POWER - Offshore Wind Supply Chain Study for the East of England

Final Report – June 2005

Final Report

A Report to Suffolk County Council by Douglas-Westwood Limited

June 2005

DOUGLAS-WESTWOOD

Interreg North Sea Region

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Glossary

£/MW	Pounds per megawatt
£m	Pounds-millions
DTI	Department of Trade and Industry
DWL	Douglas-Westwood Limited
East of England	Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk
EC	European Commission
EEDA	East of England Development Agency
EEEGR	East of England Energy Group
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPC	Engineering, Procurement and Commissioning
EPIC	Engineering, Procurement, Installation and Commissioning
EROWL	E.ON Renewables Offshore Wind Ltd
EU	European Union
GBS	Gravity-Base Structure
Greater Wash	Extends from the north Norfolk coast towards Flamborough Head and out into the North Sea
GW	Gigawatt
HVDC	High Voltage Direct Current
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt hour
MW	Megawatt
Mapergy	An internet based supply chain mapping system developed by EEEGR
North West	The eastern Irish Sea between the north Wales coast and the Solway Firth
O&M	Operations & Maintenance
ODE Limited	Offshore Design Engineering Limited
OJEC	Official Journal of the European Community
POWER	Pushing Offshore Wind Energy Regions
R&D	Research & Development
Round 1	1st round of UK offshore wind farms – located within 12 nautical mile limit, with up to 30 turbines
Round 2	2nd round of UK offshore wind farms – focused on 3 strategic areas in territorial waters
Scenario 1 Developments	Turbine capacity of 3.9 MW or less & located in water depths less than 25 m
Scenario 2 Developments	Turbine capacity of more than 4 MW & located in water depths more than 25 m
Strategic Areas	Defined as; Thames Estuary, Greater Wash & North West
SIC	Standard Industry Classification
SNS	Southern North Sea

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1 SUMMARY & CONCLUSIONS

The UK is poised to become the world's largest market within the emerging offshore wind sector. A structured national development strategy has resulted in many projects being proposed with the first two of these now operational and two further projects currently under construction.

A total of over 10 GW of offshore wind capacity is currently planned off the UK which is expected to result in over £11.2 billion in expenditure. Two of the Government's three offshore wind strategic development areas (the Thames Estuary and the Greater Wash) are within the East of England's area of influence and the region is, therefore, well-poised to capitalise on these projects.

Given the economic development potential of the UK offshore wind industry, early engagement with this emerging market and full support of regional companies wishing to explore the supply chain opportunities inherent in the growth of this sector is, therefore, of tremendous importance to the region.

1.1 East of England Supply Chain Assessment & Analysis

The East of England cannot currently offer a complete service to the offshore wind industry but it can offer a substantial one. Indeed, the East of England has the core skills, experience and capabilities to service a significant proportion of the offshore wind supply chain, with the development and operations phases of offshore wind being key areas of competence. Further opportunities for diversification into offshore wind are, therefore, wide-ranging, with the region's comprehensive offshore engineering and oil & gas experience particularly applicable.

The services that the East of England can potentially offer have already been profiled within the region's first offshore wind farm, Scroby Sands.[1] Key areas of regional content included environmental monitoring and assessment, surveys, onshore installation, onshore pre-assembly and operations and maintenance. Manufacturing and the majority of offshore installation (other than cables) work are, however, not currently met by regional companies as the region has limited proven capability for both turbines and foundations. However, this is not just a regional problem.

Table 1-1: East of England Proven Offshore Wind Capability – Scroby Sands

High	Medium	Low
Environmental Monitoring Onshore Installation Onshore Pre-Assembly Operations & Maintenance Surveys	Commissioning Project Management	Detailed Design Development Design Insurance / Legal Procurement & Manufacturing Offshore Installation Transport & Delivery

In its present state, there are difficulties in entering the offshore wind sector. Despite the opportunities identified by regional companies for potential involvement, there is currently an acknowledged imbalance between risk and reward. Of the companies interviewed almost 60% had experienced problems of varying degrees working on offshore wind projects to date. Project economics, specifically overly tight margins, is the most frequently cited problem.

