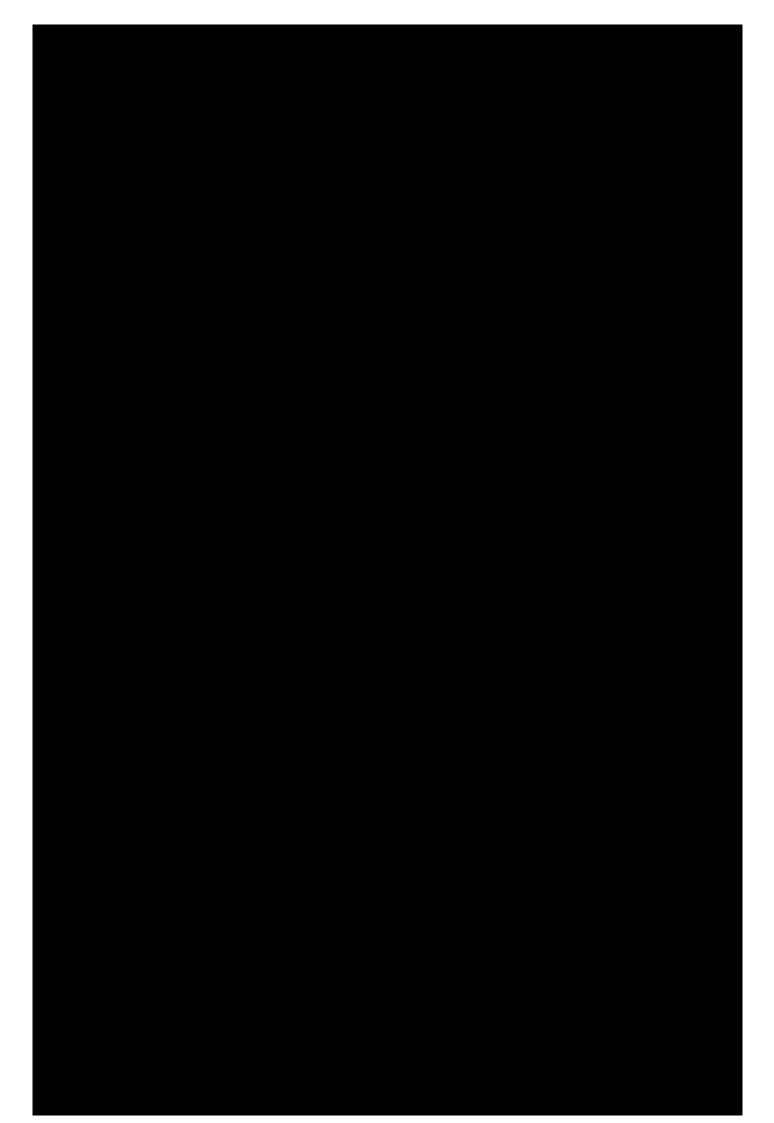






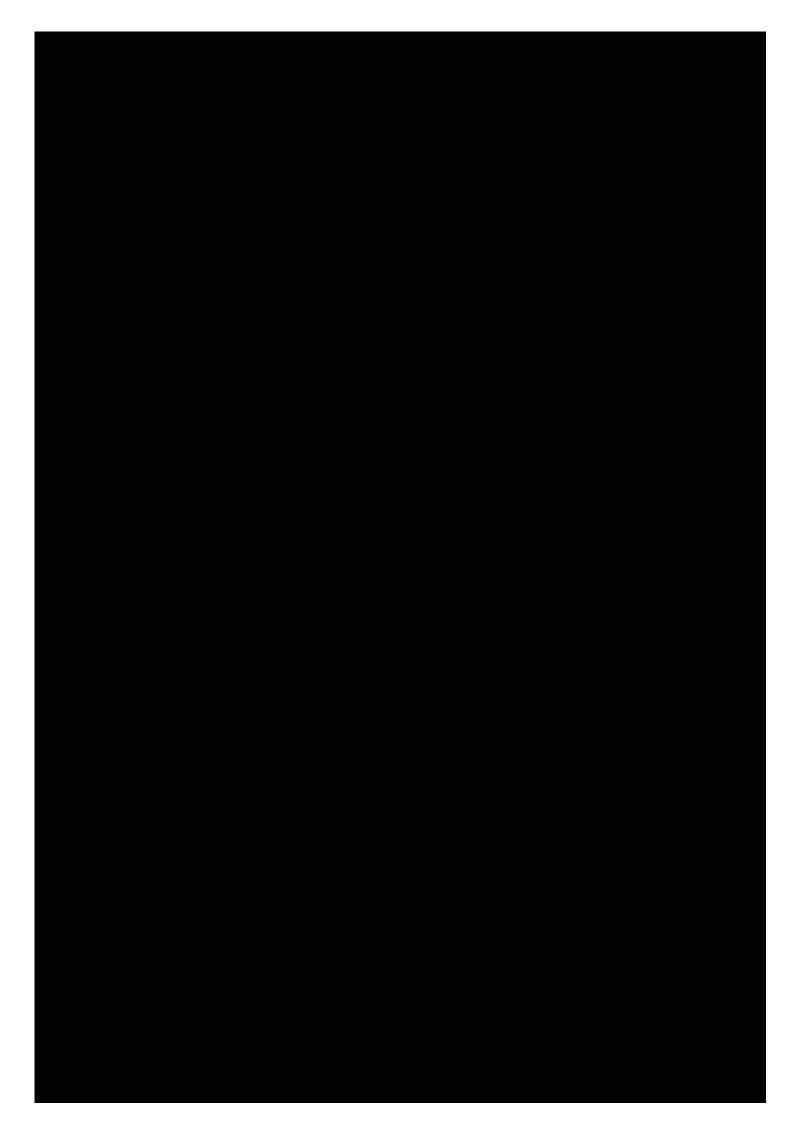


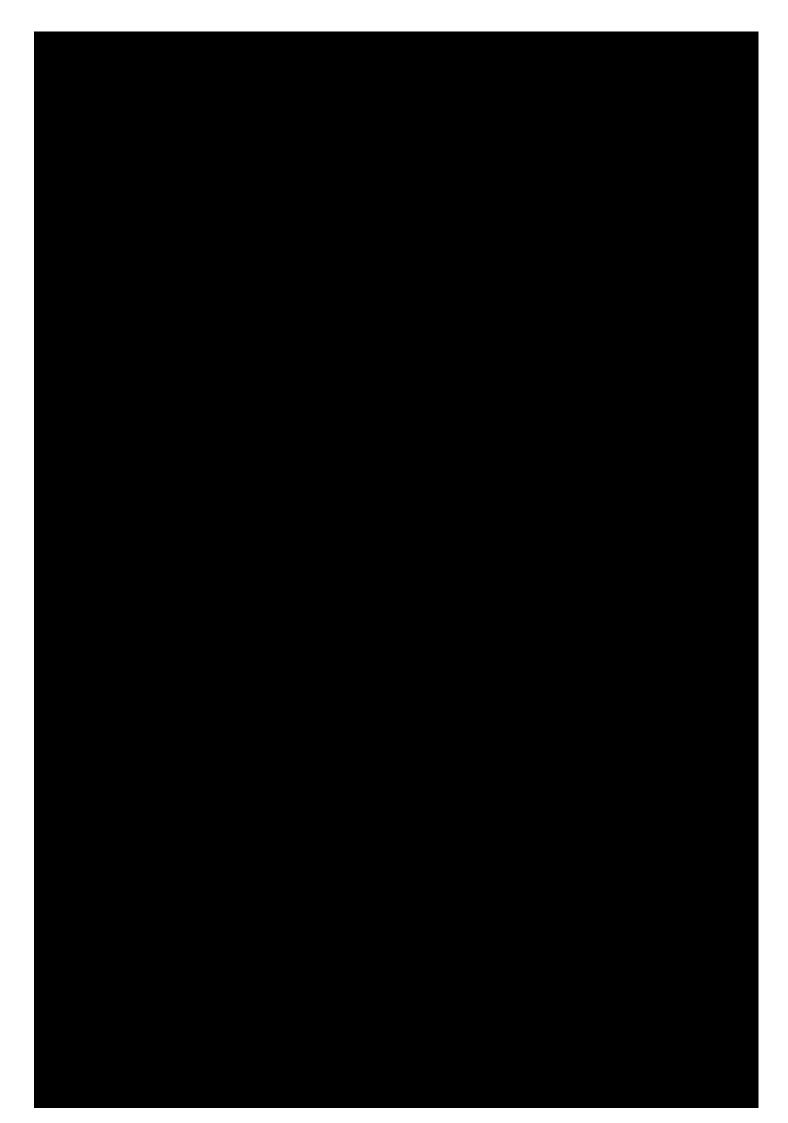


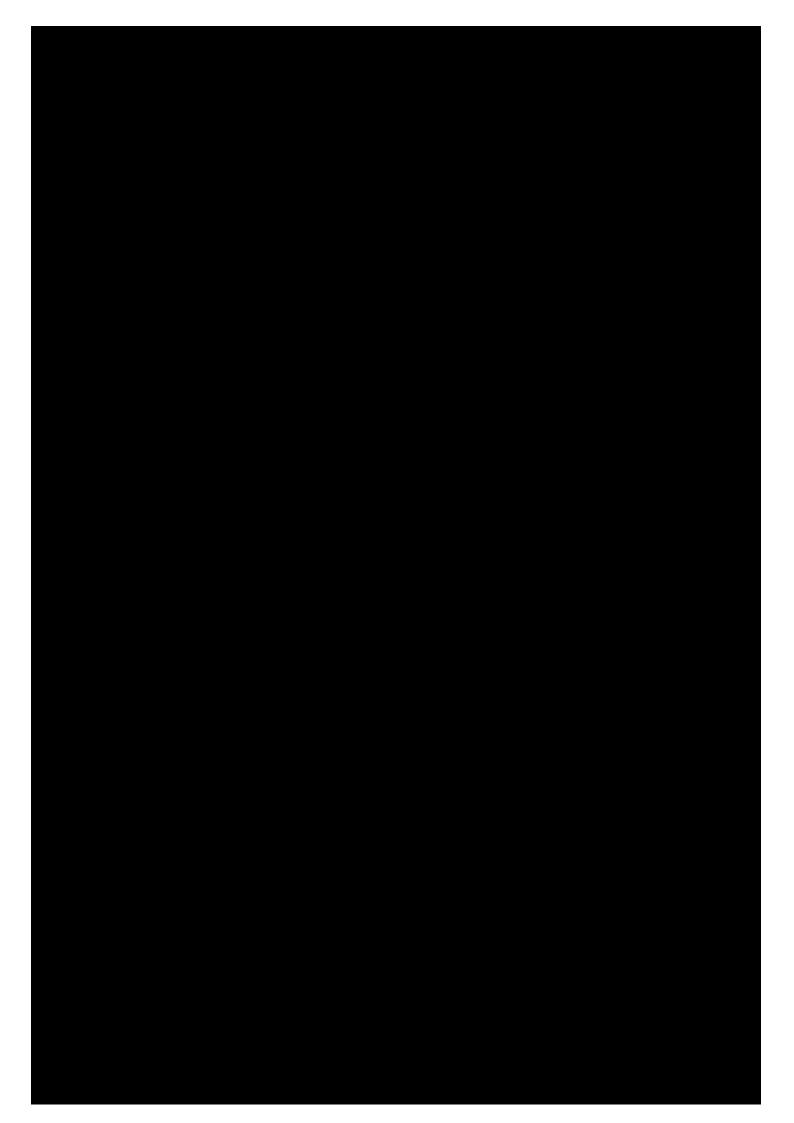




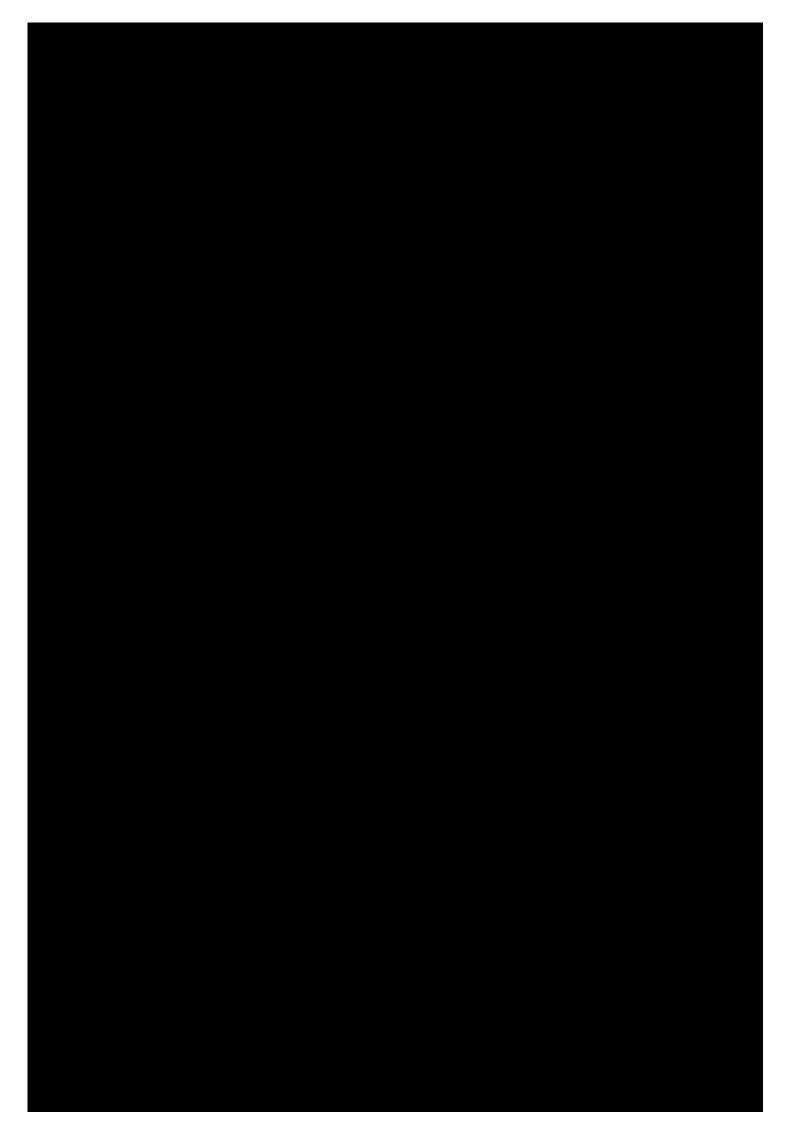






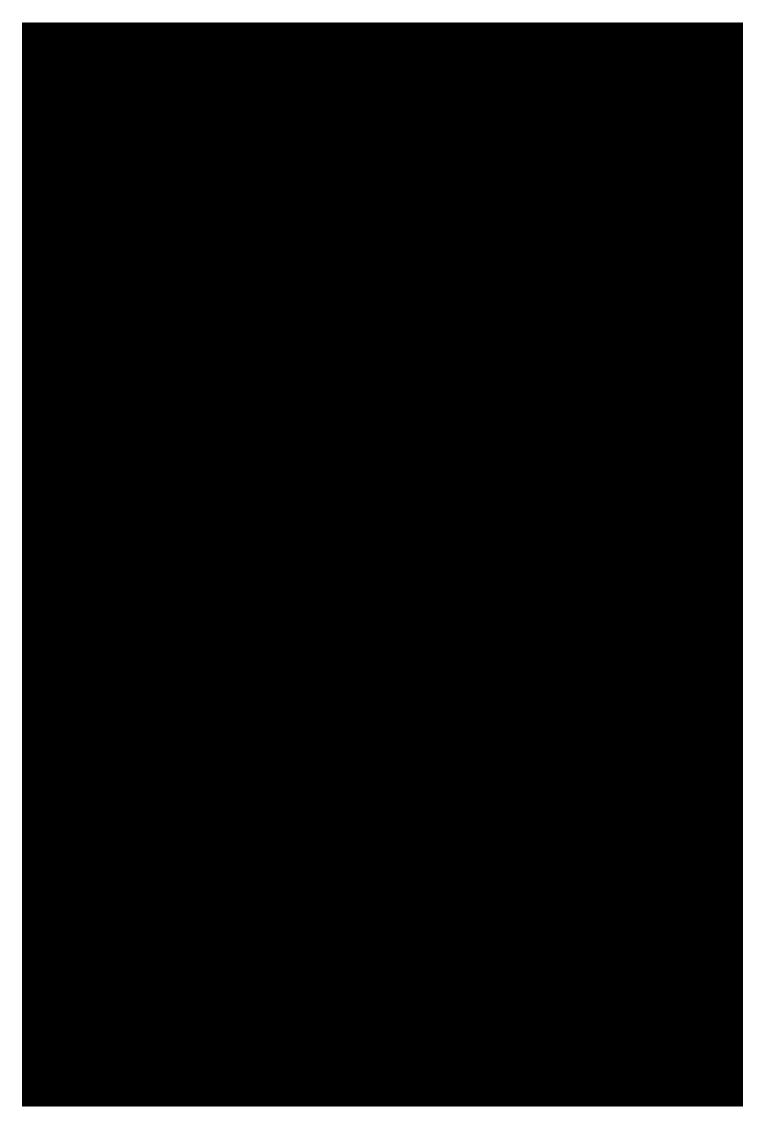


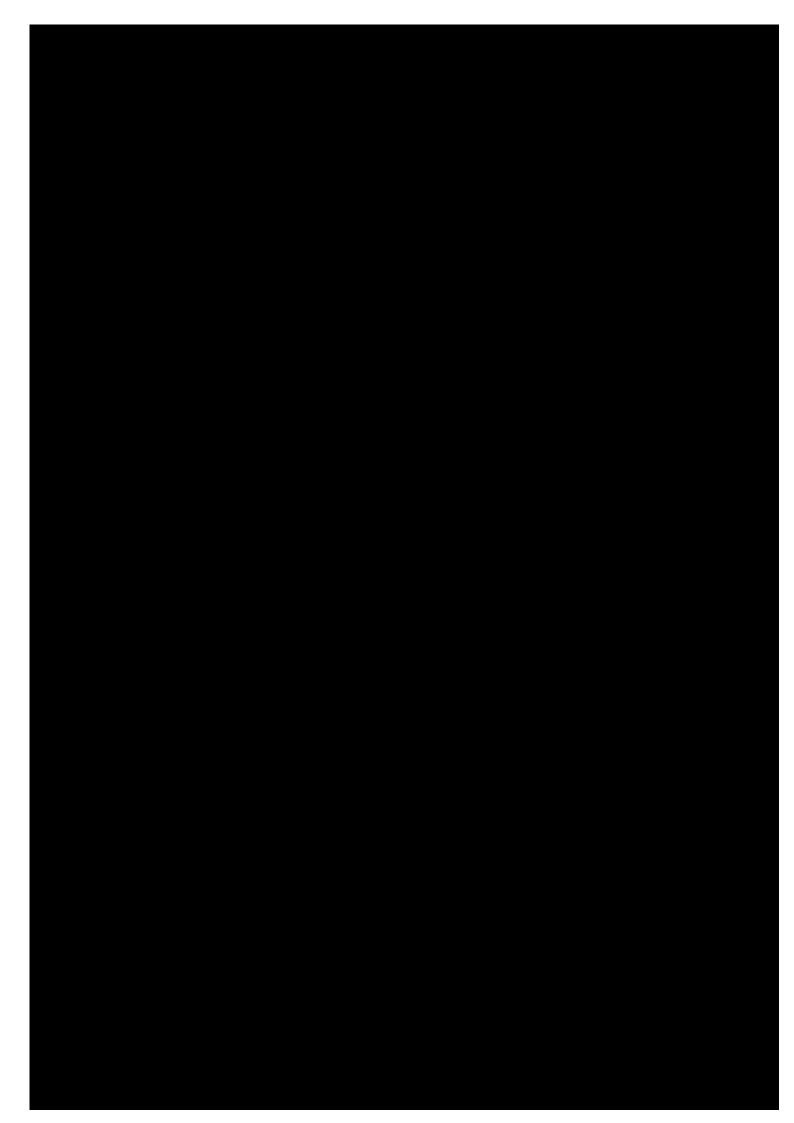




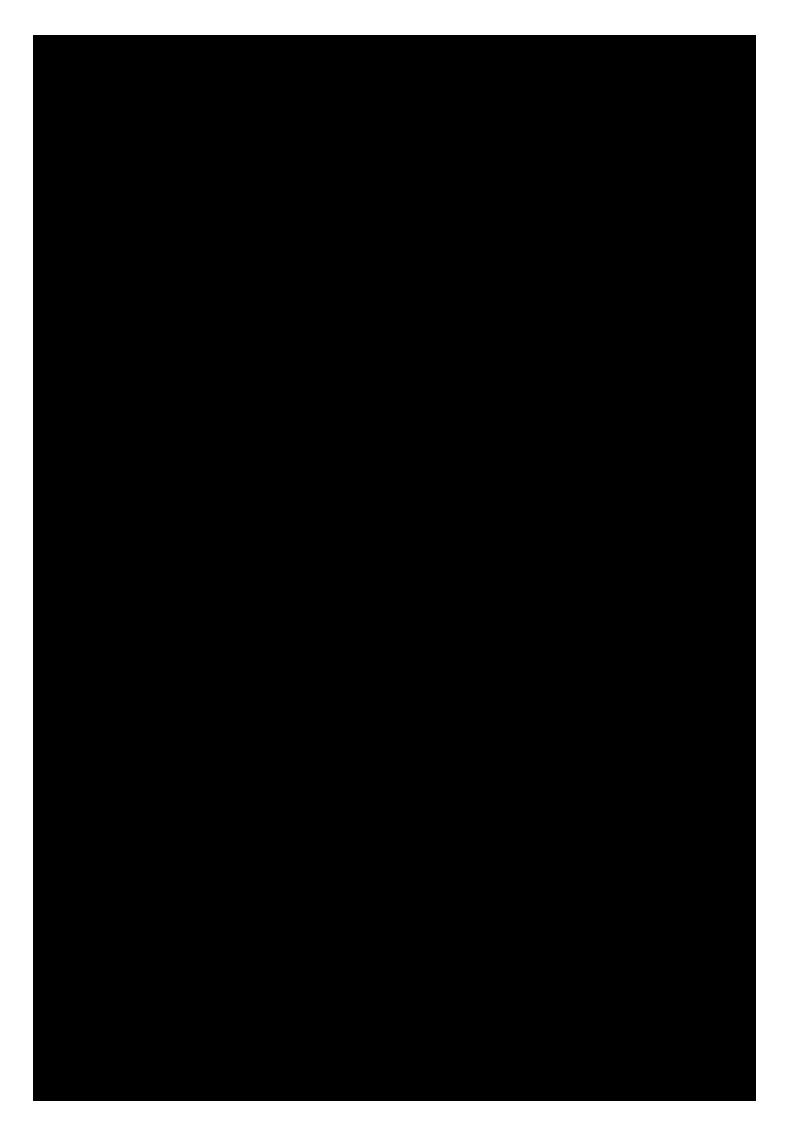


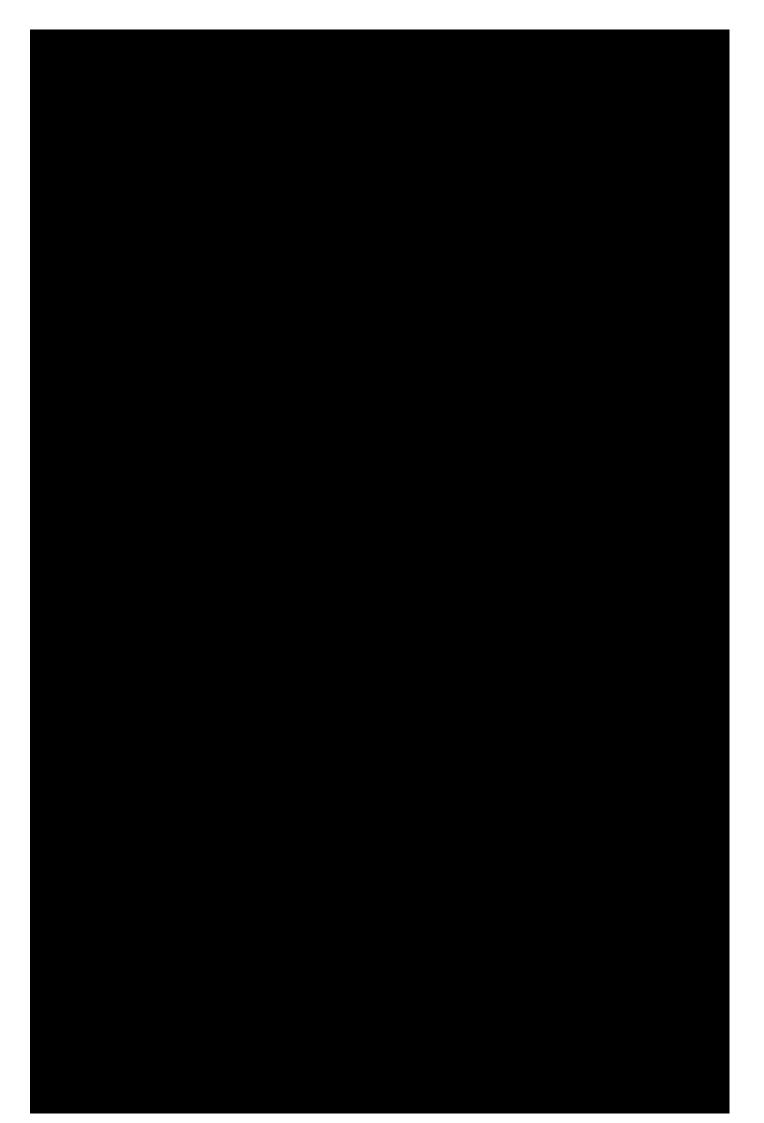




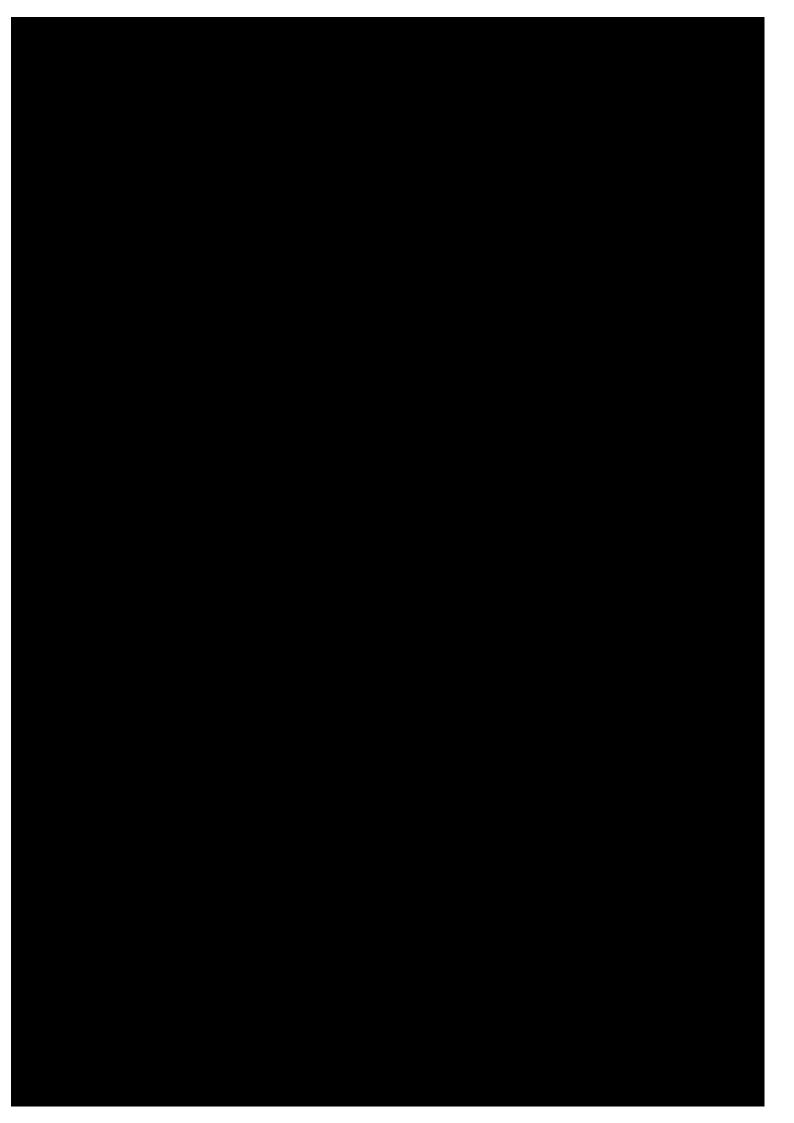












R. DE participation in UK and European Industry Fora

Organisation	Group	DONG Energy Role
International Energy Agency (IEA)		
Wind Europe	Main Group	Member
ETIP Wind		
Offshore Renewable Energy (ORE) Catapult	Main Group	Attendee
Carbon Trust Offshore Wind Accelerator (OWA)	Main Group	Attendee
Offshore Wind Industry Council	Board	Co-Chair
Offshore Wind Programme Board	Consenting	Attendee
	Supply Chain	Attendee
	Steering Group	Attendee
	Communication Group	Attendee
	Finance Group	Attendee
	Cost Reduction Monitoring Framework	Attendee
Energy UK	Generation Committee	Attendee
	Planning Workgroup	Attendee
	European	Attendee
	REC – Renewable Energy	Attendee
	Subsidy Free CFD	Attendee
	Environmental EU ETC	Attendee
	Electricity Markets and Trading	Attendee
	Communications	Attendee
Renewable UK	Board	Board Member
	Markets and Regulation	Attendee
	Offshore Wind Policy Forum	Attendee