Indeed many contractors, including regional ones, have taken losses by working on the first major offshore wind projects. Analysis of contracting strategies used on these projects suggests that the future marketplace will become more competitive and that the use of alternative contracting strategies,

[1] Ref: Scroby Sands Supply Chain Analysis - a detailed assessment of the supply chain to Scroby Sands carried out by Douglas-Westwood Ltd and ODE Ltd for Renewables East (see Section 2.5.1)

by developers and EPIC (Engineering, Procurement, Installation and Commissioning) contractors, will redress the balance between risk and reward.

Delays on UK projects have also caused problems for both national and regional suppliers. Relatively few projects are currently being constructed each year and, although this situation is expected to improve from 2006, market confidence and economies of scale have yet to be fully developed. At present UK suppliers are struggling to compete with their European counterparts who are believed to be benefiting from a larger quantity of repeat business, in some cases due to existing relationships from well-established onshore wind supply chains.

There are signs that early market entry, albeit often at a loss, will be beneficial in the long-term as a result of both the relationships formed and the lessons learnt. A high-level of awareness of the opportunities and challenges of the Scenario 2[2] type developments exists within the region with the majority of companies confident that the regional supply chain can meet the requirements of such projects and that levels of regional content will increase in turn.

Table 1-2: East of England Potential Capability

High	Medium	Low
Environmental Monitoring Surveys Insurance / Legal Detailed Design Onshore Installation Onshore Pre-Assembly Commissioning Operations & Maintenance	Project Management Offshore Installation	Development Design Procurement & Manufacturing Transport & Delivery

Industry awareness and opportunities available to regional companies are promoted well by the region's business support, economic development and industry support agencies (such as EEEGR and Renewables East) which have provided a major stimulus to the regional supply chain. A more co-ordinated approach is, however, necessary to maximise benefit to companies seeking entry into the offshore wind market.

1.2 Forecast Regional Content in East of England Projects

The figure and table below show forecast expenditure relating to the development and construction for all Scenario 1 and Scenario 2 projects within the East of England's geographical area.

No data for operations and maintenance has been included at this stage. Cost is attributed to the year the project is scheduled to come online.

[2] Scenario 2 developments are defined as having a turbine capacity in excess of 4 MW & located at sites in water depths of more than 25 m. Scenario 1 developments use up to 3.9 MW turbines and are located at sites in water depths of less than 25 m.

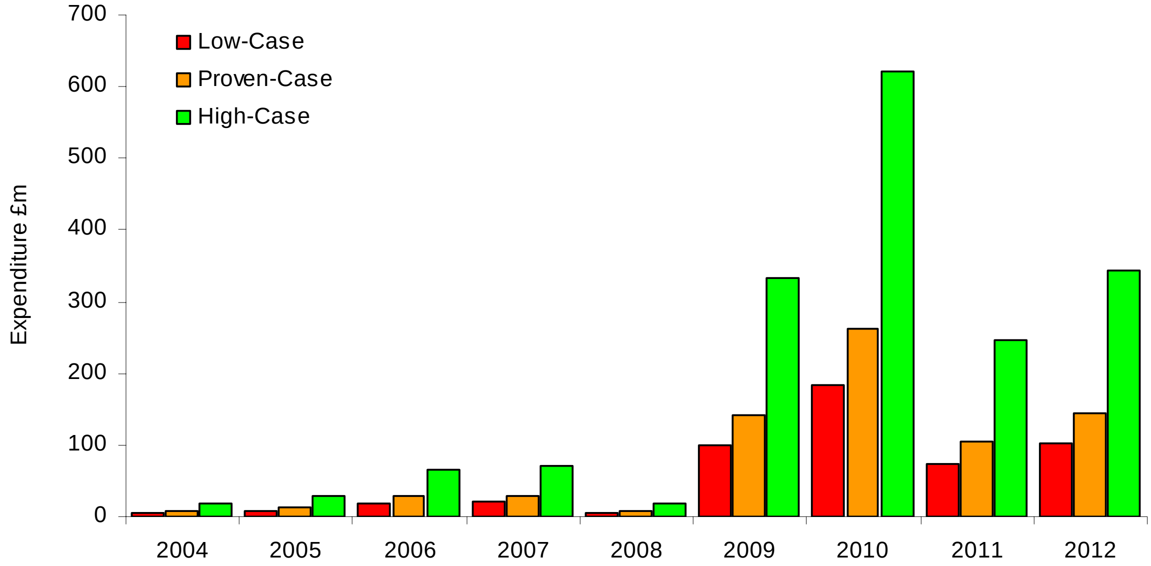

Figure 1-1: Forecast Regional Content in East of England Projects (£m)