	Offshore Consents and Licensing	Attendee
	Aviation	Attendee
	Grid and Systems	Attendee
	Health and Safety	Attendee
	Strategic Communications	Attendee
Scottish Renewables	Group	Member
The Aldersgate Group	Main Group	Attendee
Green Alliance	Business Circle	Member
PGES	Main Group	Member

S. Case study: Babcock International

Overview

DONG Energy has awarded Babcock International the contract to provide the topside jacket for the Reactive Compensation Station ('RCS') for Hornsea Project One.

The company is based in Rosyth, Scotland and has traditionally been involved in a number of other sectors such as Defence, Oil & Gas and Automotive.

Though the Hornsea Project One contract award was not their first in offshore wind, it is envisaged the contract will help them to establish themselves as another strong UK offshore wind supplier.



Competition

By awarding the contract for the RCS to Babcock, DE have helped bring another supplier into the
offshore wind market and developed competition in the sector. As previously mentioned, Babcock have
significant experience in other offshore energy sectors such as Oil & Gas and this expertise has stood
them in good stead to make the transition into offshore wind.

Innovation

• The award to Babcock for the topside of the RCS is innovative because this is the first time this component will be used on a UK offshore wind farm. This is because distance from shore Hornsea Project One is located.

https://www.babcockinternational.com/

T. Hornsea Project One contract with DeepOcean – Press Release November 2016

150 jobs safeguarded as North East firm signs contract with DONG Energy for world's biggest windfarm

30.11.2016 10:30

DeepOcean, based in Darlington, has won a multi-million pound contract to transport and install cables for DONG Energy's <u>Hornsea Project One</u> wind farm, which will be the biggest in the world.



(L-R: Pierre Boyde, Bart Heijermans, Duncan Clark, & Peter Steen Ejler)

Located 120km off the Yorkshire Coast, Hornsea Project One will be the first windfarm in history with a capacity of over one gigawatt (GW), and be capable of supplying electricity to well over one million homes.

DONG Energy has signed contracts with UK companies for other major components of the windfarm including offshore cables, the offshore reactive compensation station and the onshore substation.

Duncan Clark, Hornsea Project One Director, said: "Throughout this project we've worked hard to ensure as much value as possible is realised by UK businesses. Today's announcement further demonstrates both the UK's ability to supply the offshore wind industry, and DONG Energy's continuing commitment to investing in the UK."

The contract was signed in Grimsby at a supply chain event held by DONG Energy to connect with potential new local suppliers. Some of DONG Energy's Tier 1 suppliers also took part to meet smaller suppliers, as they too could work with local businesses to help complete the works.

Duncan continued: "DONG Energy recognises its role in supporting the Government's industrial strategy and building up the UK's offshore wind supply chain. As we progress with the construction of our wind farms we have an important part to play in linking UK firms to develop the supply chain further and support this growing sector. We're here in Grimsby today for that very reason, it's really becoming a <a href="https://document.com/https://docume

DeepOcean's Commercial Director for Cables & Trenching Pierre Boyde, said: "After our awards on the Race Bank & Walney Extension projects we are delighted to be further developing our relationship with DONG Energy. We have invested heavily in class leading installation and trenching technology with a strong focus on both safety and productivity. This award will safeguard 150 jobs in Darlington and the surrounding area as well as enabling us to offer significant opportunities to the UK supply chain".

http://www.dongenergy.co.uk/news/press-releases/articles/150-jobs-safeguarded-as-north-east-firm-signs-contract-with-dong-energy-for-world%E2%80%99s-biggest-windfarm

U. Case Study: JDR Cables

Overview

Hartlepool based JDR Cables has been a pioneer in the development of Inter-Array Cables for offshore wind (and other renewable) projects. In the past JDR has provided cables for numerous offshore wind projects including a number of DONG Energy projects including Race Bank.

Most recently, in November 2016, JDR were awarded a contract to provide Hornsea Project One with subsea power cables. This represents JDR's largest ever contract – they will design and manufacture 242km of array cables for the project. This award follows JDR's work on DONG Energy's Race Bank project. Both of these awards have been enabled by JDR's framework agreement with DONG Energy.



Competition

By implementing a framework agreement between DE and JDR, this has allowed them to develop
their business and establish themselves as one of the foremost suppliers of inter-array cables in the
offshore wind sector.

Skills

- JDR is an employer based in the North-East of England. They have a strong focus on skills and development and run their own apprenticeship scheme which focuses across the business, from engineering to communications.
- In September, DONG Energy participated in a skills careers event about energy generation held at the JDR factory in Hartlepool.

V. Case Study: OSB

Overview

OSB was established as a joint venture between the German company EEW Special Pipe Construction GmbH and the Danish company Bladt Industries A/S in November 2015.

By signing a contract with OSB to supply 16 (50%) Transition Piece ('TP') foundations to Burbo Bank Extension, DE was able to support the development of a UK factory by OSB in Teeside. We subsequently purchased a further 40 (50%) TPs for Walney Extension.

DE took delivery of the first components in May 2016 and they were installed for use at Burbo Bank Extension in June 2016.

OSB is still under consideration for HOW01 and were this contract to be placed, this would be a real vote of confidence in the facility which would have established itself as the main UK supplier of TP components into the UK



Competition

• The development of the OSB site through a number of orders for DONG Energy projects means it will be cost competitive for supplying into future UK projects like Hornsea Two

Skills

• At present it is estimated the OSB JV has created around 200 jobs in the North-East of England and this could increase if OSB attracts more orders for offshore wind projects in the future.

http://www.offshorestructures.uk/

W. DONG Energy to build O&M Facility in Merseyside – Press Release July 2016

DONG Energy to build new multi-million pound operations facility in Merseyside

20.06.2016 10:00

DONG Energy, the global leader in offshore wind, will build a new operations and maintenance (O&M) facility in Kings Wharf, Seacombe to serve its two offshore wind farms in the area.



The facility will consist of a new office and warehouse building on a disused site. It will serve the existing Burbo Bank offshore wind farm and the new Burbo Bank Extension offshore wind farm, currently under construction.

Up to 75 jobs will be created during the construction of the facility, while around 45 people will be permanently employed at the site once it is operational.

As part of the development, DONG Energy has committed to carry out work on the river promenade adjacent to the site which will improve the public amenity. This scheme has been developed through close cooperation with Wirral Council.

The announcement comes during the International Festival for Business 2016 in Liverpool, of which DONG Energy is an official supporter.

Brent Cheshire, DONG Energy's UK Country Chairman, said:

"I am delighted to announce that we are building this fantastic new facility in Merseyside to serve our offshore wind farms in the area. DONG Energy is committed to investing in the UK and we are very proud to be playing an important role in the redevelopment of this part of Kings Wharf.

"The site offers excellent offshore access and flexibility, which is exactly what we need to efficiently operate and maintain our wind farms. It is great to confirm this significant investment during the International Festival for Business as well. The festival is really highlighting all the positive activity currently happening in the North West."

Cllr Phil Davies, Leader of Wirral Council, said:

"This is another step towards establishing Wirral and the wider city region as a leading player in the renewable energy sector, and we look forward to further close partnership work with DONG Energy.

"The development will not only create jobs and bring new skills and expertise to the area in line with our Wirral Plan 2020 pledges; it regenerates a site in an important docklands location."

Vessels are expected to be operated from the Seacombe Mersey Ferries terminal. Discussions are progressing with Merseytravel with a view to entering into a long-term agreement for shared use of the terminal to facilitate daily vessel access.

Frank Rogers, Interim Chief Executive of Merseytravel, said:

"We are continuing our positive conversations with DONG Energy over the potential to share facilities. We would welcome such arrangements as not only does it help reduce the cost of the Mersey Ferries to the public purse – one of the key aims of our 20 year Mersey Ferries strategy, it also supports a new employer for the region and the benefits that will bring."

The whole facility will comprise an area of approximately 1,800 square metres. Enabling works for the site are currently underway and the main contractor is expected to commence construction later in the year with completion scheduled for mid-2017.

Burbo Bank has been operational since 2007 and has a total capacity of 90 megawatts (MW). Burbo Bank Extension is currently under construction and is expected to be fully operational in 2017. It will have a capacity of 258 MW, generating enough electricity to power approximately 230,000 homes.

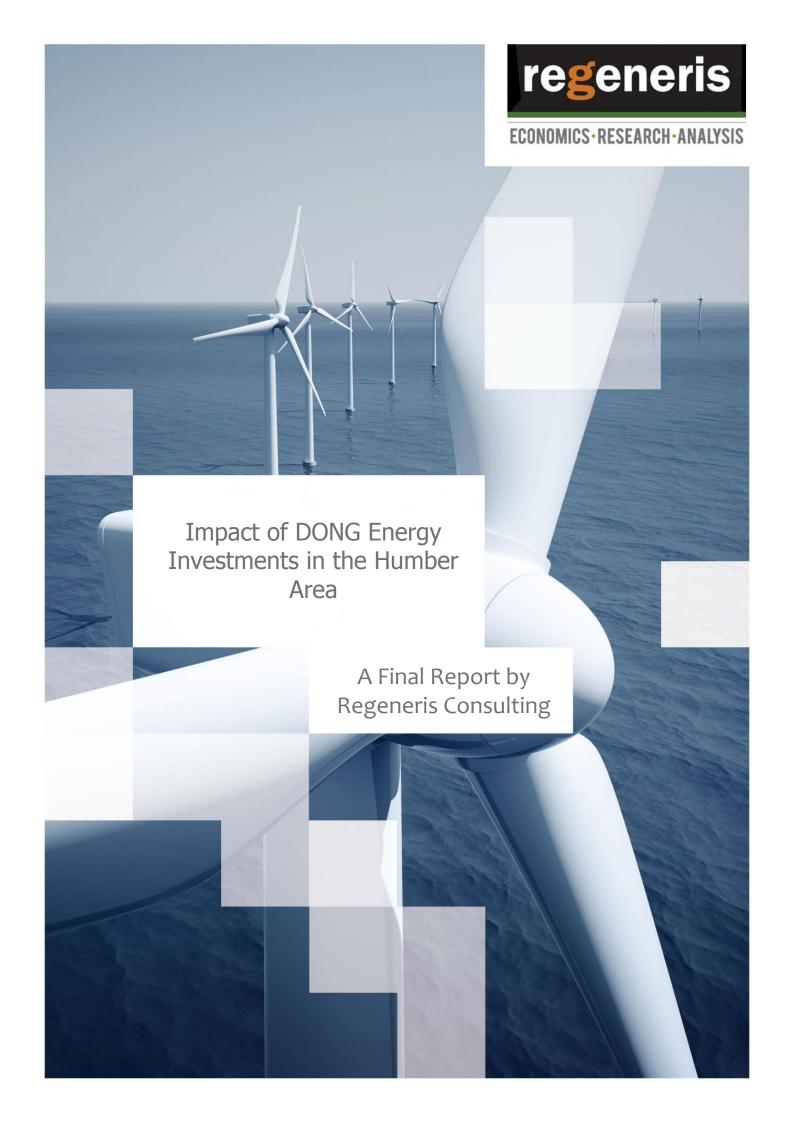
http://www.dongenergy.co.uk/news/press-releases/articles/dong-energy-to-build-new-multi-million-pound-operations-facility-in-merseyside

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Y. DONG Energy at the International Festival of Business 2016 – Events and Programme

Date	Event	Event Organiser	DONG Energy Participant
Monday 20 June	Energy and Environment Week Launch Event: 'Energy industry challenges, solutions and opportunities: 2017 and beyond'	UK Trade and Investment and IFB	Brent Cheshire, UK Country Chairman
Tuesday 21 June	'Maximising the economic benefits of offshore wind to UK PLC'	DONG Energy	Brent Cheshire, UK Country Chairman
Wednesday 22 June	Ferry trip to Burbo Bank Offshore Wind Farm	DONG Energy	Various
Thursday 23 June	'Innovation to Industrialisation: How UK Renewables can deliver global carbon reduction'	UKTI Trade and Investement	Benj Sykes, UK Country Asset Manager Duncan Clark, Programme Director, Hornsea Project One
Friday 24 June	'IFB Green Day'	IFB	Vanessa O'Connell, Senior Commercial Manager, Hornsea Project One

Z. Impact of DE Investments in Regeneris Consulting)	the Humber Area (a report by



DONG Energy

Impact of DONG Energy Investments in the Humber Area

November 2015

Regeneris Consulting Ltd www.regeneris.co.uk

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Executive Summary

- i. The city of Hull and the wider Humber region have faced significant challenges over recent decades. The overall economic picture has been one of economic decline, the loss of manufacturing, high unemployment, weak skills levels, and low population growth.
- ii. In recent years, the offshore wind industry has emerged as a major higher-value sector, providing the area with a new economic driver. The sector is at the heart of local strategic plans, with the Humber LEP recognising it as the number one economic opportunity for the region, and Hull aiming to become the 'leading UK Energy City'. To ensure the offshore wind sector brings sustainable economic benefit in the region, securing a series of investments over a longer period is critical.
- iii. DONG Energy's total investment in Humber offshore wind farms between 2013 and 2019 is expected to be around £6 billion, of which approximately £1bn will be captured by businesses and employees in the Humber area. Its investment will continue beyond this period with the operations and maintenance (O&M) phase of its current investments and new development plans, following DONG Energy's acquisition of the whole Hornsea offshore wind zone.
- iv. Including all construction and operational activity, DONG Energy's investments could generate **£1.21 bn of gross value added** (GVA¹) in the Humber area by 2030. This includes:
 - £210 m based only on activity confirmed to be delivered through the Humber and its ports²
 - **£1.0 bn** if other consented wind farm investments also use Humber based ports for construction and O&M phases³. Port use for these wind farm phases are not yet confirmed.
- v. Assuming that Race Bank and Hornsea 1 wind farms deliver construction and O&M phases through Humber ports, it is anticipated that DONG Energy's current investments will support:
 - an average of 1,600 jobs in the Humber per year over 2015-20 (ranging between 700 2,700 each year)
 - up to 500 long-term jobs in O&M activity from 2020 onwards.
- vi. DONG Energy's involvement in the Humber has also supported increased investment in the region.
 - Siemens's £310m investment in a new wind turbine factory in Hull was key to the sector securing a substantial foothold in the Humber, and DONG Energy's relationship with Siemens was cited as a key significant factor in the investment decision.
 - Other activity has followed Siemens, including approval for the Able Marine Energy Park, and investment plans for a new green technologies business park in Hull.
- vii. Sustained investment in the Humber by DONG Energy, alongside other firms, has also:
 - Provided significant new supplier opportunities in the business base
 - Supported enhanced skills provision in the area, relating to sector opportunities
 - Helped to raise confidence and aspiration in both public and private sectors.

³ Note: This includes O&M phase for Race Bank, and both construction and O&M phases for Hornsea 1.



¹ Gross value added is a standard UK measure of economic value generated, capturing employee income and business profit

² Note: This includes: construction phases for both Westermost Rough and Race Bank and O&M for Westermost Rough.

1. Introduction

Economic development in the Humber area is one of the big economic success stories currently taking place in the UK. At the core of this economic transformation is the development of the offshore wind sector, which was primarily catalysed by investment in a critical mass of offshore wind farms close to the coast of the Humber estuary. By far the largest investor in these wind farms in the Humber region is DONG Energy.

This report sets out an overview of the economic impact that DONG Energy's investments to date have had, and that future investments will have in the Humber area. It focuses on both the direct impacts of the investment, and the wider supply chain, skills and inward investment benefits that DONG Energy's investments have supported.

The study draws together information gathered through desk based analysis as well as:

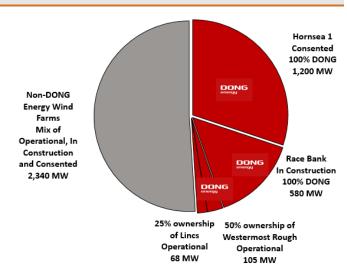
- Economic impact modelling of the direct, supply chain and induced impacts of DONG Energy investments in offshore wind farms off the coast of the Humber.
- Consultation with economic development officers, supply chain firms and other stakeholders within the Local Enterprise Partnership, local authorities, the University of Hull and business & sector bodies.

1.1 DONG Energy Investments in the Humber

Offshore Wind is a major new economic engine for the Humber region. DONG Energy is the largest wind farm investor in the area fuelling this.

Headquartered in Denmark, DONG Energy is one of the leading energy groups in Northern Europe, and is rapidly expanding in the UK. With fewer than ten employees in the UK in 2004, the UK part of the company has grown to around 600 today. DONG Energy is the UK market leader in offshore wind, directly owning around 22% of all offshore wind farms currently installed in the UK, which represents 44% of total UK offshore wind capacity. Energy has a strong UK presence, with national headquarters London and other office locations in Grimsby, Aberdeen, Liverpool and Barrow.

Figure 1.1 DONG Energy's Investment across all Humber Offshore Wind Farms (Current and Consented)



Note: Full details of wind farms set out in Appendix B.

Within the Humber area, DONG

Energy is part or full owner of four offshore wind farms including ones which are operational (Westermost Rough and Lincs), in construction (Race Bank) and consented (Hornsea 1).

As Figure 1.1 shows, the wind farms which DONG Energy has invested in comprise around half of the total energy generation potential of Humber's offshore wind farms (operational and



consented). This will equate to over 2GW of generating power, enough to power well over 1.5 million homes⁴, or two thirds of all homes in Yorkshire and the Humber, when completed.

The map below shows all of the wind farms, consented, under construction and operational, in close proximity to the Humber area, by DONG Energy and other developers.

DONG Energy has also recently acquired the full Hornsea zone and is currently taking forward the planning application for a second Hornsea wind farm, which is in the Examination stage with the Planning Inspectorate.

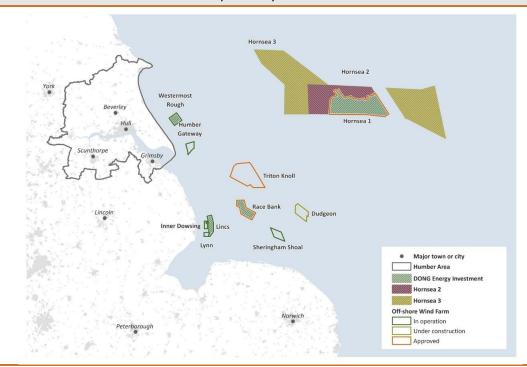


Figure 1.2 Offshore wind farms in close proximity to the Humber area

Source: Contains Ordnance Survey data © Crown copyright and database rights, 2015;

1.2 Overview of the Humber Economy and its Challenges

The city of Hull and the wider Humber region have faced significant economic challenges in recent decades, including high unemployment, skills challenges and a narrow business base.

Decline in Manufacturing

Manufacturing employment in the Humber area has declined significantly in recent decades. Data going back to the late 1990s shows that manufacturing sector employment fell by around one third between 1998-2013, equivalent to a loss of around 28,000 jobs⁵.

⁵ Note this data draws from two sources: Annual Business Inquiry (pre-2008) using SIC 2003 codes *vs* Business Register and Employment Survey (post 2008) using SIC 2007 codes, and while broadly comparable, there are minor differences in sector definitions between the two.



⁴ Assuming load factor of 42% (typical DONG project performance) and typical annual electricity demand of 4.192MWh (DECC, 2014, Energy consumption in the UK, https://www.gov.uk/government/statistics/energy-consumption-in-the-uk) 2GW produces enough power for 1,755,344 homes.

Although this manufacturing decline mirrored national trends, other parts of the country have been more successful in diversifying their economic base to provide new employment in other growing sectors.

Limited Population Growth

Economic weaknesses in the area have also had a significant impact on population change. The charts below show that between 1981 and 2011 the population of England and Wales rose by 16%, yet in the Humber it increased by only 9%, and in Hull the population is lower now than it was in 1981.

Figure 1.3 Population change in the Humber 1981-2011

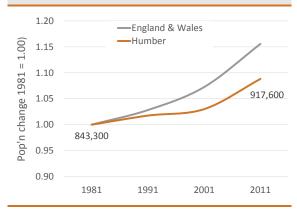


Figure 1.4 Population change in Hull 1981-2011



Source: ONS, Census 1981-2011

Source: ONS, Census 1981-2011

High Levels of Unemployment

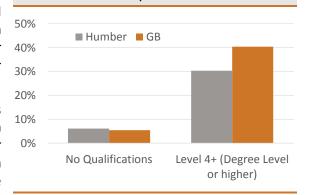
Unemployment levels across the Humber have been amongst the highest across England in recent years, and increased more greatly than other areas during the economic downturn, peaking at 9.9% in 2009/10. Data from March 2015 shows that over 30,000 working age people in the Humber area were unemployed, a rate of 6.9% of working age people. This remains significantly higher than the rate of 6.1% nationally.

Shortage of High Level Skills

Unemployment in the Humber area is partly driven by shortages in local skills levels. Figure 1.5 compares local skills levels with the national average, and highlights the greater proportion of people with no qualifications in the Humber than nationally and a significantly smaller proportion with degree-level (Level 4) skills.

This shortage of workers with higher level skills in the area represents both a constraint on developing new knowledge based and higher value sectors in the Humber area, but also a reflection of the lack of higher value jobs in the area that might attract such workers.

Figure 1.5 Skills levels in the Humber region *vs* skills levels nationally.



Source: ONS, Annual Population Survey, 2014



1.3 Offshore Wind at the Heart of Strategic Economic Plans

Offshore wind is the most important economic growth sector in the Humber, at the heart of plans to regenerate the region. DONG Energy's investments have been critical in enabling this major economic opportunity.

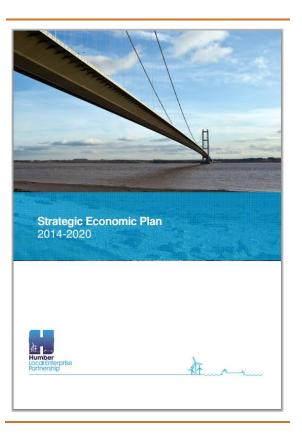
Humber LEP Economic Strategy

The Humber Local Enterprise Partnership (LEP) is responsible for setting the strategy for development of the local economy and includes local authorities, the university, local colleges, and the private sector.

In their strategic economic plan, the Humber LEP identifies the development of offshore wind and renewables as the number one economic opportunity for the region, it states a vision that:

By 2020, the Humber will have a thriving renewables sector, with ambitious capital schemes well underway and a growing reputation for excellence and expertise. Many thousands of jobs will have been created, driven by this major growth in renewables.

The plan particularly highlights that only the Humber has sufficient portside land in the right location to create a UK energy manufacturing cluster of the scale needed for the major North Sea offshore wind farm developments.



Hull City Growth Plan



Hull City Council's ten year city plan sets out the key aspirations for the city. The first of its five priority aims is to ensure Hull becomes the 'leading UK Energy City'.