Table 1-3: Forecast Regional Content in East of England Projects (£m)

£m	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Low-Case	6	9	19	21	5	99	184	73	102	518
Proven-Case	8	12	28	30	8	142	263	105	145	741
High Case	19	29	65	70	18	333	620	247	343	1,746
Total E of E £m	75	113	250	270	70	1,285	2,390	954	1,320	6,727

The development and construction of offshore wind developments within the East of England is forecast to involve a total expenditure of £6.7 billion through to 2012. The potential scale of such expenditure becomes evident when compared with annual expenditure relating to the development of and production from Southern North Sea gas reserves, which is forecast to average approximately £700 million through to 2008[3].

Using three case-based scenarios, the value of such contracts attainable by regional companies is forecast to be between £518 million and £1.7 billion. Proven regional content (assuming levels demonstrated on the Scroby Sands development in 2004 are replicable on future projects) gives a total regional value of approximately £740 million for the period to 2012.

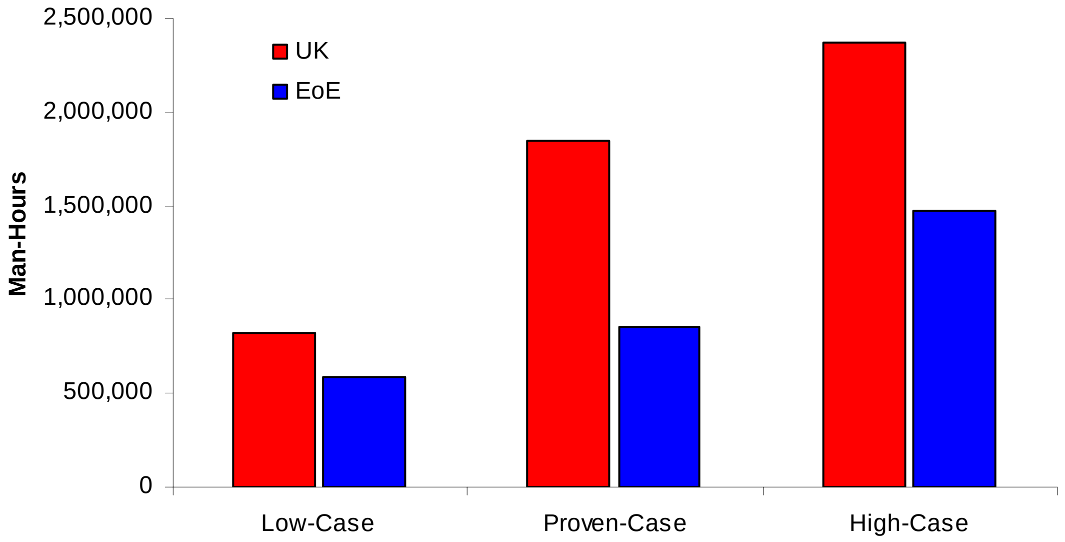

Figure 1-2: UK and East of England Man-Hours for a Typical Round 2 Project

[3] Ref: UKOOA 2004 Activity Report

Table 1-4: UK and East of England Man-Hours for a Typical Round 2 Project

Hours	UK	EofE
Low-Case Content	826,516	588,827
Proven-Case Content	1,847,101	850,106
High-Case Content	2,372,175	1,478,132
Total Typical R2 Project	2,659,663	

Note: These figures do not include operations and maintenance

Total man-hours on the development and construction of a typical Scenario 2 project of 500 MW are forecast to total over 2.6 million, of which the East of England is forecast between 0.59 and 1.5 million hours. As such the total man hours for all Round 2 projects around the region is forecast to total approximately 32.4 million hours. The key areas in which the UK and East of England can achieve maximum content are mainly the most time-consuming ones such as detailed design, project management and onshore installation.

1.3 Conclusions

The challenges of Scenario 2 type developments should not be underestimated. Whilst the region has the capability to maintain regional content in many areas of the project development cycle, it will be increasingly difficult to gain a foothold in areas where there is currently a low capability. This, therefore, suggests that targeting regional experience and capabilities on existing high-content areas of the supply chain will be the most profitable and sustainable future strategy.

Accessing the areas of the supply-chain that are currently ‘off-limits’ to the East of England supply chain should, however, be investigated as fully as possible with the aim of attracting manufacturing and installation capability to the region. It is accepted that regional capabilities in these areas will not be of significance in the near future, but with so many future projects in the region, the East of England should seek to realise some level of future involvement. The region would, for instance, provide a suitable base for a manufacturer working on projects in the vicinity.

Going forward a realistic assessment of regional capabilities and targeted and joined-up strategic approach are vital in fostering industry awareness and promoting the region if future regional content is to be maximised.

2 INTRODUCTION

The POWER (Pushing Offshore Wind Energy Regions) project is a three year European project co-financed by the European Regional Development Fund through the Interreg IIIB North Sea Programme. The project unites North Sea regions with an interest in supporting and realising the economic and technological potentials of offshore wind energy. POWER will discuss and assess issues relating to the environmental impact of offshore wind farms, the development of a reliable, economically beneficial regional supply chain and skills development issues. It is hoped that trans-national co-operation between these regions will create a North Sea competence network for offshore wind energy. The project runs from July 2004 to July 2007.

The East of England's involvement in the project is led by Suffolk County Council in association with the East of England Energy Group (EEEGR), Renewables East and Waveney District Council.

One workstream of the POWER project focuses on the supply chain and economic development in the offshore wind sector within regions with the ambition and opportunity to benefit economically from the evolving offshore wind energy industry. As part of the work package, each of the participating partner regions is to conduct a regional study on the offshore wind energy supply chain. This study aims to inform the regions on specific strengths and gaps within their supply chain to the offshore wind sector, and facilitate the development of strategies supporting supply chain development. Studies are being undertaken in Denmark, Germany, the Netherlands and UK.

The geographic scope of the supply chain analysis within the UK has been focused on the East of England, comprising Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk and specifically the Lowestoft/Great Yarmouth sub-region. For the assessment of operational and planned offshore wind farms, the geographical scope extends beyond the East of England, to cover offshore wind farms both in coastal waters of the East of England and beyond into the Strategic Areas of the Thames Estuary and Greater Wash.

Upon completion, the findings of each supply chain study within participating regions will be combined to form a transnational study, which will provide an overview of the offshore wind energy supply chain within the Southern North Sea region. Specific focus will be paid to identifying regional gaps, complementarities, opportunities for further collaboration and the different time scales envisaged for the construction of offshore wind farms in the respective countries (and their impact on pinch points of the supply chains).

2.1 Aims & Objectives

The study is specifically seeking to analyse the supply chain to the offshore wind sector within the East of England region. The study covers the whole offshore wind energy supply chain, running through the three main phases of work relating to offshore wind energy projects: development, construction, and operation.

Development – all activities completed in identifying, technically and environmentally assessing, insuring and licensing the project site through to project.

Table 2-1: Development Phase – Component Items

Tier 1 Category	Sub-Component Item
Development Design	Consultancy
	Development Agreement
	Electrical System Studies
	FEPA License Application
	Section 36 Planning Application
	Site Management
	Staff Costs
Environmental Monitoring	Environmental Surveys
Insurance/Legal	Insurance
	Legal Fees
Surveys	Geotechnical Survey / Investigation
	Site Surveys
Other Misc Costs	Reprographics

Construction – all supply chain activities relating to the contracting, financing, and procurement of all materials for the production, assembly and installation of all elements of the project. Key activities include the manufacture of components associated with the turbine, its foundation and any electrical equipment required to connect the facility to electricity infrastructure onshore, onshore and offshore installation activities and logistics at the construction port.

Construction therefore includes: a) procurement and manufacturing, b) foundation and tower building, c) machine and plant engineering and construction (gear unit), d) reinforced plastics, polymer plastics technology (rotor, nacelle), e) electrical engineering (generator, cable), f) assembly and logistics, g) offshore construction and services.