It recognises the locational advantage of the city for this sector, which particularly builds on the major opportunities presented by the offshore wind sector



2. Sustained Investment in the Humber

Establishing an offshore wind supply chain requires a pipeline of wind farm investments over a sustained period. With over £6bn investment in Humber offshore wind farms anticipated this decade, DONG Energy has provided this sustained investment for the area.

In order for the offshore wind sector to have a sustainable economic benefit in the Humber region a series of investments over a long period is critical.

The nature of the sector is such that there is a large level of activity during the construction phase including manufacture and installation of components (typically over one to three years), followed by a smaller, sustained level of activity in the ongoing operation & maintenance of the wind farms.⁶

This means that a one-off wind farm development in an area would have limited sustained economic impact, because most of the local construction phase activity would be delivered by workers based temporarily in the area, who would move on once the construction was completed.

In the Humber, however, the group of wind farm developments over 10+ years has provided the area with the opportunity to establish a stronger foothold in the sector, secure inward investment and enable local businesses to access supply chain opportunities.

Figure 2.1 below shows an estimate of DONG Energy's investments and planned future investment in the Westermost Rough, Race Bank and Hornsea 1 wind farms. The overall £6.4bn of investment represents the construction investment for these wind farms broken down by delivery timescales.

DONG Energy has also recently acquired the full Hornsea zone, and so it is anticipated that this investment timescale will extend further, beyond 2019. DONG Energy is currently taking forward the planning application for a second Hornsea wind farm.

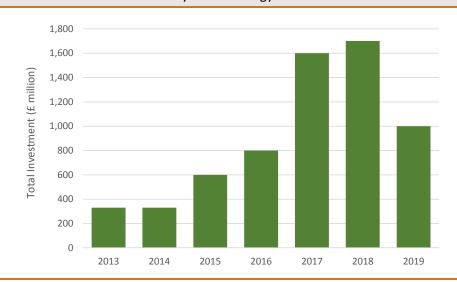


Figure 2.1 Scale of Annual Investment by DONG Energy in Humber Offshore Wind Farms

Source: DONG Energy

⁶ Subsequently there is a final phase of decommissioning or repowering the wind farm, typically after at least 20 years of O&M. As it is not yet known which option would be taken, employment relating to this phase is not included in this report.



3. Supporting Economic Impact & Employment

Assuming DONG Energy continues to use Humber ports to support its local offshore wind farms, its investments will support an average of 1,600 jobs in the Humber over the period 2015-20 (ranging between 700 - 2,700 each year), and almost 500 long-term operational jobs after 2020. This will generate around £1.2bn of gross value added⁷ in the Humber economy by 2030.

The main economic benefits of DONG Energy's investments in the region are the jobs its investment has supported in the local economy. Through its direct employment and the contracts during both the construction and operational phases of its wind farms, DONG Energy is supporting substantial employment in the Humber area.

Figure 3.1 sets out the total job creation in the Humber expected during construction and operational phases. For the construction phase of Hornsea 1 and the operational phases of both Race Bank and Hornsea 1, the main ports have not yet been identified. The hatched areas in the chart show the potential job numbers if ports within the Humber are used for these activities.

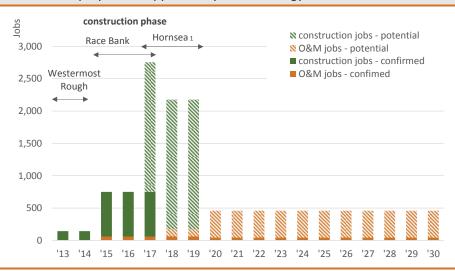


Figure 3.1 Humber Employment Supported by DONG Energy Investments

Source: Data from DONG Energy, Economic Modelling by Regeneris Consulting. Note: in each case the figures include direct, indirect and induced employment. See Appendix A for further information on the economic impact assessment methodology.

Based on the confirmed jobs (construction and O&M), we estimate that DONG Energy's investment in the Humber will generate a total of £210m of gross value added by 2030, which could increase by a further £1.0bn if Humber ports continue to be used for the construction and O&M phases of the Race Bank and Hornsea 1 projects.

DONG Energy has recently acquired the full Hornsea zone, and is taking forward a planning application for a second Hornsea wind farm, which is currently in the examination phase with the Planning Inspectorate. If consent is given and the scheme proceeds, there will be a further period of construction related expenditure, to sustain the flow of business opportunities in the area, and further increase longer-term operational phase employment.

⁷ Gross value added is a standard UK measure of economic value generated, capturing employee income and business profit.



4. Offshore Wind Supply Chain Development

4.1 Supporting Inward Investment to Kick-start the Humber Supply Chain

Attracting a major industry partner to the Humber was fundamental to growing the offshore wind supply chain. The Siemens wind turbine factory investment in Hull has provided this critical anchor body and is recognised locally as a potentially transformational investment.

Due to its size and strong supply relationship with Siemens, DONG Energy is cited as having been a significant factor in their decision to invest in Hull.

The nature of the offshore wind supply chain is such that suppliers tend to locate in proximity to original equipment manufacturers (OEMs), such as wind turbine manufacturer Siemens.



Securing the £310m Siemens inward investment in a new wind turbine factory in Hull (confirmed in 2014), was central to the Humber maximising the major economic benefits that the sector potentially offers.

As well as creating an anticipated 1,100 direct new jobs, the Siemens investment will create local supply chain opportunities, attract further investment to the area, and enhance the branding of the Humber, helping the area to develop as a major offshore wind sector hub.

As part of this study, Siemens was invited to comment on the importance of their relationship with DONG Energy in making its investment decision in Hull. Siemens confirmed that its close working with DONG Energy was a significant factor in the Siemens investment decision.

In press statements⁸, Siemens has highlighted that it anticipates its investment in Hull to be for the long-term, that it will become a household name as a Hull employer, and that the turbine factory in Hull will be producing for export, as well as serving the UK market.

The Siemens investment has also already acted as a catalyst for further investment activity in the area, and particularly within the supply chain for offshore wind. Examples include: "DONG Energy's pipeline of offshore wind energy projects is a significant part of the UK pipeline, and therefore Siemens' close working with DONG has been a significant factor in the decision to build the Hull Siemens factory."

Matthew Knight, Director of Strategy and Government Affairs (Energy), Siemens

 Planning approval for Able Marine Energy Park in 2015, providing a further major investment opportunity for the Humber, which could support over 4,000 new direct jobs.

⁸ Hull Daily Mail, 15 Novermber 2014, http://www.hulldailymail.co.uk/Siemens-ll-household-Hull-like-Reckitt-s-Smith/story-24536049-detail/story.html. Accessed 15th October 2015.



• An announcement in May 2014⁹ that planning permission had been submitted for phase one of a £25m business park in Hull, targeted at high technology green energy businesses.

4.2 Developing the Business Base

DONG Energy works closely with local business to increase Humber and UK sourcing where possible in its supply chain, and is a strong contributor to the development of the Humber offshore wind sector.

The sustained level of investment across a number of Humber area offshore wind farms by DONG Energy, alongside developments led by other firms, has provided significant new supplier opportunities in the Humber business base.

There are very positive early signs at this stage that local businesses are engaged with and interested in opportunities that the sector offers, and are already securing new work through these opportunities or preparing themselves to do so:

- Team Humber Marine Alliance, a sector body focused on the offshore wind sector has seen its membership double in recent years with membership now reaching 200 companies.
- Regional Growth Funding secured by the Humber LEP is delivering offshore wind sector support to local businesses and individuals. The programme has already supported 90 businesses and engaged over 20 foreign businesses interested in investing in the Humber.

The case studies below illustrate the economic and employment benefits of DONG Energy's investments in Humber supply chain companies.

Figure 4.1 Port of Grimsby East

The Port of Grimsby East is a major player in the ongoing development of the offshore wind sector in the Humber region. The port currently provides essential services to a number of windfarms located off the Humber Estuary, and counts DONG Energy, Siemens, EON and Centrica among its key tenants.

Over the past three years the Port of Grimsby has seen around £30m of investment in buildings and marine infrastructure, which was used as a construction base for Westermost Rough offshore wind farm.

Figure 4.2 Case Study of CallMac Scaffolding

CallMac Scaffolding is a specialist scaffolding designer firm based in the Humber area, and has been working with DONG Energy on the Westermost Rough and Race Bank offshore wind farms over the past 18 months.

The total value of orders secured by CallMac Scaffolding is expected to be up to £1m, with work on Race Bank expected to run until 2018. These and other work in the area have enabled the firm to employ four new staff on a permanent basis, as well as taking on two additional trainees.

Furthermore, the industry's growth has given CallMac Scaffolding confidence to invest around £100,000 in a second yard that will act as a training and offshore base for the firm. DONG Energy's presence in the region was one of the key factors in making this decision.

⁹ Stoneferry Estates, 30th May 2014, http://www.stoneferryestates.co.uk/news/planning-application-submitted. Accessed 15th October 2015.



5. Boosting Skills Development

Skills development is a critical part of local supply chain strengthening in the Humber. DONG Energy has played an important part in supporting local skills development, through investment in its own workforce training.

In addition to investments in infrastructure and growth in the local business base, the presence of a growing offshore wind sector has triggered new public and private sector investment in skills development, which DONG Energy has played an important part in.

As well as investing in the training and development of DONG Energy staff, the investment that DONG Energy and others have made to develop offshore wind farms in the Humber area and trigger offshore wind supply chain growth, has also led to a range of new skills and training developments and investments locally:

- The University of Hull has invested in training provision to serve the offshore wind sector and offers a Masters programme focusing on the renewable energy sector. It is also constantly looking for opportunities to link its academic research with advancements occurring in industry.
- Hull College has opened a Digital and Green Energy Centre, to support local businesses looking to grow in the renewables sectors, and offer qualifications that will create future career opportunities for young people and adults looking to re-train.
- An £11m investment has been made into a new University Technical College (UTC) in Scunthorpe, specialising in engineering and renewable energy and with a strong emphasis on a core academic curriculum as well as working on real projects in partnership with top companies operating in the offshore wind and other sectors.
- The Regional Growth Fund programme led by the Humber LEP has supported more than
 380 local apprenticeships in local priority sectors, including renewable energy.



6. Contributing to a Prosperous Future

Development of the offshore wind sector, closely tied to DONG Energy's investments, has heralded an upturn in economic fortunes in the Humber which has had a notable impact on confidence and aspiration in public and private sectors and created foundations for a more prosperous economic future for the Humber.

6.1 Clear Economic Strategy and Changing Perceptions

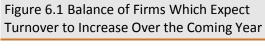
The ten year Hull City Plan, launched in 2013 was a confident, forward thinking plan for the city, built on a clear economic strategy, twinning plans for the creation of high value long-term jobs in the renewable energy sector, alongside more accessible jobs for all in the tourism sector.

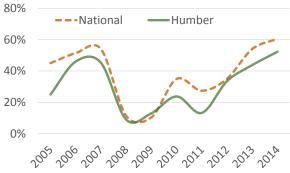
Through this strategy the city could focus its efforts at key goals, one of which was bidding to be the UK City of Culture in 2017, a prize which the city successful secured.



Hull has received excellent national coverage from this, and made some ground in shifting negative perceptions about the city. The announcement in 2015 that Hilton is planning to build its first hotel in Hull reflects the perception shift that is occurring, and will bring further significant economic benefits to the city.

6.2 Growing Private Sector Confidence





Source: British Chambers of Commerce, Quarterly Economic Survey. Annual data is based on averages across data for four quarters (and nationally across both manufacturing and service sectors).

Data on business confidence shown in Figure 6.1 shows the significant upturn in business confidence amongst Humber businesses in recent years, and that confidence levels amongst Humber businesses are a lot closer to the national average now than a decade ago in 2005.

The development of the offshore wind sector has provided a significant confidence boost to the area, generating a virtuous circle of economic development.

As a major offshore wind investor in the Humber area, and through its contribution to job creation, supply chain and skills development, DONG Energy has been a critical contributor to this transformative economic story.

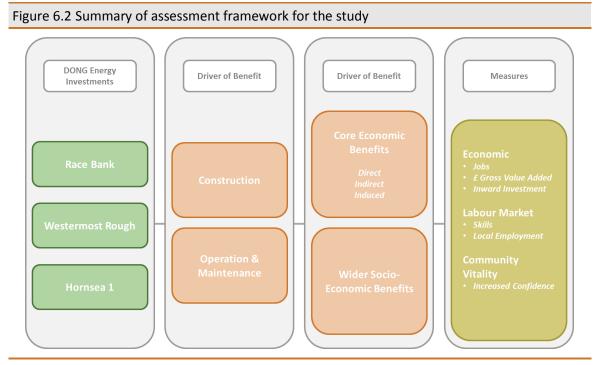


Appendix A - Economic Impact Assessment Methodology

The research tasks underpinning the economic benefits assessment of DONG Energy's activity in the Humber region cover the drivers, types and measures of socio-economic impacts resulting from the Westermost Rough, Race Bank and Hornsea 1 offshore wind farms. The central research tasks have included the following:

- **Desk-based research** and analysis of the socio-economic impacts of DONG's investments in the Humber area.
- Discussions with the delivery teams across Westermost Rough, Hornsea 1 and Race Bank to understand the costs of construction, operation and maintenance and the likely nature and geography of the supply chain.
- Development of a robust socio-economic model to capture and quantify the expected impacts of the construction as well as operation and maintenance phases of the wind farms.
- Discussions with local stakeholders (including Local Authorities, the Humber LEP, local trade bodies, businesses within the supply chain and local education providers) to understand the wider effects of wind farm developments in the Humber region.

The diagram below summarises the assessment framework that underpins this analysis. More detail of the methodology is presented below.



Source: Regeneris Consulting, 2015



A.1 Types of Benefits

The economic impact assessment focuses on two main stages of activity generating economic benefit for the Humber area:

- The construction and assembly of the wind farms and related supply chain activity.
- The ongoing operations and maintenance (O&M) of the installed wind farms.

The core economic benefits have been assessed quantitatively through an economic impact model, which estimates:

- Direct Impacts: This measure captures the economic activity that is directly supported by spend on the construction, and operation and maintenance of the wind farms. This includes DONG Energy staff employed to work on the development, and all first tier supply chain expenditure.
- Indirect Impacts: This measures the supply chain impact of the additional output generated
 by companies in the supply chain supporting the tier one suppliers. The additional
 economic activity in these companies is passed down through their supply chains and
 generates additional, indirect benefits for many other companies.
- **Induced Impacts:** This captures the knock-on benefits that additional employment supported directly and indirectly has in the economy as salaries earned by those employed in additional jobs are spent on goods and services elsewhere in the economy.

A.2 Measures of Benefit

The direct, indirect and induced economic benefits of the scheme are measured using two headline indicators, which allow the overall impact of the scheme on the Humber economy to be quantified. The key measures used are:

- Jobs the net number of full time equivalent jobs that will be created or safeguarded as a
 result of the scheme. This is calculated using the overall value of investments made for
 different goods and services in the local area, and UK benchmark figures for the turnover
 per job in these areas of investment.
- **Gross Value Added (GVA)** the value to the economy of the activity generated by the scheme¹⁰. This is calculated using UK benchmark figures for the GVA generated per employee in sectors relevant to the jobs created.

¹⁰ GVA is a standard UK measure of economic value, used by Government and the Office for National Statistics. It is effectively a measure of profits generated in businesses and salaries paid to employees.



Appendix B - Summary of Humber Offshore Wind Farm Investments

Wind Farm	Round	Status	Commissioning Date just so (Actual or Expected)	Size (MW)	Owner
Lynn and Inner Dowsing	1	Operational	2009	194	Centrica / EIG
Sheringham Shoal	2	Operational	2012	317	Statkraft / Statoil / Green Investment Bank
Lincs	2	Operational	2013	270	Centrica / DONG Energy, Siemens Project Ventures
Humber Gateway	2	Operational	2015	219	E.ON Climate & Renewables UK
Westermost Rough	2	Operational	2015	210	DONG Energy / Marubeni / Green Investment Bank
Dudgeon	2	Under Construction	2017	402	Statkraft / Statoil / Masdar
Race Bank	2	Under Construction	2018	580	DONG Energy
Triton Knoll	2	Consented	Unknown	900	RWE / Statkraft
Hornsea 1	3	Consented	2020	1200	DONG Energy
Hornsea 2	3	Consent expected 2016	Unknown	Unknown	DONG Energy





AA. How to become a DONG Energy Supplier

New suppliers for DONG Energy's wind farms are encouraged to register at the website windpowersupplier@dongenergy.com

Below is the leaflet instructing how to become a supplier to DONG Energy's offshore wind farms.



HOW TO BECOME A SUPPLIER TO DONG ENERGY WIND POWER A/S

In DONG Energy Wind Power, we know that suppliers are a vital part of our success as market leader in the offshore wind business. Therefore, we value relationships with our suppliers and welcome new suppliers to be part of our supply chain.

DONG Energy Wind Power has chosen to introduce a global qualification system framework in cooperation with Achilles who operates the systems.

Our intention is to make the process of doing business with DONG Energy Wind Power easier. For the majority of the procurement we do, this qualification system framework will enable us to streamline the way we engage with suppliers in different locations/projects, show how we qualify them and share this information across the DONG Energy Wind Power business.

Our aim is to reduce the cost, time and effort involved in doing business together for both DONG Energy Wind Power and our suppliers.

We currently use two qualification systems:

UNCE: All our global categories as well as locals in Scandinavia + Local categories in Germany UVDB: Local categories in the United Kingdom

Your delivery and country location are prior to the choice of databse we use. For more information, please visit our website: www.dongenergy.com/windpowersupplier

QUALIFICATION SYSTEMS IN DONG ENERGY WIND POWER					
Countries	Scandinavia	Germany	UK & Ireland		
Global categories					
Local categories	x	x	х		

If you have questions, please contact us windpowersupplier@dongenergy.com



About Procurement in DONG Energy Wind Power

In Procurement, we are committed to delivering a low-cost and robust sourcing basis, and where commercially advantageous, we will look to engage directly with the best local supply chains. Where it is not commercially advantageous, we will work with our current supply chain to identify new conordinities

We will do this through a number of areas:

- We will encourage first tier suppliers to utilise local suppliers in the development and delivery of the Wind Power solution.
- We will endeavour to establish contact between local suppliers and first tier suppliers to establish business relationships.
- We will host regular supply chain forums, giving an opportunity for the local suppliers to understand our business plans and approach.
- We will endeavour to create more transparency in our sourcing approach including use of open qualification systems and minimum requirements for becoming a part of such systems.

Building relationships

Building relationships with capable, competitive and innovative suppliers is essential to deliver new projects successfully. Wherever we operate, we seek a positive engagement with the local community. This has helped the development of local economy and supply chain.

We buy certain supplies and services in the global market, increasingly through framework agreements. Our approach of selecting key suppliers of specific supplies and services brings mutual benefits including cost reductions due to economies of scale.

Do you wish to qualify as a supplier? www.dongenergy.com/windpowersupplier

BB.Case Study: DONG Energy WTG Suppliers on Walney Extension

Case Study: WTG Supply on Walney Extension

Overview

Walney Extension Offshore Wind Farm is currently in the construction phase. The proposed Walney Extension offshore wind farm is located approximately 19km west-southwest from the Isle of Walney in Cumbria, 26km southwest from the Millom coast, 35km northwest from the Fleetwood and Blackpool coast and 31km southwest from the Isle of Man. Situated next to the existing Walney Offshore Wind Farm, it will have a capacity of up to 660MW and up to 90 turbines.

Walney Extension is 100% owned by DONG Energy Walney Extension (UK) Ltd.

Walney Extension is being constructed in two phases:

- Phase 1: turbines from MHI Vestas will be supplied, with blades being sourced from the Isle of Wight facility in the UK
- Phase 2: turbines from Siemens Wind Power will be supplied, with blades being sourced from the Hull facility in the UK and a number of towers being sourced from CS Wind's facility in the UK



The Walney Extension offshore wind farm will provide electricity to over half a million homes and will contribute to the government target of achieving 15% of total energy production from renewable sources by 2020. http://www.walneyextension.co.uk

Development of Competition within the Supply Chain Plan:

- One of the main reasons for using two different WTG suppliers for Walney Extension was to ensure that the highest level of competition was maintained between the turbine suppliers.
- DE took the strategic decision to go ahead with dual WTG supply for Walney Extension in order to promote competition, drive prices down and drive performance up.
- Furthermore, the dual supply strategy would also promote technological innovation, as it would encourage WTG suppliers to provide their latest technology for this project.

Innovation:

- The implementation of the dual WTG strategy required DE to design technical solutions that would allow for the coordinated control of two WTG types operating within the same wind farm.
- DE has the appropriate solutions in place to make sure all associated uncertainties are sufficiently mitigated and the dual WTG strategy can be implemented successfully.

In conclusion, the dual WTG supply on Walney Extension demonstrates that DE is committed to ensuring that the highest level of competition and UK content is achieved, while innovation level is increased.

CC. First blades from Siemens Hull factory to Race Bank – Press Release December 2016

First blades from Siemens Hull factory going to DONG Energy's Race Bank offshore wind farm

01.12.2016 08:00

The first blades manufactured at the Siemens blade factory in Hull will be used at DONG Energy's Race Bank offshore wind farm.

Race Bank is located off the North Norfolk coast and is being built out of DONG Energy's construction base in the Grimsby Fish Docks. The installation of the blades and the rest of the turbines is on track to start up in summer 2017.

The Siemens blade factory in Hull has been officially opened today (1 December 2016).

Brent Cheshire, DONG Energy's UK Country Chairman, said:

"DONG Energy is absolutely committed to investing in the UK so I'm delighted we will be the first company to use Siemens blades manufactured right here in Hull. The opening of this Siemens blade factory is another positive step forward for the UK supply chain.

"Race Bank is a significant project capable of powering over half a million homes a year and is being constructed from our base in Grimsby. To have blades manufactured down the road in Hull really underlines the great success story of offshore wind in this country."

Approximately two thirds (around 180) of the blades at Race Bank will come from the Siemens facility in Hull. The wind farm is expected to be fully operational in 2018.

Blades being manufactured in Hull is only one part of a dedicated focus by DONG Energy and Race Bank to use local suppliers where relevant and this includes the array cables – which connect each of the wind turbines to the main export cable that transmits electricity back to shore – where three different UK companies have been contracted.

In September, <u>DONG Energy also announced plans for a £multi-million investment in Grimsby</u> to create the UK's largest offshore wind operations and maintenance hub.

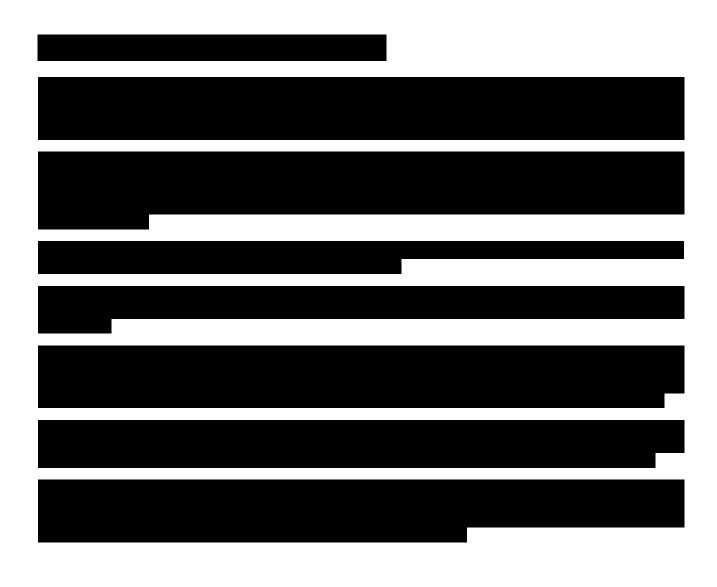
Facts about Race Bank offshore wind farm:

- Located approximately 16.8 miles off Blakeney Point on the North Norfolk coast and 17.4 miles off the Lincolnshire coast at Chapel St Leonards
- Covers a total area of 75km²
- Consists of 91 Siemens 6 megawatt (MW) turbines

Total capacity of up to 580MW, producing enough electricity to power over half a million UK homes annually

 $\underline{\text{http://www.dongenergy.co.uk/news/press-releases/articles/first-blades-from-siemens-hull-factory-going-to-dong-energy\%E2\%80\%99s-race-bank-offshore-wind-farm}$

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HH.DONG Energy East Coast Hub – Plans and Announcement

DONG Energy to build 'game-changing' operational hub for offshore wind in Grimsby

22.09.2016 09:30

DONG Energy is today (22 September 2016) announcing plans for a £multi-million investment in Grimsby to create the UK's largest offshore wind operations and maintenance hub.

Subject to planning approval, the new facility will be developed in the town's Royal Dock and will initially support Westermost Rough, Race Bank and Hornsea Project One offshore wind farms. However, it will have the capacity to support other east coast wind farms in DONG Energy's future development pipeline.

Transforming the way wind farms are supported, the hub will be served by high-tech vessels capable of accommodating up to 60 crew and technicians while remaining at sea for long periods. The hub will also include a comprehensive marine and helicopter coordination centre capable of providing 24-7 service to offshore operations across the UK and beyond.

Brent Cheshire, DONG Energy's UK Country Chairman, said:

"This new operational hub in Grimsby will be a game changing industry first, raising the bar for the way we serve offshore wind farms. It will generate direct and indirect job opportunities in the Humber region, as well as opportunities for the local supply chain."

"It represents a massive vote of confidence to the UK offshore wind industry and confirms our commitment to the Humber region where by 2019 we expect to have invested around £6 billion."

The new hub will sit alongside the existing Westermost Rough operations and maintenance facility, using additional land to be leased from Associated British Ports.



State-of-the-art Service Operational Vessels (SOVs), supplied by Ostensjo Rederi and designed by Rolls-Royce, are being chartered to operate from the new hub. The first vessel will arrive late next year to support a phased

activation on the new hub. The vessel will initially support the operation and maintenance of Race Bank, DONG Energy's 580-megawatt offshore wind farm currently under construction 17 miles off the Norfolk and Lincolnshire coastlines.