Table 2-2: Construction Phase – Component Items

Tier 1 Category	Sub-Component Item
Environmental Monitoring	Surveys - Arial, Bird & Coastal
	Bird Protection
	Environmental Management
	Noise Monitoring
Insurance/Legal	Construction Insurance
	Legal / Easements
	Site Inspection
Surveys	Site Surveys
Project Management	Board & Lodging
	HSE Site Rep
	Offshore Installation
	Onshore Logistics
	Planning Supervisor
	Project Administration
	Quality Assurance
Detailed Design	Electrical
	Foundation
	SCADA
	Scour
	Surveys
Procurement & Manufacture	Blades
	Cables
	Logistic Support
	Monopiles
	Nacelle
	Onshore Cable Supply
	Towers
Transport & Delivery	Blades
	Facility - Harbour
	Harbour Dues

Tier 1 Category	Sub-Component Item
Transport & Delivery	Nacelles
	Parts
	Surveys
	Towers
Onshore Pre-Assembly	Blade Handling
	Cranes
	Labour
	Onshore Equipment
	Quay Rental
	Site Transport
Onshore Installation	Onshore Cable Installation
	Substation / Grid Interface
Offshore Installation	Export Cables
	Inter Array Cables
	Piles
	Scour Protection
	Turbines
Commissioning	Senior Authorised Personnel
	Super Intendents
	Transfer Vessels
	Weather Forecasts
Other Misc Costs	Information Centre Building Works
	Project Film/Photography
	Training
	Visitor Centre Design & Fit Out

Operation – all supplies of goods and services necessary to operate, maintain and repair offshore wind facilities during their asset life. Decommissioning costs have not been considered in this report.

Table 2-3: Operations Phase – Component Items

Tier 1 Category	Sub-Component Item
Operations & Maintenance	Project Management
	Site Management
	Service Personnel
	Service Vessels
	Replacement Components
	Other Operational Costs

Each regional study focuses on a specific geographic region and that region's area of related expertise. In the case of the East of England this study has focused on offshore engineering and related disciplines. However, it is acknowledged that the overall maturation of the industry will have an effect on supply chain development, and as such prevailing regional capability, as offshore wind projects move from an overall development phase, through a period of extensive construction into an asset management phase replicating the experience of other industries (particularly oil and gas).

2.2 Methodology

The methodology used for the production of this study was principally based upon two main phases: desk research and an interview programme. The desk research was undertaken using Douglas-Westwood's established offshore wind databases and other established external information sources, with the aim of profiling and analysing planned offshore wind farms within the East of England and the capability of regional suppliers in servicing their requirements.

The interview programme focused on establishing the views and experiences of key contacts within companies both active in the development cycle of offshore wind developments and with those with a capability or desire to be so. The interview programme looked to establish:

- Problems anticipated / experienced working within the offshore wind sector
- Lessons learnt
- Experience within regional companies as suppliers
- Gaps in the supply chain and relative strengths and weaknesses
- How the regional supply chain can be stimulated
- ‘Pinch points’ for supply chain development
- Problems and opportunities regarding ‘Scenario 2’ developments
- What might regional business support agencies do to help?

2.3 Scenario Analysis

Supply chain analysis will be based upon two scenarios, reflecting the differences between the existing supply chain for smaller turbines in relatively shallow waters and the required future supply chain for large scale deeper water offshore wind farms. The two scenarios are defined as:

- **Scenario 1** – developments using turbines with a capacity of up to 3.9 MW, located at sites with a water depth not exceeding 25 metres. This scenario covers all already realised offshore wind farms, and some planned developments, and requires an assessment of supply chains of already known and used techniques – both with regard to turbine size and foundation type.

- **Scenario 2** – developments using turbines with a capacity in excess of 4 MW, located at sites in water depths of more than 25 metres. This scenario covers the planned larger farms in deep waters, where tripod or other types of foundation are necessary, and required installation equipment may differ from Scenario 1 developments due to the increased size and weight.

It should be noted that Scenario 1 is broadly akin to the UK’s first round offshore wind farm developments that are currently being realised. These near-shore sites typically feature 30 turbines in the 2 MW to 3.6 MW range. The UK’s second round developments are forecast to begin construction as soon as 2008, although some large projects will not be built until the next decade. These projects are broadly similar in specification to Scenario 2 projects as they will feature larger turbines and will, in most cases, be located in deeper waters, further offshore than their first round predecessors.

The Scenario categorisation used in the regional studies is only indicative. In many cases water depths on Scenario 2 projects off the East of England are less than 25 metres.