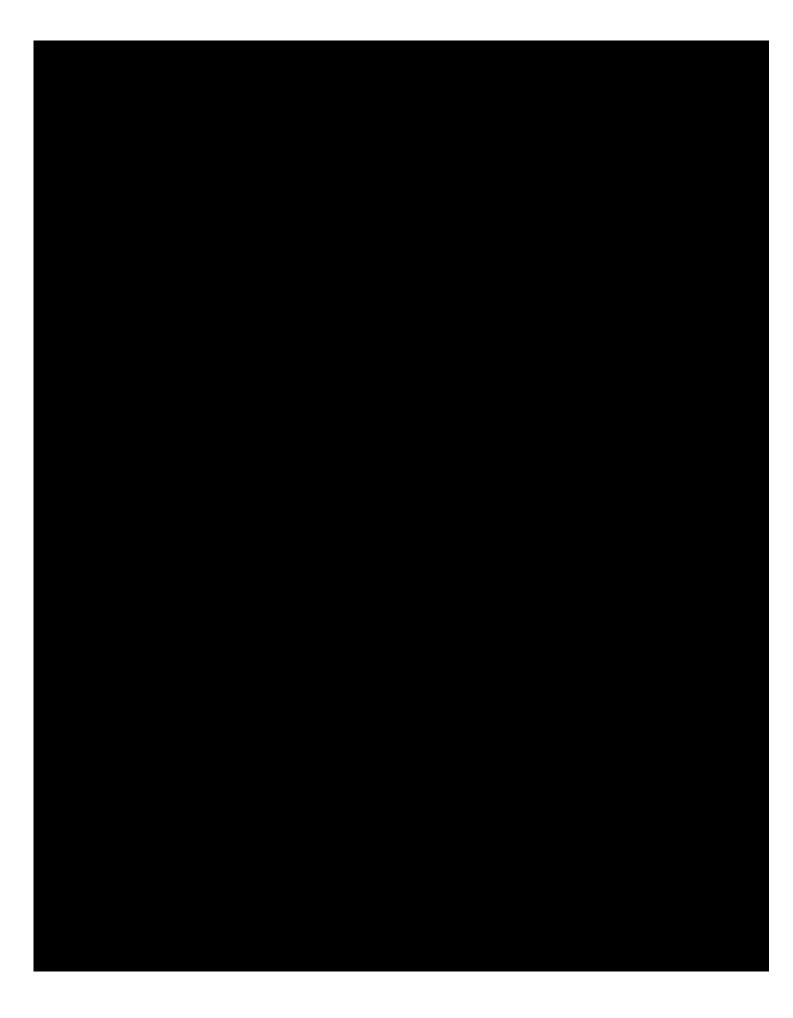
Some components needed to maintain wind turbines will be stored in a warehouse on the hub site. Other equipment will arrive from manufacturers on a 'just in time' basis to be loaded onto the new vessel.

Once mobilised, the SOV will spend up to 28 consecutive days on station at the wind farm, where it will be able to service six to eight wind turbines each day. Crews of technicians from DONG Energy and turbine supplier Siemens will work on a two weeks on, two weeks off, shift pattern.

With the SOV in position, technicians will walk safely to work from the vessel's open deck to work on the wind turbines using an innovative motion-compensated gangway. This gangway will remove the need for climbing up and down vertical access ladders as happens when traditional crew transfer vessels push on to the foundation of a turbine.

The bespoke SOVs are expected to set the blueprint for the way in which offshore wind farms are maintained in future, offering significant safety and operational efficiency benefits. They will incorporate a containerised warehouse for the storage of equipment spares, tools and consumables.

http://www.dongenergy.co.uk/news/press-releases/articles/dong-energy-to-build-%E2%80%98game-changing%E2%80%99-operational-hub-for-offshore-wind-in-grimsby





JJ.Offshore Wind Week 2016 – Events and Programme



Offshore Wind Week 2016 - 31st October-4th November

Offshore wind is an essential part of the UK's energy mix and industrial strategy. Offshore wind already generates 5 per cent of the UK's electricity and by 2021 this will to double to over 10 per cent. Building out the current pipeline of offshore wind projects could supply over a third of the UK's power needs. The industry is investing over £18bn in projects over the next five years and offshore wind will be one of the lowest cost sources of new power in the 2020s.

To continue developing into the next decade and beyond, offshore wind requires sustained political support from Government and Parliament. RenewableUK and partner companies are working to deliver Offshore Wind Week 2016, which will run from 31st October to 4th November and celebrate the growth of this industry and the benefits it is delivering for Britain. Bringing together companies from across the UK, Offshore Wind Week aims to help deepen policymakers understanding of, and support for, the offshore wind industry. The programme of activity for Offshore Wind Week 2016 includes

- Industry-wide **Offshore Wind Week Parliamentary Reception** on Monday 31st October, <u>register here</u>.
- Launch of new regional factsheet documents and a new UK exports document
- New video and social media content follow @RenewableUK on twitter for the latest content
- Offshore wind blogs and articles in regional, trade and Westminster media
- A series of Westminster events:

Private House of Lords and Industry Dinner sponsored by ORE Catapult MHI Vestas Offshore Wind Parliamentary Reception DONG Energy's MPs Export Roundtable

Department for International Trade and RenewableUK Supply Chain Roundtable

• East Anglia Offshore Wind Week Event delivered by EEEGR

Supported by Offshore Wind Week Partners:



















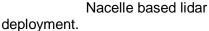


LL. Light imaging, Detection And Ranging (LiDAR) and Floating LiDAR (FLiDAR) overview and use on DE projects

LiDARs allow the accurate measurement of wind speed and wind direction through the use of laser technology. Since 2010, DONG Energy has deployed more than thirty lidars, including fix lidars nacelle based lidars and floating lidars. Lidar technologies are now part of our "DE standard measurements package". Lidars have been developed in order to reduce costs of the development phase (compared to meteorological masts costs) and reduce the uncertainty of offshore wind projects (in those cases where no measurements on site exit) but also to measure power curves and optimise production of existing farms.

Both *ground-based lidars* and *nacelle-based lidars* have been tested in-house and the results from our internal R&D projects have challenged the wind industry as a whole in areas such as power curve verification (EWEA, 2012), and energy yield assessments. DONG Energy has made a big effort to support and promote the use of ground based lidars to a level of being accepted as a standalone unit through the R&D "Bankable lidar" project (EWEA 2013). In this project and others, DONG Energy's role has been crucial in growing industry confidence on this technology and pushing consultants towards acceptance. On the hand, and thanks to the successful outcome of the EUDP project, NBL has become now the preferred solution for measuring power curves offshore, not only for Dong Energy but for the industry.







Ground based lidar offshore

DE first trialled a floating lidar at our Burbo Bank extention offshore wind farm in 2014. DE has worked very closely with lidar manufacturers and has pushed them towards higher quality developments and made them understand the need of exploring new applications. In this context, Dong Energy has worked

closely with partners across the industry in order to support the development of the floating lidar technology and to promote its use.

In 2015, DE deployed a second floating lidar unit at our Walney extention project. Also in 2015, DE collaborated with AXYS Technologies in the deployment of a third floating lidat unit at West of Duddon Sands offshore site.

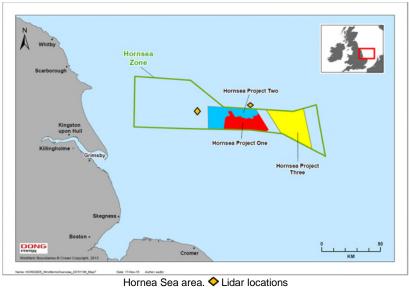


Floating Lidar

As summary, DE has actively participated in the following activities floating lidar related:

- First floating lidar trial funded by the Offshore Wind Accelerator where two different types of lidar where deployed.
- Definition of the Carbon Trust "Roadmap for commercial acceptance of floating LIDAR technologies"
- Second floating lidar trial funded by the Offshore Wind Accelerator where other two different technologies have been tested.
- Contribution through the International Energy Agency (IEA) in the preparation of the IEA "Recommended Practices for Floating Lidars Systems"
- Contribution through the Offshore Wind Accelerator (OWA) programme in the preparation of the Carbon Trust "Recommended Practices for Floating Lidars Systems"

In particular, data collected from existing Lidars in the surroundings of HOW02, will be used to optimise the design of HOW02 by providing a more accurate picture of the spatial distribution of the wind resource over the entire area.





MM. The BEACon project—a new paradigm in wind energy measurements

The project was initiated in 2014 and the proto-type radar system was installed at a location in Tunstall in East Riding of Yorkshire in 2016.

The land-based system has undertaken a comprehensive measuring campaign at the Westermost Rough Wind Farm off the coast at Withernsea. Overall, through the acquisition of greater data as a result of the implementation of BEACon, the project will lead to improved efficiency of wind farm designs, improved yield assessments and stronger component design. Subsequently, each of these benefits will help lower the cost of electricity produced by offshore wind.

Knowledge of the wind is essential for a wind farm designer, producer and operator. Improved wind measurements can potentially enhance operation and lifetime of existing wind farms, and serve as input for design and optimisation of future wind farms.

Until now, wind measurements have been conducted locally on a met mast by means of a cup anemometer or a ground-based lidar. The Dual-Doppler (DD) radar technology, which was developed for wind hazards research, now shows the potential for measuring the wind speed in a three-dimensional grid covering an entire wind farm. This makes the technology superior to present technology. The DD radar technology has a measurement range of 10-30 km meaning that the radars for wind farms that are close to the shore can be placed onshore, and that a costly installation on an extra met mast platform can be saved.

The measurements can be used during operation in a performance analysis of each wind turbine through the creation of individual power curves. In contrast, the present practice is to verify the contractual power curve only on a single turbine, using a met mast erected upstream of the turbine or a nacelle-based lidar. In addition, the flow over the entire wind farm can be analysed, which will lead to unprecedented understanding of the structure and behaviour of wakes. The advances thus gained in wake modelling will ultimately lower the uncertainty of pre-construction production estimates and help the optimisation of future wind farm layouts. Further, the production of wind turbines in wakes and the influence of shear can be analysed.

The detailed measurements of the inflow wind field upstream of individual machines can also serve as input for the numerical model used to determine the loads on each wind turbine. A better handle on the influence of site-specific shear, turbulence and waked inflow on the turbine loading will guide the optimisation of the design process.

The custom-made radar setup was designed and built by SmartWind Technologies and deployed onsite, close to Withernsea, during the summer of 2016. See images of the two radar sites below. From august 2016 the DD radar setup has been online and will be measuring the wind flows at Westermost Rough for a total of 18 months.





The output from the radar measurement systems are tremendous amounts of data corresponding to complexity of wind flows. A simple graphical representation of this is shown in Figure 1 below.

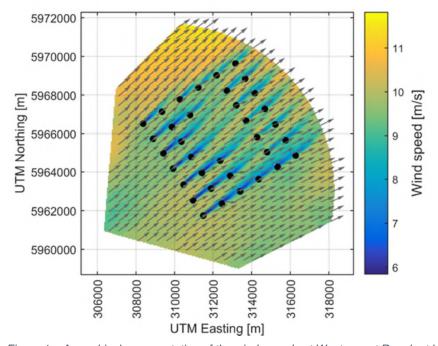


Figure 1 – A graphical representation of the wind speeds at Westermost Rough at hublevel.

The BEACon project is the first of its kind in the industry and DONG Energy has through the innovative use DD radars brought the understanding of complex wind flows in offshore wind farms to a new level. This will have major impact on several aspects of designing and operating an offshore wind farm. The short-term impact will deliver cost reductions through better wake modelling, wind farm-level power curve verification and lighter foundations as well as enabling a new level of wind farm control.



The long-term potential for the utilisation of the data obtained in the BEACon project continues to expand as the vast amounts of data is analysed and it will continue to provide LCoE reductions for several years throughout DONG Energy's future assets.

Note: BEACon has received funding from the Carbon Trust OWA as a discretionary project and currently there are no other developers involved in the project.

NN. The Pile Soil Analysis ('PISA') project

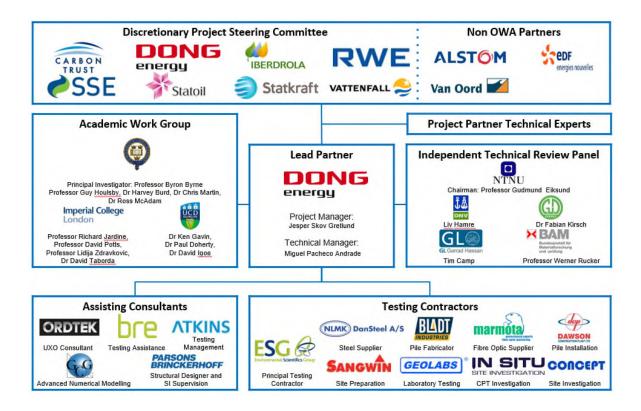
Developing a design method for the laterally loaded pile specifically tailored to the offshore wind industry

- DE in collaboration with researchers at Oxford University, Imperial College London and University
 College London worked together to develop new insight into soil structures and interaction with
 piling, with the overall aim of reducing piling conservatism in construction phases.
- Findings surmised that if the thickness or length of steel piles used as foundations can be reduced even by a small fraction that could represent quite considerable cost savings for the industry.
- The sites where testing was undertaken reflected soil conditions seen in much of the North Sea and it is therefore expected that the findings from this initiative will be used to help improve the design of Hornsea Two.

The most popular method of analysis for laterally loaded piles, and the method adopted in the offshore design code is based on the Winkler model and is commonly termed the p-y approach. This method of analysis assumes that the pile acts as a beam supported by a series of uncoupled springs, which represent the soil reaction. These springs are normally described by non-linear curves, which describe the soil reaction, p, at a given depth as a function of the lateral movement, y.

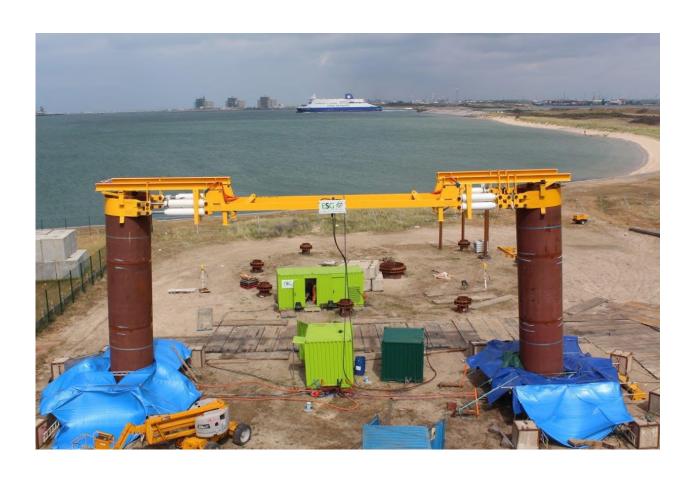
The traditional method for the laterally loaded pile, forming the basis for the monopile foundation design, was originally developed for the oil and gas industry and has not received any academic attention since the middle of the 1980s. While certain insights from the oil and gas industry can be applied to the offshore wind industry there are significant differences between the two industries which demands innovation. Furthermore, measurements from DONG Energy's offshore wind farms suggest that monopiles are stiffer than assumed and that they are being designed conservatively. On this basis, the PISA project was set up in 2012, with the objective to develop a design method for the laterally loaded pile specifically tailored to the offshore wind industry.

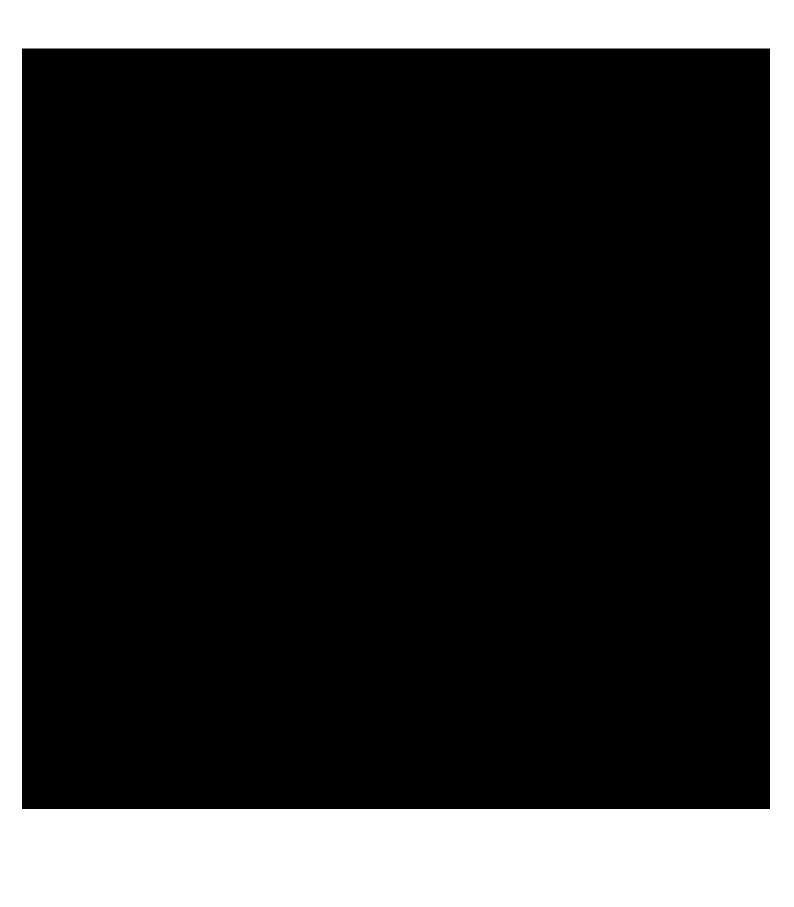
In order to develop the new design method, the project brought together a skilled group of offshore wind farm developers and actors from the offshore wind value chain, as well as highly renowned academic institutions, recognised certification bodies and a number of competent consultants and testing contractors. The project was carried out under the Carbon Trust Offshore Wind Accelerator framework. The project organisation along with the involved institutions is illustrated in the diagram below.

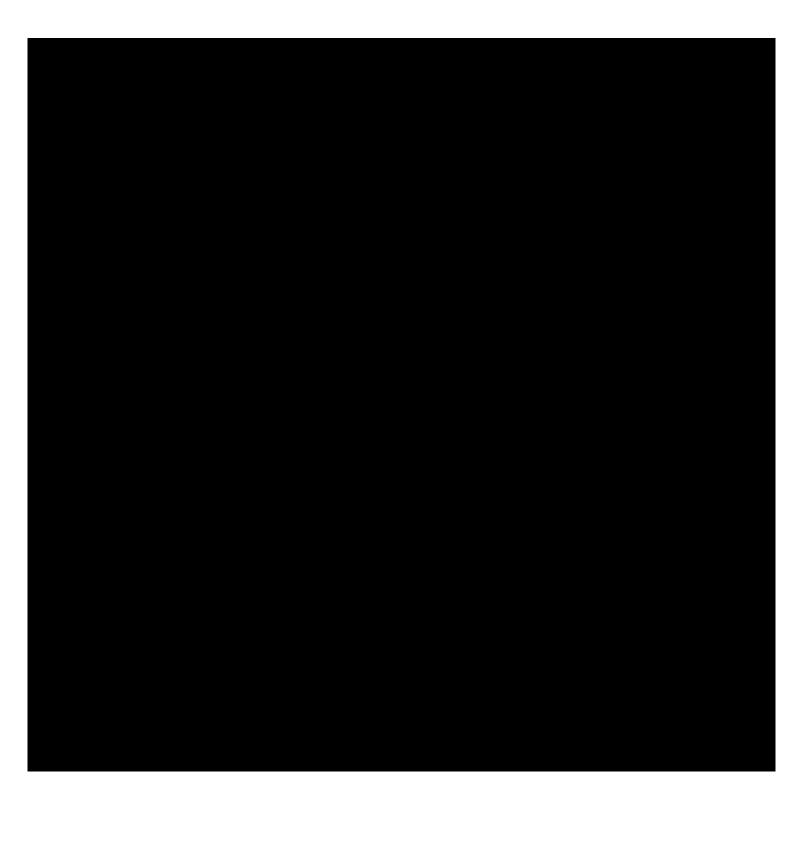


The results from the project suggest that the traditional design methods have been very conservative. Improved design methods enable the design of thinner and shorter monopiles and consequently less steel is required. With a lower quantity of steel, the cost of electricity will ultimately be lowered. In addition a more accurate method of the design may allow monopiles to be installed in deeper waters than is currently possible, using the existing standards, and potentially with larger turbines on top. This makes monopiles a suitable foundation solution for many of the UK Round III projects.

The project is a great example of industry and academic collaboration and how focusing the innovative activities of the industry, can bring significant cost reductions. While the results of the project are initially restricted to the project partners, they will be disclosed through publications from Oxford University, Imperial College London and University College Dublin in the beginning of 2017. In this manner, the results will eventually benefit the entire industry.















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RR. Research and Development within electrical engineering

DONG Energy has have a long history of research and development within electrical engineering though own activities as well as through national and international research programmes, where the Carbon Trust Offshore Wind Accelerator, <u>OWA</u>, programme is another important example of a long term commitment to reducing the cost of renewable energy through joint industry development.

DE development efforts and contributions to industry development within the electrical engineering area is best illustrated by referencing the track record of publications, student projects etc. in the area, currently (summer 2016) the track record lists 83 B.Sc., M.Sc and Ph.D. projects and 137 publicised technical papers. Please see below for more information.

83	R. Krishna lyer, "Passive filter design and optimization for offshore wind farms", MSc Project at Norwegian University of Science and Technology, Trondheim, Norway, 2016.
82	H. Brantsæter, "Wind Turbine and Offshore Wind Farm Modelling for System Level Simulation", MSc Project at Norwegian University of Science and Technology, Trondheim, Norway, 2015.
81	C. Wolter, "Analysis of overplanting for large offshore wind farms under different regulatory regimes", MSc Thesis, Dept. of Management Engineering, DTU, June 2016
80	F. Vives, "Analysis of overplanting for large offshore wind farms considering dynamic line rating", MSc Thesis, Dept. of Wind Energy, DTU, June 2016.
79	A. Graumann Moser, "Reliability investigation on array cable loops in large offshore wind farms", MSc Thesis, Dept. of Wind Energy, DTU, June 2016.
78	M. B. Dowlatabadi, "Harmonic Modelling, Propagation and Mitigation for Large Wind Power Plants Connected via Extra Long HVAC Cables", PhD Thesis, Department of Energy Technology, Aalborg University, 2015-2018.
77	Henriksen, Mathew Lee, "Investigating the Feasibility of Direct Drive Wind Turbine Generator Topologies that are Independent of Rare Earth Elements, Ph.D. Thesis, Technical University of Denmark, Department of Electrical Engineering, 2015.
76	T. Sarto "Temperature assessment along wind farm export cables", MSc thesis, Technical University of Denmark, Department of Electrical Engineering, 2016.
75	T. Sarto "Mapping of data and methods for temperature assessment in WOW2 export cables", Special project, Technical University of Denmark, Department of Electrical Engineering, 2015.
74	T. Sarto "Investigation of the influence of installation techniques on submarine transmission cables", Special project, Technical University of Denmark, Department of Electrical Engineering, 2015.
73	Martins Paberzs "Decision support tool for array cable installation in offshore wind energy", MSc thesis, AAU, 2015.
72	Gryning, M. P. S., Blanke, M., Andersen, K. H., Wu, Q., & Niemann, H. H. "Offshore Wind Park Control Assessment Methodologies to Assure Robustness.", PhD Thesis, Technical University of Denmark, Department of Electrical Engineering, 2015
71	L. Zeni, "Power system integration of VSC-HVDC connected offshore wind power plants", Ph.D. thesis, Dept. of Wind Energy, DTU, April 2015.
70	K. Kyriakidis, "Detection and active damping of unwanted resonance frequencies by converter modulation control in grid connected wind power plants", MSc Project at Technical University of Denmark, 2015.
69	L. Petersen, F. Kryezi, "Wind Power Plant Control Optimisation with Embedded Application of Wind Turbines and STATCOMs", MSc Project at Aalborg University, Denmark, 2015.
68	E. Ozturk, "Harmonic Handling in Offshore Wind Power Plant DC Collection Grid", MSc Project at Technical University of Denmark, 2015.

Most recent Ph.D., M.Sc. & B.Sc. projects within electrical engineering defined and supervised by DONG Energy Wind Power

137	L. H. Kocewiak, M. Gautschi, L. Zeni, B. Hesselbæk, N. Barberis Negra, T. Stybe Sørensen, B. Blaumeiser, S. Vogelsanger, "Power Quality Improvement of Wind Power Plants by Active Filters Embedded in STATCOMs," in Proc. The 15th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as Transmission Networks for Offshore Wind Farms, Energynautics GmbH, 15-17 November 2016, Vienna, Austria.
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133	M. K. Bakhshizadeh, J. Hjerrild, F. Blaabjerg, L. Kocewiak, C. L. Bak, X. Wang, F. Silva, B. Hesselbæk, "Document: A Numerical Matrix-Based method in Harmonic Studies in Wind Power Plants", in Proc. The 15th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as Transmission Networks for Offshore Wind Farms, Energynautics GmbH, 15-17 November 2016, Vienna, Austria.
132	Asghar Barghandan, Behzad Sedaghat, "Simulation of switching overvoltages of 400 kV shunt reactor", Transformers Magazine, Vol.2, Issue 1, January 2015.
131	H. Hamidi, B. Sedaghat, "Technical and Economical ground electrode design in Various soil and depth in HVDC system by analyzing voltage distribution using FEM", PSC international conference, 2015.
130	Thomas Herskind Olesen, part of working group, Cigre WG A2.48 "Technology and utilisation of oil insulated HV Shunt Reactors" Pondus doc no. <u>2420268</u>
129	S. Ali Hosseini Anaraki, Kalaimani Muthu, Thomas Herskind Olesen, Behzad Sedaghat, "Protection and interlocking design challenges for interconnected offshore windfarm substations" Pondus doc no. <a doc="" farms"="" for="" href="https://example.com/renewed-up-le-le-le-le-le-le-le-le-le-le-le-le-le-</td></tr><tr><td>128</td><td>Behzad Sedaghat, S. Ali Hosseini Anaraki, Thomas Herskind Olesen, " implement="" in="" miss="" mitigation="" no.<br="" numerical="" offshore="" pondus="" relays="" sequential="" to="" tripping="" utilizing="" wind="" zero="">2415764 PAC world conference Ljubljana 2016
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126	H. Brantsæter, Ł. Kocewiak, A. Rygg Ardal, E. Tedeschi, "Passive Filter Design and Offshore Wind Turbine Modelling for System Level Harmonic Studies," in Energy Procedia, Vol. 80, 2 December 2015, p. 401-410.
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TT. Details on Sunfish and Moonfish (Race Bank offshore wind farm)

Overview

Onshore construction for the Race Bank offshore wind project began in early 2015 with the onshore substation and the onshore cable works. The offshore wind farm, which will consist of up to 91 wind turbines, is located almost 17 miles off Blakeney Point on the North Norfolk Coast. Offshore construction began in 2016 and the project is expected to become operational in 2018.

The landfall works required a specific and highly innovative approach to be taken, since the area where the cable reached landfall comprised of a protected Special Area of Conservation (pSAC) saltmarsh habitat. As a result, DONG Energy (DE) developed the site-specific approach together with specialist contractors Mott MacDonald and Jan De Nul.





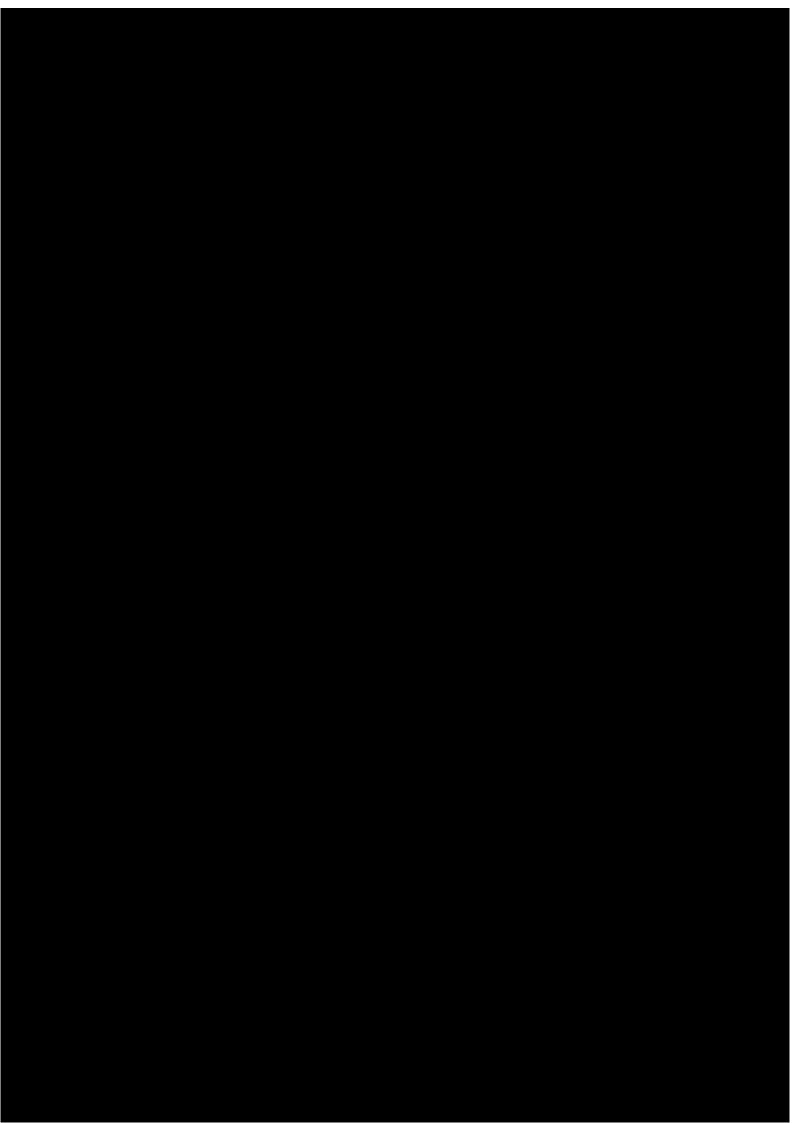
Innovative Approach and Engagement with Suppliers:

- The construction works within the saltmarsh habitat had the potential to cause habitat loss due
 to the direct impacts of the works on the saltmarsh vegetation and the compression of
 sediment which would have further impacts on the ability of the habitat to recover after the
 completion of the works.
- To complete the works across the saltmarsh, DE went out to tender for the complete scope of
 works for the cable installation, with separate "lots". This enabled DE to split the main cable
 works from the intertidal scope to ensure DE had the best contractors for both scopes of
 works.
- Four potential suppliers were shortlisted and were offered an opportunity by DE to undertake
 preliminary engineering works on the solutions that the suppliers had proposed. This new and
 novel approach was taken to allow DE to assess in detail how the solutions would work in the
 saltmarsh habitat and how they would meet the specific environmental considerations of the
 pSAC.
- Jan De Nul was selected as the preferred supplier as they provided the best technical and commercial offer. A major reason for selecting Jan De Nul was their in house technical expertise which is unrivalled within the industry. Once selected and in a very collaborative approach with DE, Jan De Nul began with the technical design of their solution.
- The technical solution not only had to be designed and developed to cope with the specific environmental considerations of the saltmarsh habitat, but also the deep burial requirements of the local port authorities to safe guard the marine traffic in the area.
- Scale models for proof of concept were developed for the various major components (for example the plough and the roller mechanism) to help demonstrate to the authorities that minimal impact would take place on the saltmarsh.

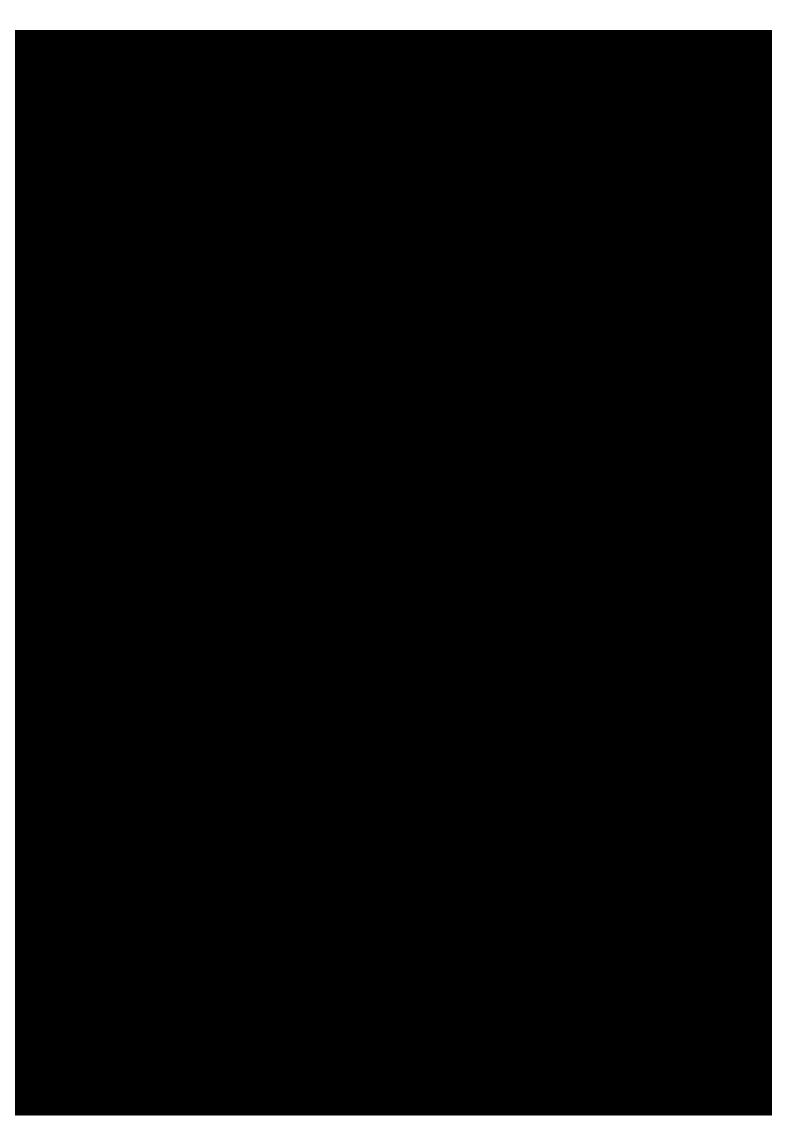
- Extensive field trials of the tools were carried out (lasting 3-4 months) in the UK prior to the tools being mobilised for the works. A variety of key personnel from the Marine Management Organisation and Natural England were invited to witness the trials and to ensure they were involved throughout the design and implementation of the technical solution.
- One particular unique and innovative tool that was developed was the cable roller deployment system. This was able to operate self-laying rollers for the cable pull, then reverse, collecting the rollers back on board automatically while simultaneously burying the cable. This negated the need for numerous vehicle trips and place up to 700 rollers on the delicate saltmarsh.
- Overall, the entire process from tender through to the final works was completely innovative and bespoke for these complex conditions.

UU.Hornsea Two Schools Events

Event	Location	Date
SMart Futures Summer	Immingham	3 rd Oct 2014
SMF (SMart Futures)	SMF South Axholme Academy	16 th Jan 2015
SMF (SMart Futures)	Vale Academy	26 th Feb 2015
SMF (SMart Futures)	Hornsea School and Language College	13 th Feb 2015
UTC – Discover Engineering	Tata Steel	19 th Feb 2015
SMF (SMart Futures)	Holy Family Catholic Academy	12 th March 2015
SMF (SMart Futures)	SMF Franklin College	15 th April 2015
SMF (SMart Futures)	Humberston Academy	25 th March 2015



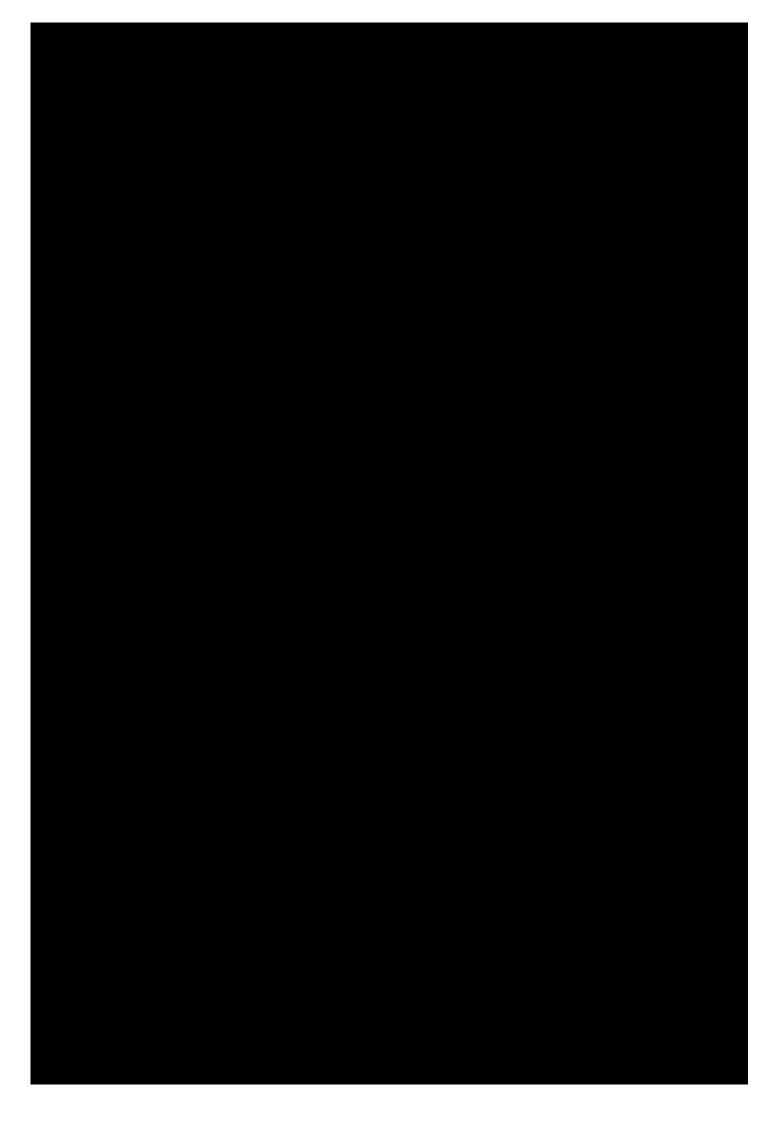


















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ZZ.DE CSR Report 2015

DONG ENERGY IN THE UK

LEADING THE ENERGY TRANSFORMATION February 2016



DONG Energy at a glance Power distribution Gas distribution 0 Leased gas storage facility Heat and power generation* Power generation, gas-fired power station Wind power in operation Wind power under construction DONG Energy office; sale of gas and/or power Marulk Producing oil/gas field. DONG Energy is the licence operator Producing oil/gas field. DONG Energy is a licence partner Oil/gas field under development Gas pipeline owned by DONG Energy Ormen Lange Gas pipeline partly owned by DONG Energy Gas pipeline owned by third parties Oil pipeline owned by DONG Energy * Nine central power stations in Denmark Glenlivet Å Edradour Laggan-Tormore Gothenburg Oselvar 💆 Anholt Siri area Copenhagen Syd Arne Horns Rev 1+2 Walney Extension Gode Wind Walney 1+2 Barrow Westermost Rough \ Hornsea 1 West of Duddon Sands Borkum Riffgrund 1 **Etzel** Hamburg Burbo Bank Extension Race Bank Burbo Bank Gunfleet Sands 1+2 Enecogen Gunfleet Sands Dem



UK Country Chairman Foreword

It has been another landmark year for DONG Energy in the UK. We have celebrated the inauguration of our eighth UK offshore wind farm, Westermost Rough Offshore Wind Farm, a world pioneering project, which has taken our UK installed capacity to over 2GW, providing enough green electricity to power almost 2 million UK homes annually. We have also reached a milestone in our Oil & Gas business with first gas produced from Laggan Tormore in February 2016.

At DONG Energy we believe that green energy must become cheaper than black energy within the next decade. We are working hard to build green, reliable and efficient energy systems in the markets where we operate.

Since 2004, we have invested over £6 billion in the UK through expansion of our offshore wind portfolio, continued development of our oil and gas activities in the West of Shetland region and introduced new flexibility solutions for our business customers. As a company, we are working hard to reduce the cost of electricity from offshore wind by driving down costs at every stage of the process.

At the same time, we are helping to develop a sustainable UK supply chain, through employing local firms and working with our suppliers to invest in new UK facilities, such as MHI Vestas' blade facility on the Isle of Wight, Siemens' Green Port Hull facility and Offshore Structures Britain (OSB) in Teesside, which will supply some of the components for our Burbo Bank Extension and Walney Extension projects.

The UK is a key market for DONG Energy and our decision to take forward a further three offshore wind projects (Hornsea Project One, Race Bank and Walney Extension), in addition to our acquisition of the whole of the Hornsea offshore zone earlier this year, highlights our long-term commitment to 2020 and beyond. In this report you can read about our most notable sustainability efforts in the UK.

Clebluri

Brent Cheshire
UK Country Chairman,
DONG Energy UK

DONG Energy is rapidly expanding in the UK. With fewer than ten employees in 2004, we have grown to almost 700 today. We are the global leaders in the development of offshore wind power and the UK is our largest market. In the UK, we also continue to develop oil and gas resources, provide flexibility solutions to gas and electricity industrial and commercial customers, and are in the process of introducing our new energy from waste technology.

We have an ownership share of 7.5% of all renewable generation installed in the UK and around 43.8% of all the offshore wind farms currently installed in the UK. We have a strong UK presence, with

national headquarters in London and other office locations in Aberdeen, Liverpool, Barrow, Grimsby, Brightlingsea and Ramsgate.

Our group performance 2015

Revenue:

6.9bn



Gross Investments:

1.8bn



Operating Profit (EBITDA*):

1.8bn...



Employees:

6,700



Our Sustainability Strategy

The four priority areas that make up our Sustainability Strategy are:



'Reliable energy'. Maintaining and developing the energy system is the foundation for our business and helps to provide our customers with reliable energy.



'Environmental and climate impact'. When we work to reduce our environmental impact and convert to green energy, we help to preserve the environment and avoid serious climate change.

Further information on our Sustainability Strategy can be found in our "DONG Energy in society – Sustainability report 2015" located on our website: www.dongenergy.com



'People matter'. By advancing the satisfaction, motivation and development of our employees, we are better able to attract and retain talented people.



'Sustainable communities'. When we seek to contribute positively to the societies we are a part of, we help generate the necessary support from our stakeholders.

Reliable energy



How are we renewing the energy supply?

The UK, based on government targets for 2020 and beyond, faces the challenge of ensuring the nation's energy demands are met during its transition to a low-carbon economy.

At DONG Energy we are working to build green, reliable and efficient energy systems in the markets where we operate. We are on course to double our offshore wind capacity by 2020 with three offshore wind projects currently in the construction phase. They include Hornsea Project One which, at 1,200MW, will be capable of meeting the electricity needs of over 1 million UK homes.



Development of offshore wind power

DONG Energy has more than 20 years' experience in the development, construction and operation of offshore wind farms. We have achieved a leading market position in the offshore wind power industry and have developed some of the largest offshore wind farms in Europe.

The UK is DONG Energy's primary market for developing offshore wind and we have secured a strong pipeline of projects, which will enable us to meet our 2020 target.

Reducing the cost of offshore wind

We have set ourselves the ambitious target of reducing the cost of electricity from our offshore wind projects by 35-40% to €100/ MWh, subject to final investment decisions in 2020. We are well on track.

To achieve this objective, we are focusing on three key areas: standardisation of wind farm components, technological innovation and improving efficiency.

The visibility of future projects has given us, and our suppliers, the confidence to invest in and support new technological developments such as larger turbines. In 2013, we worked with Siemens at Gunfleet Sands to trial their new 6MW turbines for the first time offshore. The knowledge gained from this experience enabled us to install the same turbines at our Westermost Rough Offshore Wind Farm (now operational) more efficiently.

DONG Energy continues to be at the forefront of the step-up to next generation 6-8MW turbines, which have been a key driver in recent cost reductions across the sector. We plan to commercially install MHI Vestas 8MW turbines at our Burbo Bank Extension project due to be commissioned in 2017.



By 2020, our target is to have installed 6.5GW of offshore wind. That is enough green power for 16 million Europeans.



Our installed capacity



The installed capacity of DONG Energy's offshore wind farms in the UK have the potential to power almost 2 million UK households for one year. $^{\rm 1}$

Reducing our CO₂ emissions





Our wind farms in the UK are helping to offset UK CO₂ emissions.

The emissions saved by the electricity generated from our offshore wind farms equates to taking 1.8 million cars off UK streets for one whole year.²

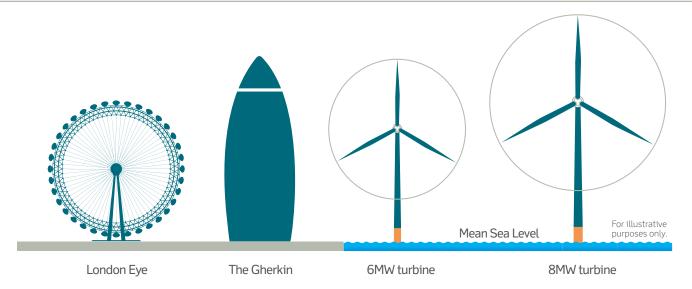
A lower cost



Compared with 2012, we will reduce costs by 35-40% for offshore wind farm projects subject to final investment decisions in 2020.

 $^{^{\}scriptscriptstyle 1}$ We have based this on a load factor of 42% and a household consumption of 4.1MWh per year.

 $^{^2}$ This figure assumes a load factor of 42%, and a CO $_2$ emissions factor of 430g CO $_2$ / kWh and an emissions saving per car of 1909 tons CO $_2$ /year.



Optimising business energy consumption with flexibility solutions

Improving the sustainability and affordability of energy while maintaining security of supply are key parts of the Government's strategy and fundamental for the future success of the UK energy landscape.

Working in partnership with our business customers, DONG Energy develops a range of solutions to help UK businesses to reduce energy consumption, energy costs and carbon emissions. We are also helping customers unlock flexibility in their energy consumption to reduce their costs by optimising when and how they consume energy.

DONG Energy's Power Hub technology optimises a customer's energy consumption and production against a wide array of market signals, as well as the operating constraints of a company's plant assets. Power Hub produces optimum run schedules each day to inform the customer of how best to operate in order to minimise exposure to high energy prices. This provides a tangible, resource-light way for energy professionals to access their flexibility and reduce energy costs. We believe that by using this technology, some customers have the potential to reduce their energy costs by 5-8% per annum.

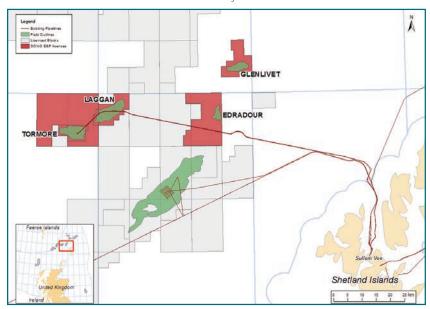
West of Shetland: First gas at Laggan-Tormore

While we build out green energy, DONG Energy understands that oil and gas will be essential for the foreseeable future.

In February 2016, DONG Energy welcomed the commencement of gas production from the Laggan-Tormore fields, which is being developed in partnership with TOTAL as operator and SSE. Laggan-Tormore has been a pioneer project to develop new infrastructure and to secure gas production from this frontier area of the UK Continental Shelf. Work is also

well underway to bring the next generation of fields forward, building on hub potential to deliver long-term value.

Over the past year, significant progress has been made in advancing the Edradour and Glenlivet Projects, which will see these two fields developed as subsea tie-backs to the Laggan-Tormore infrastructure. When on stream, the Edradour and Glenlivet fields will sustain production through the Shetland Gas Plant, maintaining the long-term operation jobs based on Shetland.



Cable length



If all the pipelines and umbilicals to be installed as part of the Laggan-Tormore and Edradour-Glenlivet Projects were laid end-to end, they would cover 1127km, which could span the distance between London and Copenhagen.



How do we minimise our climate and environmental impact?

Energy production and respect for nature must go hand in hand. In the UK, we are helping to reduce CO_2 emissions by building offshore wind farms and investing in new technologies that will produce energy from waste.

However, we are aware that environmental impact is not only about greenhouse gas emissions. To us, it is also about improving energy efficiency, protecting biodiversity and minimising our waste.







REnescience

In recent years, UK recycling performance has improved significantly. However, millions of tonnes of waste are still sent to landfill sites every year. REnescience Northwich is a bioresource management project which will recover resources from waste and generate renewable electricity through treatment with enzymes, mechanical sorting and anaerobic

digestion. The plant will be the first large-scale plant in the world, and will be financed, built and operated by DONG Energy. Expected to be operational in 2017, the plant will have an annual capacity of 120,000 tonnes of waste, which is equivalent to the waste from almost 110,000 UK households.

REnescience is gentler and simpler than many conventional waste processing technologies and has a high recovery rate of biomass and cleaned recyclable materials, which is good for the environment.



Voluntary bird research – Gulls, geese and shearwaters

DONG Energy is working in partnership with leading conservation bodies – British Trust for Ornithology (BTO) and the Wildfowl and Wetlands Trust (WWT) – to learn more about how birds respond to offshore wind farms. As part of our commitment to minimise the impact on the natural environment, DONG Energy has agreed with Natural England and the Marine Management Organisation to fund innovative bird research using GPS tags to record the movement of birds within and around our soon to be built Walney Extension and Burbo Extension offshore wind farms.

The research program proposed by the BTO will look at gulls from the South Walney

breeding colony in Cumbria, and potentially birds nesting in towns such as Barrow outside of the colony, and seek to answer questions about where these birds forage for food, how they use the wind farm areas, their flight speed, flight height and night time flights.

The research program proposed by the WWT will seek to place neck tags on pink-footed geese to better understand the migration routes these birds follow and how they navigate through offshore wind farms. Subject to agreeing project details, these programmes could begin as soon as summer 2016.



Lesser black-backed gull on ground with monitoring tag on its back © Gary Clewley, British Trust for Ornithology.



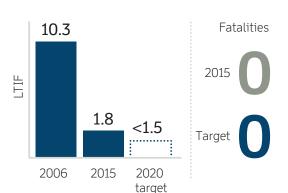


Safety is our licence to operate

Safety is an integral part of our work. Our target is to reduce 'Lost Time Injury Frequency' (LTIF*) to less than 1.5 per million hours worked by 2020, and we are well on track. In 2015, we had an LTIF of 1.8, with two thirds of accidents occuring among contractors.

We are constantly working to increase safety, focusing on three areas: Firstly, we are strengthening our safety culture, including our managers' commitment and ability to be role models for safety. Secondly, we want to improve our collection of the data providing us with the knowledge to be better able to prevent accidents, and lastly, we want to work with our suppliers to ensure a high common safety level.

Fewer accidents



Our target is an LTIF* of less than 1.5 by 2020.

We are on the right track with a continuous reduction of the injury frequency since 2006. In 2015, we had an LTIF of 1.8 with two thirds of accidents among contractors.

An office employees can be proud to work in



In October 2015, DONG Energy's London employees moved office to 5 Howick Place, bringing all of the UK business units together for the first time under the same roof.

Our ambition was to ensure that the office lived up to our wider company ambitions. The contractors' brief was to build an environmentally sustainable office and this was at the heart of all the decisions we made. Just as in Wind Power, we are working hard to increase local content and looked to involve local companies in the process. We also implemented a plan to reduce the volume of waste, by making sure we either rehomed or recycled any furniture that was no longer of use.

Our office move team worked hard to create a sustainable office environment, which employees can be proud to work in and this has been recognised with the office gaining SKA Gold rating.⁴

The DONG Energy Challenge



In 2015, over eighty DONG Energy employees working on our West Coast projects, including members of the Siemens and MHI Vestas teams, competed in a number of sports events as part of the DONG Energy Challenge to improve team work and increase wellbeing.

DONG Energy's forty riders in the Tour De Furness all finished the 50 mile ride. Forty employees attempted either the Coniston to Barrow (23 mile) or Keswick to Barrow (40 mile) walks, and DONG Energy's very own Grant Johnson came in with the winning time of 4 hours and 12 minutes, 2nd best in the event's history. All but one out of twenty three participants completed the gruelling 1 mile Great North Swim.

In total, the events raised over £9000, supporting a number of local charities, as well as The Barrow Rotary Club, St Mary Hospice, Cancer Research and Kidney Research.

^{*&#}x27;Lost Time Injury Frequency' (LTIF) and is the number of accidents resulting in absence of one day or more per million working hours. The figure includes both DONG Energy employees and contractor employees working on sites either owned or operated by DONG.

⁴ An environmental assessment tool for sustainable office fit outs.



How can we be a good corporate citizen within our local communities?

Naturally, when we invest large amounts of money into energy infrastructure, local communities expect these investments to have a positive impact locally.

As a responsible company, we want to ensure that we make a positive contribution to our local communities both in the near and long-term. This not only applies to our own business conduct, but also to the conduct of our business partners.





Sustained Skills Programme

In 2014, anticipating the increasing demand for technicians with industry-specific skills, DONG Energy joined forces with Maersk to give people a head start in offshore wind by offering valuable training and hands-on experience. Six people from the Maersk course had placements with DONG Energy, one of whom is now working full-time at Walney Offshore Wind Farm.

Following on from last year's success, we decided to repeat this support, providing placements to a further six people and covering the cost of accommodation for their twelve week Maersk training course in Newcastle. The six trainees completed placements at a number of our west coast offshore wind farms, including Barrow, Walney and West of Duddon Sands.



A second successful year again for the work placements, a number of whom have already secured employment in the sector following their time with DONG Energy. It's really pleasing to see local talent secure employment.

Adrian Macklin, Head of Walney Operations

Creating skilled jobs across our projects



Between 250-1,000 people are involved in the construction of our projects.

Once complete, the operation and maintenance of each wind project employs between 35-100 people for the 25 year lifespan of the project.

Regeneration of the Grimsby Dock area

In the 19th century, Grimsby Dock was home to a thriving fishing industry, which reached its peak in the early 20th century before abruptly declining in the 1970s and 1980s. As the industry declined, so did the docks and, although some parts of the town's fishing legacy remain, it has left a number of factories and large areas of the docks unused.

After a prolonged period of economic decline, the potential for offshore wind in the North Sea provoked renewed interest in the Humber region. In 2013, DONG Energy arrived in Grimsby, establishing the construction base for our Westermost Rough Offshore Wind Farm at the Fish Docks. Just two years later,

DONG Energy celebrated the inauguration of Westermost Rough Offshore Wind Farm in the newly built Operations & Maintenance (O&M) facility on the Royal Dock, under the shadow of the iconic Grimsby Dock Tower.

Our investments in facilities like the O&M base, which will provide over 100 full-time jobs for the lifetime of the Project (25 years), is helping to fuel local economic growth in the area and this is just the beginning. Today the docks are a hub of activity: most of this is the result of the endeavours of the offshore wind industry, which has found a welcoming home in Grimsby and the locals who support it.

Our investment in the Humber



Over the period 2013 to 2019, DONG Energy is investing £6 billion into our projects in the Humber region. This will on average support 1,600 construction jobs between 2015 and 2020, and up to 500 long-term 0 ± 0.000 onwards.

Working in collaboration with academic institutions to support new research

At DONG Energy, we recognise the importance of investing in students and academic research. We have a strong track-record of collaboration with Durham University at all levels and this year, to celebrate this strengthening partnership, DONG Energy signed a Memorandum of Understanding for further research and collaborative engagement.

Since 2011, we have funded 'top-ups' for Masters Students at Durham (eight Masters Students in Renewables so far), and have provided full sponsorship for one Masters Student at Imperial College per year. Last year a number of students undertook projects in our London E&P office; one on Geoscience and the other in Business Management, and we currently have two full-time employees who have come through our partnerships with Durham University and Imperial College.



Durham Energy Institute

Having the opportunity to engage in a pressing issue for a national energy company in a rare market downturn was an exciting prospect to take on. I chose DONG Energy because I wanted to immerse myself in an environment where I could truly learn and develop my interest in upstream oil and gas from a leading, forward-thinking E&P company.

Charles Miller-Stirling, Previous student at Durham University



Community Benefit Funding

DONG Energy wants to support the local communities near our wind farms. Voluntary Community Benefit Funds make a valuable contribution to local areas by supporting projects such as community building improvements and recreation facilities, conservation and wildlife projects and sporting activities

We have committed to a Community Benefit Fund for both our Burbo Bank Extension Project near Liverpool and Walney Extension Project near Barrow in Furness (both under construction). The funds will be worth up to £225,000 and £650,000 per year over the lifetime of the wind farms (25 years) respectively. Both funds will be managed and reviewed annually by the independent, not for profit funding organisation, Grantscape to ensure they are being used effectively.

For more information on the two funds please visit: www.grantscape.org.uk

For more information on our Local Community Engagement Policy please visit our website: www.dongenergy.com







Liverpool Bay – our precious resource

The Wildlife Trust for Lancashire, Manchester and North Merseyside is a local wildlife charity, working to protect wildlife for the future. They work in partnership with others to actively survey, manage, campaign and protect our land and seascapes.

The trust has been awarded a grant of £20,000, in the first allocation round of the Burbo Bank Community Benefit Fund. This will support one full-time Project Officer, who will deliver a programme of inspirational and engaging marine activities to help raise awareness about the importance of marine life in Liverpool Bay.

Supporting the development of a sustainable UK supply chain

Our UK projects are helping to provide opportunities for UK industry, contributing to sustaining skilled jobs in the manufacturing sector and bringing increased investment to coastal regions.

West of Shetland

Our most recent investments in the West of Shetland region, in the Edradour and Glenlivet developments, are helping to provide opportunities for UK industry and contributing to sustaining skilled jobs in the manufacturing sector.

- The project's subsea control umbilicals, totalling 56km in length, are being manufactured by Technip Umbilicals in Newcastle, England.
- In Invergordon, Scotland, bespoke equipment manufacturer Isleburn is fabricating 535 tonnes of specialist subsea structural assemblies.



Brenig

In January 2015, UK based firm Balfour Beatty were awarded a £12 million contract to develop an onshore substation for our Burbo Bank Extension Project. Balfour Beatty is working in partnership with local North Wales Conwy firm, Brenig Construction, on what is their largest project since their foundation in 2012. The contract, valued at around £3.5 million, includes elements such as the reinforced concrete works associated with the technical substation equipment, drainage and access roads.

JDR Cables

In June 2015, DONG Energy signed a framework agreement with JDR to manufacture array cables, connectors and hang-offs, and provide termination and testing for a minimum of three offshore wind projects, one of which of which is DONG Energy's Race Bank Project, on the East coast.





Offshore Structures Britain

DONG Energy has supported a joint venture of EEW and Bladt (60/40) in the establishment of Offshore Structures Britain. A substantial number of transition pieces for Burbo Bank Extension and Walney Extension Projects will be manufactured in the new upgraded UK facility in Teesside.

Green Port Hull

Our strong pipeline of projects in the Humber have supported investments like Siemens' Green Port Hull wind turbine factory, which is expected to create 1,100 direct new jobs.

Hornsea 1

Race Bank

Array 1



Gunfleet Sands 1+2
Gunfleet Sands Demo
London

MHI Vestas Blade Factory

The blades for Burbo Bank Extension and Walney Extension (50%) will be sourced from the MHI Vestas facility on the Isle of Wight.



AAA. Hornsea Two UTC Presentations and Hornsea Two Educational Presentations



Delivering a New Energy

SMart Wind The Hornsea Zone

Presentation to Franklin College

15th April 2015

smartwind.co.uk

SMart Wind Ltd. is a joint venture between Mainstream Renewable Power and Siemens Project Ventures GmbH

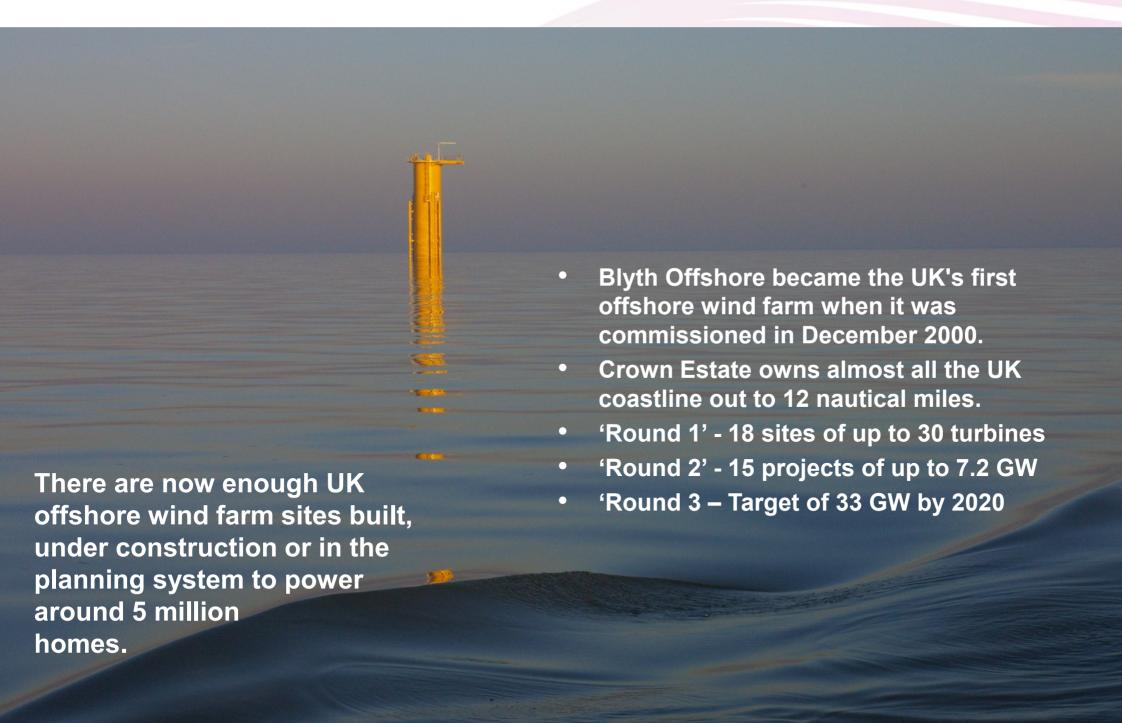


Introduction





Brief History of Offshore Wind in the UK





Hornsea Zone - Project One & Two



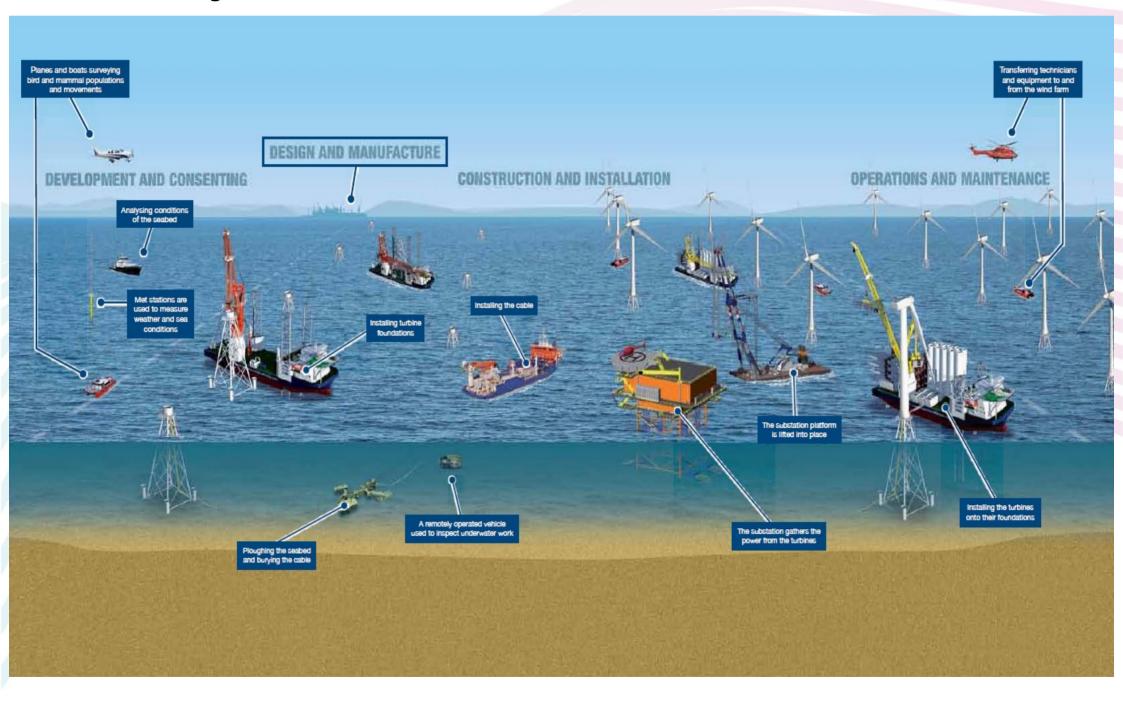
800,000 homes

Project
Two Even

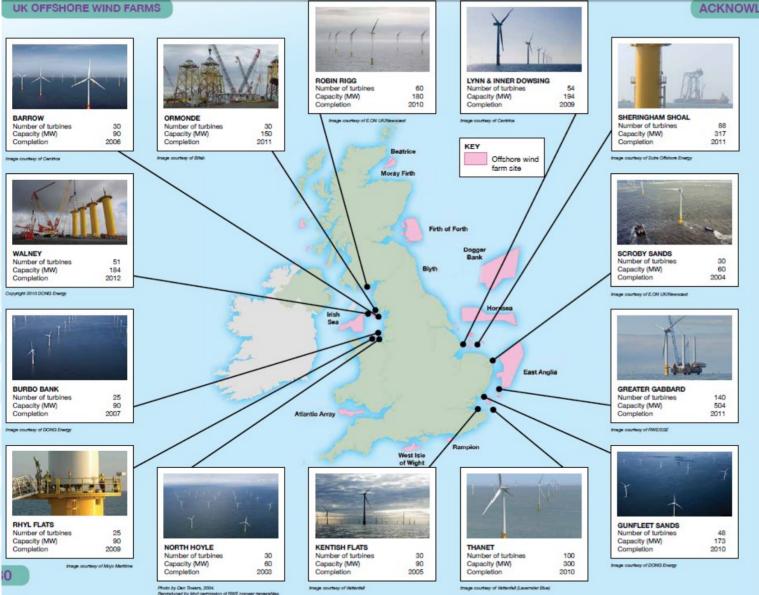
SMart Bigger
Wind



Life Cycle of an Offshore Wind Farm



Other Offshore Wind Farm Projects









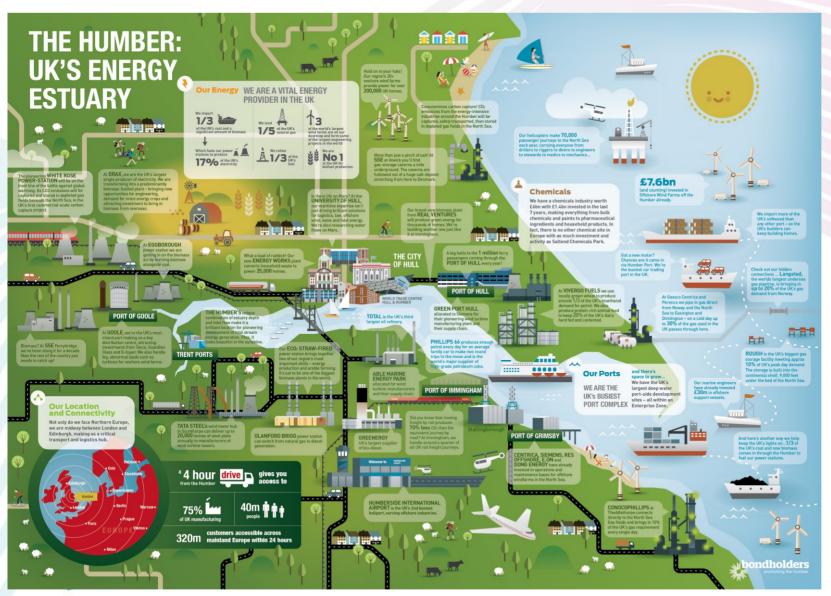








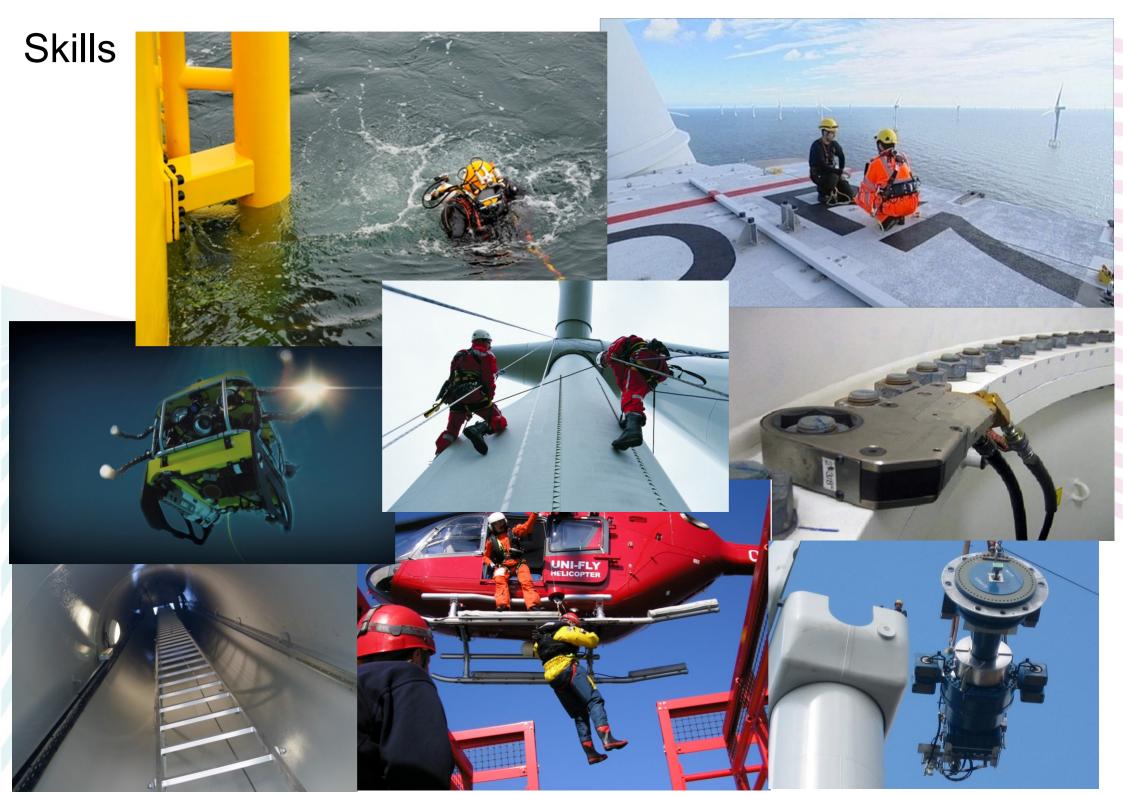
Opportunities in The Energy Estuary

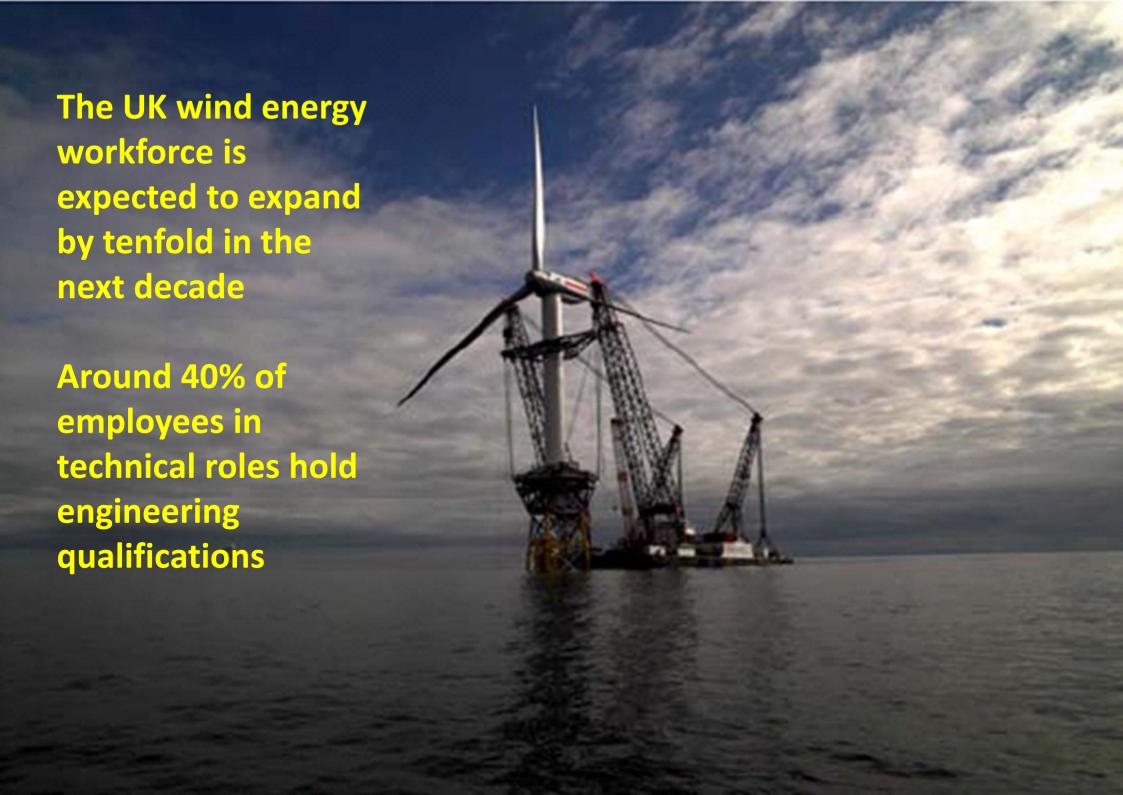












We need you!











What kind of qualifications do I need?

Craft and technician careers: Are you good with your hands? If so, you may want to focus on the craft and technician careers. With suitable GCSEs or equivalent, you can start training at a further education college, at a firm's training school or on the job as an apprenticeship or working towards NVQs.

Graduate careers: Do you enjoy your studies and want to do a degree before you find a job? Many of the professional positions in companies will require you to hold a graduate or even a postgraduate qualification. Core STEM degrees are respected by companies. Many universities offer renewable energy related modules and specialist qualifications.

What kind of working environment am I after?

Looking for adventures off the coast?

If you have the ambition to work at sea, there are many roles for you. It is an exciting environment and you will need good sea legs and be prepared to face the wind, waves and rough weather. Fitness and stamina will be important, especially in the more vocational roles, and working in extreme conditions means that being responsible and safety conscious are crucial parts of the job.

Working in offshore wind energy while keeping your feet dry...

Success offshore comes from doing as much as possible onshore – every activity completed on land saves time and money. This means that there are opportunities to work in the industry even if working at sea does not appeal. Manufacturing and operations sites are usually at ports, while much of the planning, management, R&D and engineering design can be anywhere.

Environmental Skills required for Offshore Wind?

Oceanographers **Statisticians** Metocean specialists

Planning / Legal Support **International Law** PR / Communications **Environmental Impact Assessors** Marine Geologists Marine Biologists Ornithology & Marine Mammals Surveyors Archaeologists **Acoustic Experts** Navigation Experts – Master Mariners Aviation Experts / Pilots

Ecologists Economists

Traffic & Transport Computer Graphics / Modellers

Health & Safety

IT / Data Management / GIS Operatives **Logistics Operations**

Any Questions?

Email: Sophie.hartfield@mainstreamrp.com

www.smartwind.co.uk



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BBB. DONG Energy and Teach First Partnership (prepared by Teach First)

TEACH FIRST & DONG ENERGY PARTNERSHIP

Across the term of the partnership, Teach First will report on the impact of our charitable work in a number of specified geographic areas, in relation to a number of agreed objectives. This appendix provides an overview of the key areas of impact, and the goals we will aim to achieve, with the support of DONG Energy over the next three years. This will be reviewed on an annual basis, with targets being reviewed, amended or added as appropriate.

Executive Summary

Teach First is committed to changing educational outcomes for children from low-income backgrounds across England and Wales. Over the coming years, we are placing particular focus on educational 'cold spots', often found in isolated and coastal areas.

Cold spots face particular challenges around teacher attraction and retention and significant differences in attainment and progression among the poorest children compared to other areas of England and Wales.

Grimsby, Hull and Merseyside are three such areas, where pupils - many of whom are from deprived backgrounds - leave school without the skills, qualifications and inspiration to access the growing number of job opportunities in their hometowns. These areas are the focus of an exciting new partnership between Teach First and DONG Energy, the UK's leading offshore wind company, who are committing to large-scale economic investment and growth in their local community.

DONG Energy are working with Teach First to transform the skills landscape, particularly in relation to STEM, by working with Teach First to support, develop and retain leaders in classrooms in three educational 'cold spots': Grimsby, Hull and Merseyside.

Over the next three years, we will support classroom leaders in the following ways:

Invest more teaching talent in Grimsby, Hull and Merseyside

• Teach First will aim to increase the number of participants working in eligible schools in these areas, and will also aim to increase the number of STEM teachers in these areas – for example, in Merseyside, we will aim to grow the number of teachers by up to 50% in 2017/18. DONG Energy will aim to support these leaders to deepen their impact in the classroom through coaching and offering summer internships, enabling teachers to gain new skills and knowledge to bring back to the classroom.

Retain excellent teaching and leadership in classrooms in these key areas

DONG Energy and Teach First will work together to retain alumni of the Teach First programme, known as
ambassadors, in Hull and Grimsby, and to attract ambassadors from the Teach First programme to teach key
subjects, such as STEM, in these areas. Ambassadors have completed the two year Leadership Development
Programme (LDP) and continue to support Teach First's mission through their roles in the classroom and
beyond. DONG Energy will also support Teach First to develop these ambassadors' leadership capabilities to
deepen the impact of their teaching and to help them progress to middle and senior leadership positions
within schools.

Help young people to gain the skills and aspiration they need to make informed decisions about their future and engage in the changing local employment landscape

• Through hosting employability workshops called The Workplace and work experience days with pupils from local schools, Teach First and DONG Energy will work together to educate pupils on the changing employment landscape in their local areas, and in particular to improve awareness of careers within the offshore wind industry. By working together, we aim to help pupils to gain the skills and the confidence needed to access these opportunities. Teach First will aim to increase the number of pupils involved in our Futures access programme and will leverage support from DONG Energy employees to mentor pupils to help them make informed choices about their futures.

Participant Impact: Invest more teaching talent in Grimsby, Hull and Merseyside

Teach First recruits, trains and places teachers in schools serving low-income communities. These participants on our LDP work directly with pupils to transform their educational outcomes, ultimately helping Teach First's mission to end educational inequality on a national scale.

DONG Energy will support our participants in Hull, Grimsby and Liverpool through a range of vital interventions to deepen their impact on local pupils by:

- hosting summer projects, enabling participants to gain vital experience from the world of work to bring back to the classroom
- encouraging staff to volunteer and coach participants, becoming a vital pillar of support to those on the Leadership Development Programme

DONG Energy will aim to offer opportunities for pupils in participant's classrooms to join Workplace employability workshops, helping them to gain practical experience of the world of work, get advice on future jobs and the skills and qualifications needed and information about the variety of routes to work, such as apprenticeships and degree qualifications, in the offshore wind industry.

How will we do this?

Teach First will aim to attract and place growing numbers of teachers in areas of strategic priority.

In Merseyside we will:

- aim to grow the number of participants teaching in Merseyside by up to 50% in 2017/18
- 50% of all teachers placed in Merseyside to come from STEM subjects
- By 2018, we will aim to have placed an additional 50 teachers across Merseyside, specifically in priority areas such as Knowsley

In Hull and Grimsby, we will:

- Aim to place our first primary participants in the city in 2017, working with Kelvin Hall (Outstanding secondary) to place in their feeder primaries as part of their Cooperative Learning Trust
- aim to place 25% of the 2017 Yorkshire and Humber cohort in coastal areas, with an intention for 20% of these to be placed in Grimsby and Hull, depending on local context and school demand
- Aim to grow the number of participants teaching in Grimsby and Hull in Yorkshire and Humber by 35% in 2017
- aim to increase participants teaching STEM subjects in schools in Grimsby and Hull in our Yorkshire and Humber region by 30% in 2017, depending on recruitment and school demand
- By 2018, we will aim to have placed an additional 50 participants into schools in Grimsby and Hull

Should these targets be achieved, we aim to reach over 14,000 pupils through our participants by 2018.

How will we measure this success?

Across a three year partnership, Teach First would be able to measure the impact of its intervention in communities in Grimsby, Hull and Liverpool, driven by DONG's support.

At the beginning of the partnership, we could define each geographic area and create a baseline dataset against which we could measure impact over three years. This baseline would look at a range of metrics in current Teach First partner schools, Teach First eligible schools and non-eligible schools in each area to set the context of educational disadvantage in the area.

Over the course of the partnership, Teach First could monitor these key metrics, including the gap in attainment at GCSE between free school meal (FSM) pupils and non FSM pupil, Progress 8¹ and Attainment 8². At a classroom level, we would also look at pupil impact via pupil surveys and trackers carried out by our teachers.

Quantitative data would be supported by qualitative case studies from the local area, outlining the role Teach First participants and ambassadors are playing within schools and the challenges faced by pupils in the area.

¹ The Progress 8 will measure pupils' progress across 8 subjects from age 11 to 16.

² Attainment 8 measures a student's average grade across eight subjects - the same subjects that count for Progress 8

Teach First will report on an annual basis, outlining progress in these metrics against the baseline measurement and the changing educational landscape in each geographic area.

Pupil Impact

To measure pupil impact, we would anticipate using a number of tools: the annual Teach First participant survey, the Pupil Progress Tracker (PPT) and the iKnow my Class survey. The performance of Teach First will be monitored through the success of participants on the LDP.

The PPT is an online tool that helps participants to measure the academic progress of pupils. All participants on the LDP are asked to use the tool with their focus class, the class which participants feel will benefit most from increase focus and dedicated support from their Leadership Development Officer (LDO). LDOs are qualified teachers who provide crucial coaching and advice to participants. The LDO role is something that sets our LDP apart from other routes into teaching, and we're currently recruiting new people to support our growing group of participants

Primary participants focus on a subject area instead of a class. The PPT is used for pupils at Key Stage 1 and above. First year participants enter data at the start and end of the academic year. Second year participants enter data at the end of autumn, spring terms and the start and end of the academic year.

iKnow My Class survey is a survey for pupils, consisting of 2550 questions which measure motivations and aspiration. Teach First reports on pupils who 'agree' or 'strongly agree'.

Surveying pupils about their teachers and classroom experiences was identified by the Gates' Foundation's Measuring Effective study as one of three types of measure that give the most accurate reading of a teacher's effectiveness. With over 22,800 baseline pupil responses, the survey is the largest of its kind in England. Both Year 1 and 2 participants are asked to use the iKnow My Class survey with their focus class during the first autumn halfterm and summer term. Participants have the option of collecting data at each half term across the year.

These tools will be used to measure the impact of STEM participants on the LDP and the success of the wider cohort. Beyond the scope of this grant, Teach First has a comprehensive set of metrics to measure and report on the success of the LDP and its impact in the UK. These metrics use the tools listed above to ensure the organisation is meeting targeted KPIs.

The table below provides an overview of indicative metrics that we could monitor across the partnership.

Metric	2014/15 Baseline	Target 2016/17
	Questions	Data available Dec 2017
The % Summer Institute starters gain QTS grade 2 or higher	89%	91%

	Note: of those that completed QTS, 99% achieved grade 1 or 2	Note: We have a target of 100% of participants gaining QTS gaining a 1 or 2 and a target of 91% of SI starters completing QTS
% pupils in a focus class taught by a STEM Teach First participant in Grimsby, Hull or Merseyside agree or strongly agree that their teacher inspires them to do their best, measured by the Teach First iKnowMyClass survey % pupils in a focus class taught by a STEM Teach First participant in Grimsby, Hull or Merseyside will agree or strongly agree that what they are learning is important for their future, measured by the Teach First iKnowMyClass survey % pupils in a focus class taught by a STEM Teach First participant agree or strongly agree that they put forth their best effort in class, measured by the Teach First iKnowMyClass survey	Following baseline results relate to the 2014/15 EoY results for all secondary participants across England and Wales: 1) Inspired me – 74% 2) Learning is important – 75% 3) Best effort – 77%	No target for 16/17 Baseline for STEM pps in these area available in January 2017 EoY available in December 2017
Teach First Participants in Hull, Grimsby and Merseyside achieve their pupil impact measure	68% - this refers to the proportion of our participants' classes where the pupils are performing above national expected progress at EoY 15/16. Note: We don't currently cut this data by participant location so will begin this in order to report on this metric next year	No target for 16/17 EoY results available in December 2017

Ambassador Impact: Retain excellent teaching and leadership in classrooms in these key areas

By 2019 we will have approximately 10,000 ambassadors working in schools, policy, social enterprises, business and beyond. Our ambassadors have the potential to be an even more powerful force for change than they have been to date. We will better develop and prepare our participants to meet the expectations we have of them as ambassadors, help connect them to each other, showcase their work and mobilise ambassadors to take action, supporting development in their roles.

A recent study³ has shown that teachers recruited and developed through Teach First are:

- Seven times more likely to be in senior school leadership positions
- Taking on more additional responsibilities and middle leadership positions, demonstrated by them earning, on average, £3,000 and £6,000 more by years 3 and 5 in teaching, respectively
- Three times more likely to be teaching in schools serving low income communities three years after starting to teach
- Working in schools in challenging circumstances; the majority teach in schools rated by Ofsted as Requires Improvement or Unsatisfactory.

Teach First now has nearly a thousand middle and senior leaders working across schools. Schools' confidence in progressing Teach First teachers to leadership roles, and their continued focus working in low-income areas, demonstrates the commitment of the community to tackling educational inequality and their passion for this work.

DONG Energy will support Teach First's work with our ambassadors by:

- Coaching ambassadors who are involved in the schools career pathway and are participating in the Teach First Coaching programme
- Acting as a strategic partner to our Yorkshire and Humber team to advise on a specific ambassador attraction and retention projects in Hull and Grimsby
- aiming to offer opportunities for pupils in ambassador schools to join Workplace employability workshops, helping them to gain practical experience of the world of work, learn vital employability skills and get information about the variety of routes to work, such as apprenticeships and degree qualifications, in the offshore wind industry.
- Engaging with ambassadors through key events across the term of the partnership (dates and events tbc)

How will we do this?

Despite this national progress of ambassadors, Hull and Grimsby face particular challenges in retaining and attracting ambassadors from the Leadership Development Programme. With the support of DONG Energy, a high-profile business with a strong long presence, DONG Energy will support Teach First to retain and attract more ambassadors to work in leadership positions in schools in Grimsby and Hull.

Teach First are also supporting ambassadors in places like Hull, Grimsby and Liverpool through our Careers Pathways programme. Career Pathways are programmes of training and support designed to help ambassadors have even more impact in schools and to help them take their teaching to the next level or progress into school leadership.

³ https://www.teachfirst.org.uk/press/new-research-reveals-teach-first%E2%80%99s-success-developing-leaders-challenging-schools

Challenge the Impossible

2017 marks Teach First's 15th anniversary of working to make education fairer in the UK. It also is the mid-way point between establishing the Fair Education Impact Goals in 2012, and meeting them in 2022.

To mark this year we are embarking on a yearlong campaign to mobilise our networks of teachers, businesses, policy makers and crucially our ambassador community, and work towards closing the education achievement gap.

As part of this year, there will be a series of events and activities that look to engage our networks. The details will be confirmed and shared as soon as possible.

Ambassador retention and attraction project in Hull/Grimsby

The Yorkshire and Humber region are working to build a critical mass of Teach First participants in our coastal areas in the region, particularly around Hull. To achieve this, they are developing a "unique Hull offer" to coincide with Hull City of Culture 2017 to attract and retain ambassadors in Hull. Through this project, Teach First will:

- work with the Education Manager for Hull City of Culture 2017 to develop a plan for participants and ambassadors to contribute to the City of Culture education plans for 2017,
- work with Hull headteachers to develop a unique Hull retention package to attract and retain ambassadors during 2017
- Work with local estate agents and builders to market Hull housing as part of the benefits package

DONG Energy will aim to act as a strategic partner to our Yorkshire and Humber team to support the development of our retention package. DONG Energy would play an advisory role in this project who could support by:

- sharing insights and learnings from recruitment and/or relocation to Grimsby and Hull to support Teach First in developing an attractive narrative and offer to encourage participants placed in the local area to remain as ambassadors, and attract ambassadors from other local areas
- supporting Teach First to strengthen its local networks to support participants and ambassadors to become embedded in the local community
- supporting Teach First to understand local ambassador development requests and helping with these where possible by for example, sharing non-sector specific development opportunities, facilitating networking opportunities or enabling skills development through shadowing line managers within the business
- showcasing the business community's economic and social commitment to Hull and Grimsby through attending events across the partnership.

One such event is the annual Springboard event, marking a participant's completion of the LDP and the beginning of their role as an ambassador. By supporting this event, which enables participants to reflect about their experience on the LDP and make a commitment to the Teach First mission going forward,

DONG Energy may be able to showcase its own commitment to the Teach First and the local area, and outlining some of the support available to ambassadors through its programme of support.

School Career Pathway

The School Career Pathway is a programme of training and support designed to help our ambassadors have even more impact in their existing roles, or explore new career possibilities.

The School Career Pathway is open to all ambassadors either in teaching or who are considering a return to teaching. It's designed to help ambassadors take their teaching to the next level, or take the next step in their school leadership journey.

How will we measure this success?

We anticipate setting yearly targets in terms of ambassador attraction and retention, and the number of teachers from these areas entering leadership positions and participating on the schools pathway programme.

In 2017, we aim to attract or retain 12 ambassadors in Hull and Grimsby, with the intention of increasing this target beyond 2017.

The target for number of Merseyside ambassadors recruited onto our Schools Pathways programme to be agreed in Summer 2017. This target will be dependent on 2015 cohort retention in the area.

The impact of the ambassadors will be monitored through the improved educational outcomes in the local area, as noted above for participant impact.

In March 2016, evaluation of our coaching programme showed that 76% of coachees felt coaching was most helpful in developing their leadership in the classroom. In 2018, we aim to meet and/or exceed this target.

Access: Help young people to gain the skills and aspiration they need to make informed decisions about their future and engage in the changing local employment landscape

Our access work aims to help Teach First achieve our vision of more young people in the schools we work to make informed choices about their futures, for example attending universities, including the most selective universities. We will work with these pupils to support them to gain access to university so that they can break the link between low socioeconomic background and poor educational attainment.

How will we do this?

- Expand Futures to more local areas and grow in existing areas and scale up Oxbridge support
- Integrate Access training into our Initial Teacher Training (ITT) for participants and ambassadors

How will we measure this success?

We will measure the success of our work around access through the support and training we provide to participants and through participant in our Futures programme.

Throughout the two-year LDP, participants will access a series of high quality learning opportunities that are designed to meet their development needs and achieve our vision of ending educational inequality in the classroom and beyond. These will take place in a range of contexts such as university development days, leadership development conferences, peer learning networks, interactions with colleagues, inschool Continuing Professional Development (CPD) and mentoring, online learning, self-reflection and study.

Access training is delivered through leadership development conferences which take place across the year. Participants are required to attend a minimum of two conference days in their first year.

- Achieve a 66.6% attendance rate at each conference day including access training in the North West in 2016/17
- Achieve an attendance rate of 200 participants at each conference day including access training in Yorkshire and the Humber in 2016/17

The Futures programme is currently reviewing its eligibility criteria, and will be setting targets for our next cohort recruitment, cohort 11, in late 2016.

We current partner with:

- four schools in Merseyside, with 14 students on the Futures programme
- one school in Grimsby, with 3 students on the Futures programme
- one school in Hull, with 11 students on the Futures programme

With DONG Energy's support, we aim to grow the scale of the Futures programme in these three areas. DONG Energy's support will help Teach First to overcome logistical challenges faced by students in the isolated and coastal communities.

KEY METRICS

Teach First is committed to working towards the measurements below, but the following metrics are indicative and may be influenced by factors beyond Teach First's control, including (and not limited to) school demand for teachers and subject-specific demand, school environment and changing training conditions, and graduate recruitment market. Teach First will also only place participants on the Leadership Development Programme in eligible schools.

Teach First will:

- Achieve a 66.6% attendance rate at each conference day including access training in the North West in 2016/17
- Achieve attendance rate of 200 participants at each conference day including access training in Yorkshire and the Humber in 2016/17
- In March 2016, evaluation of our coaching programme showed that 76% of coachees felt coaching was most helpful in developing their leadership in the classroom. In 2018, we aim to meet and/or exceed this target.
- With DONG Energy's support, we aim to grow the scale of the Futures programme in these three areas [Grimsby/Hull/Merseyside], dependent on school demand.

In Merseyside, we will:

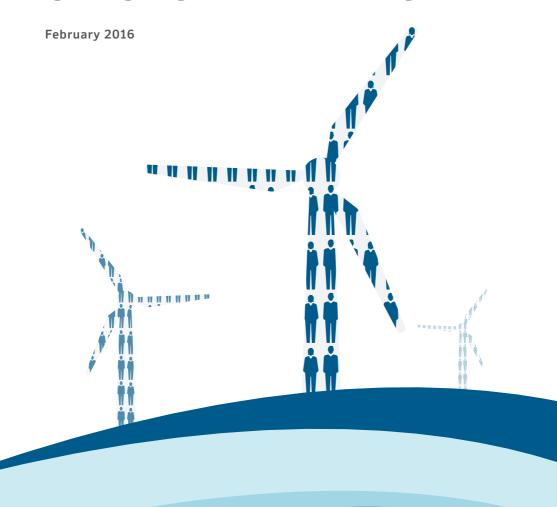
- aim to grow the number of participants teaching in Merseyside by up to 50% in 2017/18
- 50% of all teachers placed in Merseyside to come from STEM subjects
- By 2018, we will aim to have placed an additional 50 teachers across Merseyside, specifically in priority areas such as Knowsley
- The target for number of Merseyside ambassadors recruited onto our Schools Pathways programme to be agreed in Summer 2017. This target will be dependent on 2015 cohort retention in the area.

In Grimsby and Hull, we will:

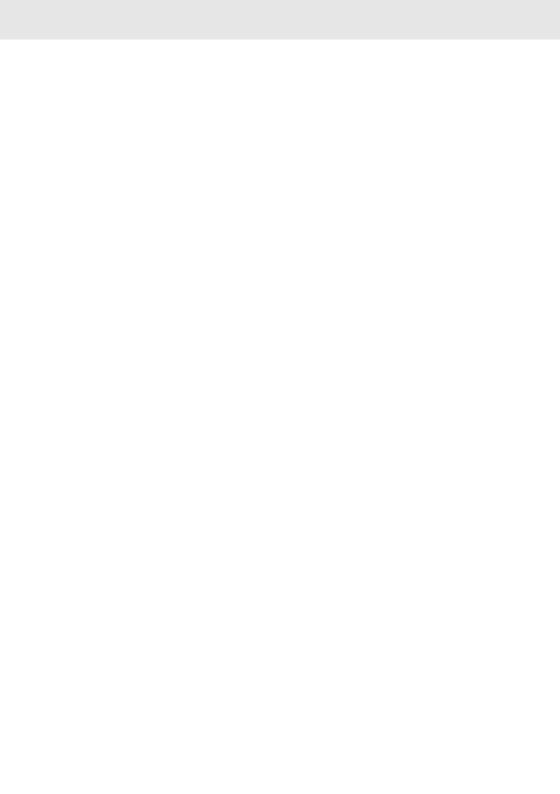
- Aim to place our first primary participants in the city in 2017, working with Kelvin Hall (Outstanding secondary) to place in their feeder primaries as part of their Cooperative Learning Trust
- aim to place 25% of the 2017 Yorkshire and Humber cohort in coastal areas, with an intention for 20% of these to be placed in Grimsby and Hull, depending on local context and school demand
- Aim to grow the number of participants teaching in Grimsby and Hull in Yorkshire and Humber by 35% in 2017
- aim to increase participants teaching STEM subjects in schools in Grimsby and Hull in our Yorkshire and Humber region by 30% in 2017, dependent on recruitment and school demand
- By 2018, we will aim to have placed an additional 50 participants into schools in Grimsby and Hull
- In 2017, we aim to attract or retain 12 ambassadors in Hull and Grimsby, with the intention of increasing this target beyond 2017.

CCC. Routes in Leaflet

THE PEOPLE BEHIND OFFSHORE WIND POWER







Introduction

This booklet will provide you with a brief introduction to the offshore sector and the types of roles involved in the construction and operations and maintenance (O&M) of an offshore wind farm.

For each phase, we have provided real life examples of people working on our projects and operational wind farms across the UK. Hear from the people behind offshore wind power, as they describe their role and daily activities, their previous experience and some of the qualifications they have gained to work in that role.

We hope you find this guide useful and that it helps to inform your future career choices. Hopefully you will see that there are a wide variety of roles available and that there is no single route into the sector.

About DONG Energy

DONG Energy is headquartered in Denmark and is the world leader in developing, building and operating offshore wind farms. We have been market leaders since we built the first offshore wind farm Vindeby, in Denmark, in 1991 and now we have offshore wind farms in the UK and Germany. Our largest offshore wind fleet is now situated in the UK. As well as being the market leader in offshore wind, we invest in the exploration of oil and gas, along with selling gas and electricity to our industrial and commercial customers. We are also investing in new technologies which convert household waste into energy.

Investing in the UK



We are investing heavily within the UK with a total of

£6 billion invested to date.





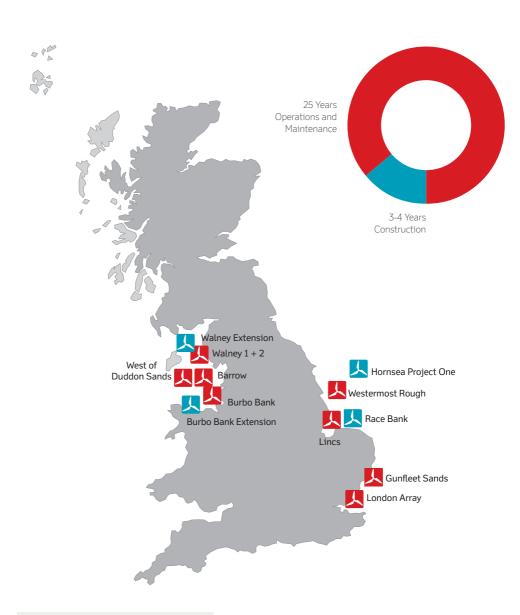
We are investing in people, growing our business with almost

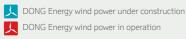
700 direct employees



We are creating long term operation and maintenance jobs in areas near our projects, including the Humber, Barrow, Brightlingsea, Ramsgate and Liverpool.

DONG Energy wind farms in the UK

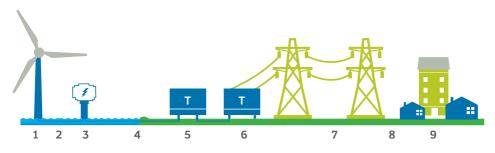




Building an offshore wind farm

What makes up an offshore wind farm?

There are several components that make up an offshore wind farm. Electricity generated at the offshore turbines travels through underwater cables via an offshore substation towards shore. Once it reaches the onshore substation it is converted to the correct voltage, ready to be transmitted to the electricity network.



- T = Transformer
- 1. **Wind turbine** Electricity is produced as the wind turns the rotor blades, which then turns a shaft containing magnets inside loops of copper wires.
- 2. Array cables These cables link the turbines to one another and to the offshore substation.
- **3. Offshore substation** Converts electricity to a higher voltage so less energy is lost as it transmits to shore.
- **4. Export cables** These cables connect the offshore substation to the onshore substation.
- 5. **Project specific onshore substation** Connects the electricity supplied from the offshore wind farm to the national grid.
- **6. National Grid onshore substation** Converts the electricity to the voltage of the onshore transmission network.
- Transmission Transmission lines carry electricity at high voltages over long distances from power plants to communities.
- 8. **Distribution** Electricity from transmission lines is reduced to lower voltages at a substation prior to distribution to communities.
- 9. Homes

Constructing an offshore wind farm



The construction phase of an offshore wind project can typically last between

3-4 vears



250 - 1,000 people are involved in the construction of our projects. 1



An array of professionals are needed to design the wind farm, construct the

substation, cable routes and erect the final

out at sea.



Construction roles vary from local construction specialist

that come from around the world.



There are over 100 different roles

involved, from operations planning coordinators who manage and coordinate offshore logistics and personnel, to electrical engineers who design and verify electrical connections to the grid, to commercial managers who manage the agreements with local landowners



Specialist DONG Energy staff design and oversee the building of each wind farm. We also use a range of contractors who

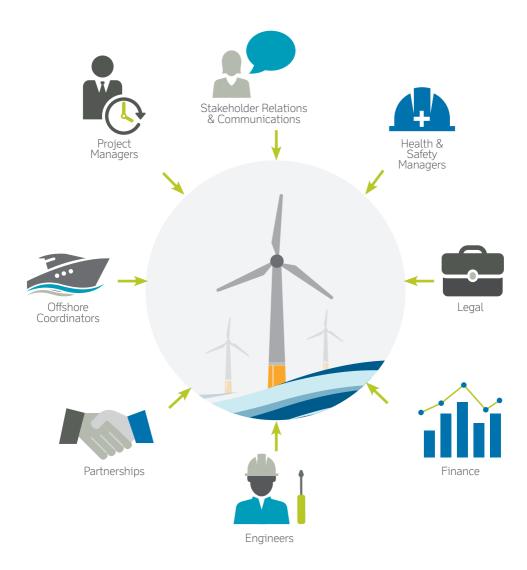
things like the onshore substation and the operation and maintenance facilities.

We'll now consider the different jobs associated with building an offshore wind farm.

¹This includes contractors.

Meet the team

Here are some of the DONG Energy roles and teams who help to build our wind farms.



We will now meet some of the people who work on our projects.



Jason Ledden Construction Project Manager

Race Bank Project 🙏



My job is to manage and coordinate all of the construction and related activities in the Construction Design Management (CDM) area with a high focus on safety, quality and the programme deliverables. I am responsible for a number of tasks including coordinating and managing the other package project managers², updating and monitoring the budget and time schedule, identifying project risks, managing contracts and maintaining relations with contractors and suppliers.

Previous employment

- Roval Marines
- Civil Engineering Diver
- Saturation Diver (closed bell)
- Diving coordinator (Wind farm construction)
- HSE package lead (Cable installation)
- Offshore facilities manager
- Deputy construction project manager

Oualifications

- HSE Commercial diver, Parts:4,3,2&1
- IMCA diver Medic
- IMCA Diving supervisor
- NVQ Level 5 Occupational health and safety practice
- NEBOSH General Certificate
- IOSH Graduate Member

What makes your job unique?

"The day to day challenges of running and coordinating a major offshore construction site with a high performance team means no two days are ever quite the same."

Steven Nicholson Health, Safety & Environmental Engineer

Race Bank Project 🙏



I am responsible for supporting the project in all matters relating to Health, Safety and Environment. This involves liaising with contractors to ensure statutory compliance and monitoring all construction activities.



Previous employment

- Offshore Rigging Supervisor at Subsea 7
- Business Owner Fabrication/Machinery Moving/Steel Erection
- Offshore Rigging Supervisor/HSE Coach at Subsea 7
- HSE Advisor at Siemens Wind Power
- HSE Engineer on the Westermost Rough Project at DONG Energy

Oualifications

- NVO Level 4 Diploma in Occupational Safety and Health
- NEBOSH General Certificate
- IOSH Graduate Member

What makes your job unique?

"Every day is different, every day is a learning day."

² Project packages include components such as foundations, onshore and offshore substations, cables and turbines.



Rebecca Goff Marine Manager

Race Bank Project 👢



As the Marine Manager for the Race Bank Project, I am in charge of coordinating the movement of people and equipment from the onshore base to the offshore site and within the offshore construction zone. I monitor all the project traffic between local ports ensuring safe operations at all times and that everyone is medically fit and has the correct training.

Previous employment

- Vessel Master at Seacat Services
- Super-Yacht crew on vessels up to 45m

Oualifications

- BA (Hons) Business Studies; University of Liverpool
- Commercial background in Marketing and PR following on from degree

- Maritime qualifications:
- Master 200gt CoC (MCA) / OOW Deck 500at
- GMDSS GOC
- MCA Approved Engine Course
- STCW 95 Basic Training
- ENG 1 Medical Fitness Certificate

What makes your job unique?

"The job is fantastic and unique due to the variety of work scope. Every day offers different challenges and requires thinking outside the box - there is never a dull moment. You are working with an energetic range of people each with their own interesting background. It is great to be working in the construction stage where you can see the results as the project moves forward."

Jessica Westcott Offshore Foundation Installation Manager

Race Bank Project 🙏



As an Offshore Foundation Installation Manager, I am responsible for the transport and installation of the Wind Turbine Generator (WTG) foundations. I oversee our main contractor and the large boats that are used to install the foundations.



Previous employment

- Project Superintendent for Dredging and Offshore projects at Van Oord
- Project Engineer and Operations in Offshore Wind Projects at Van Oord

Oualifications

- BSc Geology with Oceanography; Southampton University
- MSc Coastal Engineering and Environmental Studies; Southampton University

What makes your job unique?

"The dynamic offshore environment and numerous technical interfaces, coupled with the cohesive nature of the project execution team, makes my job both challenging and highly fulfilling."



Michael Schmidt Nielsen Graduate Engineer Burbo Bank Extension Project

I am on the Graduate Scheme working as an Interface Manager for the Burbo Bank Extension onshore substation. I am responsible for overseeing the installation of the low voltage system and the cable schedule at our onshore substation, making sure we meet National Grid's standards of high power quality.

Previous employment

- Work experience as an Electrician
- Electrician education from 2004-2008

Oualifications

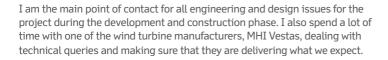
 MSc Electrical Engineering with specialization in Electric Energy Systems; Technical University of Denmark (DTU)

- BSc Exchange in Singapore Nanyang Technological University (NTU)
- BSc Electrical Engineering; Technical University of Denmark (DTU)

What makes your job unique?

"My job is unique because I help in ensuring a sustainable future for the next generation."

Edward Ridgway Technical Project Manager (Contractor)Walney Extension Project





Previous employment

- Engineer, then project manager at Pelamis Wave Power – Start-up Company making a device to harness wave energy
- Technical Project / Sales Manager at Siemens Wind Power

 Engineering technician at Edinburgh Designs

Oualifications

 BSc Mechanical Engineering; University of Edinburgh

What makes your job unique?

"We are doing things that haven't been done before, and meeting challenges that even 10 years ago we were not sure we could solve. These wind farms will be working for the next 25 years which is an amazing thought. It is very satisfying to be able to make a contribution to clean reliable energy in the UK for years to come."



Gordon Pope Deputy Construction Project ManagerWalney Extension Project

Supporting the Construction Project Manager, I facilitate the daily coordination of site management, HSE Engineers, Offshore Marine Managers, and logistics and commissioning during the construction of the wind farm.

Previous employment

- Project Manager, built and completed two onshore 132/ 275kV substations in Stonehaven and north of Inverness
- Lead Engineer on a further three onshore wind farms
- Civil Engineering Manager for Griffin Wind farm in Aberfeldy
- Intern for Scottish and Southern Energy (SSE) in power distribution in Inverness, Aberdeen then Southampton and Portsmouth

Oualifications

MEng Civil Engineering; Glasgow University

What makes your job unique?

"During construction no two days are the same. There are a lot of stakeholders, packages and interfaces with their own deliverables and you need to strike the balance that's best for the projects overall. This doesn't take into consideration a plan ruined by weather, equipment or resources, which means you need to be adaptable and make the best decisions as quickly as possible, while keeping safety at the forefront of any decision."

Ailsa Goodliff Project PlannerWalney Extension Project

I am responsible for coordinating planning activities, negotiating contractual requirements and ensuring we have enough staff for the lifetime of the project.



Previous employment

- Project Coordinator at Wind Support
- Feed-In Tariff Internship at Ofgem working on the domestic Feed in Tariff (FiT)

Oualifications

- A Levels (Geography, Biology & French)
- BSc Geography; University of Birmingham (dissertation on offshore wind)

What makes your job unique?

"My position is an overarching role that gives me exposure to most parts of the project; I enjoy the challenge of synchronising the different interfaces and juggling a busy workload. Having worked at DONG Energy for four years, I have been part of Walney Extension through the Development Phase and into Execution, which has been very exciting!"



Gabriel Davies Lead Commercial Manager

Walney Extension Project 🙏



I provide commercial support for the project, negotiating contracts, dealing with divestments (when we sell parts of our wind farms) and managing government subsidies.

Previous employment

- Six years in private practice law firms specialising in major infrastructure planning and energy law
- Two years on secondment at DONG Energy as in-house legal counsel, advising development projects on planning and commercial issues

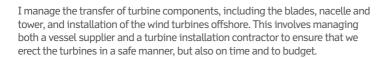
Oualifications

- BA (Hons.) American History & Politics; University of Manchester
- Graduate Diploma and Legal Practice Certificate: Nottingham Law School

What makes your job unique?

"Despite not having a background in engineering, my job allows me to hold a central role in the execution and construction of one of the world's largest offshore wind farms. I work with people from a huge variety of backgrounds, bringing my experience and perspective to the table to work with them to solve problems and create new and innovative solutions to existing industry practices."

Mark West Wind Turbine Installation Specialist Race Bank Project 👢





Previous employment

- Field technician on high speed rotating machinery at Angelus Machine Corp.
- Wind turbine technician (Onshore) at
- Wind Turbine Commissioning Engineer (Lincs Offshore Wind Farm) at RES

Oualifications

BSc Mechanical and Manufacture Engineering; Portsmouth University

What makes your job unique?

"I get to build one of the biggest mechano sets in a challenging environment for the benefit of mankind."



Sally Holroyd Lead Consent Project Manager Walney Extension Project

I make sure we build the wind farm without causing harm to the local environment. During the project development phase, my team is responsible for undertaking environmental surveys and studies, along with applying for the key environmental consents. We ensure that our onshore and offshore site contractors remain compliant with all required environmental constraints.

Previous employment

- Environmental Scientist at Oakwood Environmental: EIA and consenting for the marine aggregates industry
- Principal Consultant at Intertek Metoc: EIA and consenting for the cables and marine renewables industries

Qualifications

- BSc (Hons) Applied and Environmental Biology; University of York
- MSc Crop Production in the Changing Environment; Essex University
- 1998: Pg. Dip Geographical Information Systems; University of Portsmouth

What makes your job unique?

"My role enables me to be involved from the development and consent application phase through to construction works and commissioning of the wind farm, which is unusual as colleagues in other roles typically concentrate on a specific phase of the wind farm lifecycle. I find it hugely rewarding to be part of a multidisciplinary team involved in developing and building this impressive feat of offshore engineering."

Operating & maintaining an offshore wind farm



Today's offshore wind farms will produce electricity for

25 years



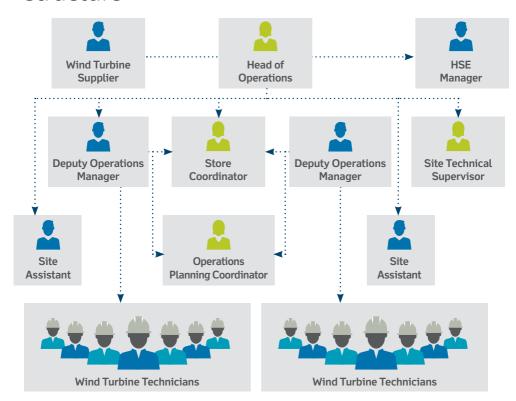
It can take around 35–100

people to operate and maintain an offshore wind farm. ³



A large proportion of these people will be **locally based**For example at Westermost Rough Offshore Wind Farm over 80% of staff come from the local area.

Typical operations and maintenance team structure



 $^{^{3}}$ The structure and size of the operations and maintenance team will depend on the size of the offshore wind farm.



Josh Gallacher Wind Turbine Technician

Westermost Rough Offshore Wind Farm



As an Offshore Wind Turbine Technician my main role and responsibility is to work safely and carry out a variety of manual tasks to ensure that the wind turbines are working reliably and at maximum efficiency. We work out at sea fixing the complex machinery in the wind turbines, so it is important that we communicate effectively and work together.

Previous employment

 Rotating Equipment Technician at Total Lindsey Oil Refinery

Oualifications

- HNC Mechanical Engineering
- ECITB Level 3 Diploma Installing engineering construction plant & systems (Mechanical)
- Mechanical fitting Modern Apprenticeship
- ACE card
- IRATA Level 1 rope access
- NVO Level 2 Performing Engineering Operations (Instrumentation)

What makes your job unique?

"The offshore wind industry is constantly evolving and expanding, and it is exciting for technicians as we get to work with the newest technologies available. We are always developing to meet the needs of the role and the opportunities that come with it."

Paul Hazell Offshore Coordinator

Westermost Rough Offshore Wind Farm 👢



As the Offshore Coordinator, I am responsible for coordinating marine operations via both helicopter and sea vessels. I plan both proactive and reactive maintenance, responding to emergency situations.



Previous employment

- Site Planner at Siemens (11 Months)
- Learning and development officer/Logistics offshore/Communications instructor in the Royal Artillery, British Army – (26 Years)

Oualifications

- **NEBOSH General Certificate**
- Facilities Management Certificate

- Level 7 Diploma in Strategic Leadership & Management
- Logistics NVO Level 3
- Coach and Mentor
- Fully GWO Offshore trained (First Aid, Sea Survival, Manual Handling, Fire Awareness & Working at Heights)

What makes your job unique?

"Each day is different and brings its own challenges that when overcome provide an immense feeling of job satisfaction. Site Management fully empower me in the role and I am trusted to make executive decisions on their behalf with little or no micro management."



Clare McVeigh Offshore Coordinator

Westermost Rough Offshore Wind Farm 👃

1 📐

As an Offshore Coordinator, I am responsible for monitoring turbine activity and addressing any issues with turbines that are not working. I also report on vessel and helicopter activity and maintain constant communication with passengers when helicopters and vessels are offshore.

Previous employment

- Morrisons (Student)
- Media Sales at the Grimsby Telegraph
- Training Assistant at Centrica Energy
- Training and SHE Coordinator at E.ON UK

Qualifications

- GCSE's & A Level's in Advance Business Studies
- AS English Literature & A Level Law
- NEBOSH General Certificate

What makes your job unique?

"Every day is different and you never know what to expect from one day to the next. It requires you to be on the ball, ready to react and able to make judgements and decisions on the spot."

Ryan Marsland Technical Site Supervisor

West of Duddon Sands Offshore Wind Farm 👃



I provide technical support to fix turbine components, undertake maintenance and find faults. I work with the technical departments such as Wind Turbine Systems, Diagnostics and Technical support. I also work closely with our other wind farms so we can share lessons learnt.



Previous employment

- 4 year Mechanical Maintenance
- Engineering Apprenticeship at a local paper production and converting factory
- 5 years as a shift mechanical resource
- 6 years offshore turbine experience with DONG Energy on the Siemens 3.6MW turbine
- 5 years as an Authorised Technician carrying out fault finding/trouble shooting tasks and servicing
- 6 months as a Supervisory Technician before moving into the Technical Site Supervisor role

Oualifications

- BSc Mechanical Engineering; University of Lancaster (Furness College)
- NVQ level 2 & 3. Key skills level 3
- ONC, HNC and HND in Mechanical Engineering and CAE

What makes your job unique?

"In the TSS role you are involved in turbine technical issues at a higher level, adding your own personal and site input to help resolve the problem. I believe the TSS role is the eyes and ears of the technical back office, passing the relevant information back."



Andrew Bell Warehouse Manager Coordinator

Burbo Bank Offshore Wind Farm



I am responsible for looking after technicians along with ordering spare parts, Personal Protective Equipment, tools and lifting equipment. I will deal with all deliveries in and out of the warehouse and work closely with local suppliers to procure the necessary parts.

Previous employment

- Retail Manager at Scottish Power
- Retail Manager at SONY Centre

Oualifications

- GSCE equivalent (History, Maths & PE)
- GWO Certification (First Aid. Manual Handling, Sea Survival, Working at Heights)
- Forklift Licence
- Good communication skills
- Invoicing and inventory management

What makes your job unique?

"The variety of the job itself."

Tricia Percy Site Assistant

Westermost Rough Offshore Wind Farm



As the site assistant, I am responsible for the full administrative site support, including management and technicians. This includes travel arrangements. processing of orders and shift input, training co-ordination, document management, monthly reporting and analysis.



Previous employment

PA/Site Secretary

Oualifications

- GCSE & A level equivalents
- RSA/Pitman typing Advanced
- Microsoft Office (Word, Excel, PowerPoint)
- Pondus/Qube
- GWO First Aid, Sea Survival, Fire Awareness, Manual Handling, HUET
- Fire Warden
- Safety Rep

What makes your job unique?

"The job is the most varied role I have experienced, incorporating a wide range of support duties with the ability to prioritise, co-ordinate and multi-task being essential! A high level of organisational skills are key to this role."



John Vernon Health, Safety & Environmental Manager

Burbo Bank Offshore Wind Farm



My role is to provide DONG Energy managers and employees with advice, guidance and direction on all aspects of health, safety and environmental issues.

Previous employment

- Trainee Electronic Technician in the Royal Air Force
- 18 Years in Plastic Manufacturing Industry in a variety of roles including; Machine operator, Engineer, Safety and Systems Manager and Production Manager
- 8 years in a Health, Safety and Environment management role in a variety of organisations (Public Transport, NHS and Construction)

5 years as HSE Manager (Burbo Bank Wind Farm) at DONG Energy

Oualifications

- NEBOSH Diploma (part 2) in Occupational Safety & Health
- Institute of Environmental Management Certificate
- **HNC** Engineering
- Chartered Member of the Institute of Occupational Safety and Health

What makes your job unique?

"Safety plays a part in pretty much everything we do so I find myself central to all activities on site. No two days are the same in this role. One day you can be offshore on a jack up vessel observing a gearbox exchange, and the next you could be at a meeting in the London office planning for a new wind farm."

Steven Clarke Head of Operations

West of Duddon Sands Offshore Wind Farm



As Head of Operations, I am responsible for the running of the offshore wind farm and ensuring it meets all its strategic business objectives. I am accountable for all elements of the business including our Quality, Health, Safety and Environmental performance, energy production, finance and people management.



Previous employment

- Deputy Operations Manager, Walney Offshore Wind Farms, DONG Energy
- Commissioning Manager, Walney Offshore Wind Farms, DONG Energy
- Technician and Project Supervisor, Vestas Offshore
- Electrical Technician, Kimberly-Clark Ltd

Oualifications

- **HNC Electrical & Electronic Engineering**
- Global Wind Organisation (GWO) Sea Survival Certification
- **GWO** Rescue from Heights
- GWO Fire Awareness

What makes your job unique?

"The ability to make a significant difference to the offshore wind industry both for today and the future pipeline. I am also extremely privileged to be working with so many talented and dedicated employees."

List of Acronyms

ACE card – Assuring Competence in Engineering Construction

BSc - Bachelor of Science Degree

CAE - Computer-Aided Engineering

CDM - Construction Design Management

CoC – Certificate of Competency

ECITB – Engineering Construction Industry Training Board

EIA - Environmental Impact Assessment

ENG1 – MCA approved medical certificate required for all crew on commercial superyachts

GMDSS – Global Maritime Distress and Safety Systems

GOC - General Operator's Certificate

GWO – Global Wind Organisation

HNC – Higher National Certificate

HND – Higher National Diploma

HSE – Health, Safety and Environment

HUET – Helicopter Underwater Escape Training

IOSH – Institution of Occupational Safety and Health

IMCA – International Marine Contractors Association

IRATA – Industrial Rope Access Trade Association

MCA – Marine Coastguard Agency

MEng – Masters of Engineering

MSc - Masters of Science Degree

NEBOSH - National General Certificate in Occupational Health and Safety

NHS - National Health Service

NVQ - National Vocational Qualification

ONC – Ordinary National Certificate

Pg. Dip – Post Graduate Diploma

PPE – Personal Protective Equipment

SHE - Safety Health Environment

STCW – Standards for Training, Certification and Watch keeping

For information on upcoming opportunities at DONG Energy please visit our careers site at www.dongenergy.co.uk/careers

For further information on the wider Offshore Wind sector visit www.offshorewindworks.com





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DDD. DONG Energy Apprenticeship Schemes

DDD. DONG Energy Apprenticeship Schemes

Growing new technicians for the future



As more offshore wind farms are constructed in the UK, technicians with the right skills and experience to maintain the turbines are becoming highly sought after. Anticipating this demand, DONG Energy joined forces with Maersk to give people a head start in the industry by offering valuable training and the opportunity for hands-on experience. Since the start of the scheme, at least 12 people have found careers in the offshore wind industry. In October 2014, six people came to do placements with DONG Energy and the course is due to run again in 2015.

"I have thoroughly enjoyed my training with Maersk and DONG Energy, it has been an excellent opportunity to learn and gain further knowledge and skills, which I can now use throughout my new career in the wind industry. I would like to thank both Maersk and DONG Energy for giving me the opportunity. I would not be in the position I am without them.

It is a challenging but rewarding experience and the start of my new journey to success!"

Kieran Lamb Walney Offshore Wind Farm DONG Energy UK "This course allows us to expand people's skill sets from their Diploma and Global Wind Organisation training and combine them with real-time experience, paving the way for their potential new career as a wind turbine technician — a rapidly growing market in the UK. The success of this scheme is testament to everyone involved.

I am delighted we will now be repeating this support in 2015 with local candidates from the Barrow area, which hopefully will assist local people in securing long-term employment."

Adrian Macklin Head of Barrow Operations DONG Energy UK

FFF. ROW01 Recruitment Advert June 2016

We are currently recruiting for our Race Bank Offshore Wind Farm in Grimsby

Application deadline 18:00 on Monday 20 June 2016.



Would you like to take up the challenge and be part of the first wind farm project ever to utilise a service operations vessel at our cluster of offshore wind farms in Grimsby?

Join us and become a Deputy Operations Manager or a Wind Turbine Technician where you will live and work on a service operations vessel (SOV) off the coast of Lincolnshire on a roster of 2 weeks on/2 weeks off. We are also looking for a Site Assistant based onshore to be part of this innovative setup operation using the latest offshore technology.

For further information, please see dongenergy.com/en/careers/vacancies

Deputy Operations Manager

Based in the SOV, you will be a key member of the team handling offshore operations activity for our offshore wind farms, with the highest regard for safety standards and performance excellence. You will be responsible for developing a team of wind turbine technicians, optimising wind farm performance through collaboration with colleagues and suppliers, and driving a culture of continuous improvement. You'll have prior experience of working in health and safety critical environments and ideally a technical, electrical, engineering or mechanical background.

Technician

Based on the SOV, you will be part of team to perform servicing, troubleshooting and repairing of electrical, mechanical and hydraulic components. You'll also perform balance of plant maintenance and carry out high voltage switching, isolating and earthing as an Authorised Person (34kV), and contribute to planning and operational excellence with the highest regard for safety standards. Experience as an engineer/technician would be ideal, preferably electrically biased and with mechanical aptitude.

Site Assistant

Based onshore, you will ensure the offshore teams are looked after and business critical requirements are met. You will provide administrative support to the Head of Operations and the wind farm team, coordinating suppliers, training and courses for site, and update records, contracts and guidelines. A proven track record in providing secretarial/administrative support is essential with strong organisational. IT and communication skills.

GGG. Acronyms and abbreviations

Acronym	Definition
BEIS	Department of Business, Energy and Industrial Strategy
ВоР	Balance of Plant
BST	Basic Safety Training
BVG	BVG Associates
CBF	Community Benefit Fund
CfD	Contract for Difference
CSR	Corporate Social Responsibility
DCO	Development Consent Order
DE	DONG Energy
DEI	Durham Energy Institute
DP	Dynamic Positioning
DIT	Department for International Trade
EEW	EEW Special Pipe Construction GmbH
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
ESG	Environmental Scientifics Group Ltd
EU	European Union
EWEA	European Wind Energy Association
FID	Financial Investment Decision
FLiDAR	Floating Light imaging, Detection and Ranging
GWO	Global Wind Organisation
HOW01	Hornsea Project One Offshore Wind Farm
HOW02	Hornsea Project Two Offshore Wind Farm
HSE	Health and Safety Executive
HVAC	High Voltage, Alternating Current
IEA	International Energy Agency
IFB2016	International Festival for Business 2016
IP	Intellectual Property
JdN	Jan de Nul
JDR	JDR Cable Systems

KPI Key Performance Indicator kV Kilovolt LCCC Low Carbon Contracts Company LCOE Levelised Cost of Energy LDP Leadership Development Programme LEP Local Enterprise Partnerships LiDAR Light imaging, Detection and Ranging LL Lessons Learnt MCPS Multi-Contract Procurement Strategy MHCC Marine Helicopter Coordination Centre MP Monopile MVOW Mitsubishi Vestas Offshore Wind MW Megawatt NGET National Grid Electricity Transmission plc NSIP National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team 0&M Operations and Maintenance 0EM Original Equipment Manufacturer 0REF Offshore Renewable Energy Emergency Forum 0SB Offshore Structures Britain 0WA Offshore Wind Accelerator 0WIC Offshore Wind Industry Council 0WPB Offshore Wind Programme Board Pile Soil Analysis P	JV	Joint Venture
LCCC Low Carbon Contracts Company LCOE Levelised Cost of Energy LDP Leadership Development Programme LEP Local Enterprise Partnerships LiDAR Light imaging, Detection and Ranging LL Lessons Learnt MCPS Multi-Contract Procurement Strategy MHCC Marine Helicopter Coordination Centre MP Monopile MVOW Mitsubishi Vestas Offshore Wind MW Megawatt NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Accelerator OWIC Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewable In Employment Strategy Group	KPI	Key Performance Indicator
LCOE Levelised Cost of Energy LDP Leadership Development Programme LEP Local Enterprise Partnerships LiDAR Light imaging, Detection and Ranging LL Lessons Learnt MCPS Multi-Contract Procurement Strategy MHCC Marine Helicopter Coordination Centre MP Monopile MVOW Mitsubishi Vestas Offshore Wind MW Megawatt NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewable UK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	kV	Kilovolt
LDP Leadership Development Programme LEP Local Enterprise Partnerships LiDAR Light imaging, Detection and Ranging LL Lessons Learnt MCPS Multi-Contract Procurement Strategy MHCC Marine Helicopter Coordination Centre MP Monopile MVOW Mitsubishi Vestas Offshore Wind MW Megawatt NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Accelerator OWIC Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewable I Employment Strategy Group	LCCC	Low Carbon Contracts Company
LEP Local Enterprise Partnerships LiDAR Light imaging, Detection and Ranging LL Lessons Learnt MCPS Multi-Contract Procurement Strategy MHCC Marine Helicopter Coordination Centre MP Monopile MVOW Mitsubishi Vestas Offshore Wind MW Megawatt NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewable Jackets SESG Skills and Employment Strategy Group	LCoE	Levelised Cost of Energy
LiDAR Light imaging, Detection and Ranging LL Lessons Learnt MCPS Multi-Contract Procurement Strategy MHCC Marine Helicopter Coordination Centre MP Monopile MVOW Mitsubishi Vestas Offshore Wind MW Megawatt NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Accelerator OWIC Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	LDP	Leadership Development Programme
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MCPS Multi-Contract Procurement Strategy MHCC Marine Helicopter Coordination Centre MP Monopile MVOW Mitsubishi Vestas Offshore Wind MW Megawatt NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Accelerator OWIC Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN RenewableUK R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	LiDAR	Light imaging, Detection and Ranging
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MW Megawatt NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Accelerator OWIC Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	MP	Monopile
NGET National Grid Electricity Transmission plc NSIP Nationally Significant Infrastructure Project NWBLT North West Business Leadership Team O&M Operations and Maintenance OEM Original Equipment Manufacturer OREEF Offshore Renewable Energy Emergency Forum OSB Offshore Structures Britain OWA Offshore Wind Accelerator OWIC Offshore Wind Industry Council OWPB Offshore Wind Programme Board PISA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	MVOW	Mitsubishi Vestas Offshore Wind
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OWA Offshore Wind Accelerator OWIC Offshore Wind Industry Council OWPB Offshore Wind Programme Board PiSA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	OREEF	Offshore Renewable Energy Emergency Forum
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OWPB Offshore Wind Programme Board PiSA Pile Soil Analysis Project PL Product Line pSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	OWA	Offshore Wind Accelerator
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PSAC Protected Special Area of Conservation R&D Research and Development RCS Reactive Compensation Station RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	PiSA	Pile Soil Analysis Project
R&D Research and Development RCS Reactive Compensation Station RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	PL	Product Line
RCS Reactive Compensation Station RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	pSAC	Protected Special Area of Conservation
RTN Renewables Training Network R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	R&D	Research and Development
R-UK RenewableUK SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	RCS	Reactive Compensation Station
SBJ Suction Bucket Jackets SESG Skills and Employment Strategy Group	RTN	Renewables Training Network
SESG Skills and Employment Strategy Group	R-UK	RenewableUK
	SBJ	Suction Bucket Jackets
SOV Service Operational Vessel	SESG	Skills and Employment Strategy Group
	sov	Service Operational Vessel

ST3	ST ³ Offshore
STEM	Science, Technology, Engineering and Maths
TP	Transition Piece
TSA	Turbine Supply Agreement
TSO	Transmission System Operator
UKC	UK Content
UKTI	UK Trade and Investment
UTC	University Technical College
WTG	Wind Turbine Generator