For both scenarios, the study aims to identify and analyse:

- Significant differences between Scenario 1 and 2 and the regional capabilities required to work on these types of projects.
- Strengths, weaknesses and opportunities in the supply chain.
- Crucial gaps in the supply chain, and identify opportunities for diversification of local companies to fill these gaps.
- Core constraints within the region, highlighting the areas that are likely to become pinch points focusing on infrastructure, space requirements, the availability of critical equipment and the capacity of the market.
- Future training and research needs.
- Targeted actions required to provide focused business support and to encourage supply chain development, and summarise the impacts of not providing such support.

2.4 Project Deliverables

The following project deliverables were agreed:

- Establish the total value and likely level of regional content, both in terms of expenditure and employment, regarding offshore wind development in the East of England to date and develop a forecast for the future if the present situation were to continue.
- Determine which local companies are active or plan to be active as suppliers to the offshore wind sector with regard to manufacturing, installation, operation and maintenance, training and research.
- Develop a market compatibility matrix to show regional capabilities.
- Assess how the benefits to the region may increase through changes to the supply chain aimed at filling existing gaps.
- Produce recommendations for specific targeted actions for the further development of the offshore wind supply chain within the East of England.

2.5 Related Studies

There are two regional studies directly related to the POWER project which Douglas-Westwood Ltd have conducted in 2005: *Scroby Sands - Supply Chain Analysis* and the *Catalogue of Energy Industry Classifications.*

2.5.1 Scroby Sands – Supply Chain Analysis

Douglas-Westwood Ltd and ODE Ltd were commissioned to undertake a detailed review of the Scroby Sands offshore wind farm. This study was completed in June 2005 for Renewables East. The aims of the study were to:

- Map the supply chain to the Scroby Sands project down to Tier 3 service and component supply and identify the associated contracts, sub-contracts, and in-house services required to develop, construct and operate the project.
- Assess maximum level of UK and East of England supply chain penetration in project construction on current contracting procedures and possible variance through use of alternative contracting structures.
- Identify gaps within the supply chain for Scroby Sands that were not obviously open to UK penetration, confirm which of these opportunities should be targeted to maximise UK and regional economic benefits, and asses what mechanisms exist to develop the necessary business skills to secure contracts to supply goods and services in these areas.
- Forecast likely scale-up effects in to a typical Round 2 project including changes in fundamental logistical, contractual and equipment supply requirements.
- Outline potential future research required to assess probable UK supply chain levels in such projects and levels of public sector intervention required to support or extend the UK supply chain to secure greater economic benefits at national and regional level.

2.5.2 Catalogue of Energy Industry Classifications

This study was commissioned by EEEGR and completed by DWL in December 2004. The project required the creation of a “pragmatic” coding system to be applied to all companies identified, or seeking, to be working within the supply chain to the energy industry. The framework created will act as a means of facilitating the identification of specific capabilities of companies servicing one or more sectors and enable the effective segmentation of the industry.

This is to be achieved through the creation of three independent, relational datasets, structured as a keyword listing based on a maximum of 150 categories, with each dataset to be supplemented by a glossary defining keywords where appropriate. The three independent relational datasets are:

1. **Industry Sectors** – Oil & Gas, Wind, Solar, Nuclear, etc
2. **Industry Roles** – Operator, Service Provider, Support Organisation, etc
3. **Industry Classification** – Drilling & Wells, Installation & Commissioning, etc.

The coding system will be supplemented by suggestions of the key industry metrics that should be recorded within supporting databases to facilitate attempts to perform a consistent and repeatable analysis of the nature and scale of activity within any supply chain to the energy industry (full details of which are available from EEEGR upon request).

Having established an appropriate framework of use the catalogue of categories will then be integrated into EEEGR's 'Mapergy' system and made available to all POWER project partners as a means of providing a common terminology in completing their country specific supply chain studies. It is also envisaged that such a system will be complementary to work being developed to better identify skills sets against the capabilities of the industry.

See Appendix 2 for a detailed explanation of the classification system and full category listing.

3 OFFSHORE WIND MARKET TRENDS

3.1 World Offshore Wind 2000-2009

3.1.1 Development History

The first offshore wind turbines were installed at Vindeby off the Danish island of Lolland in 1991. The first ten years of the industry saw small projects being built in very shallow water near-shore locations. These wind farms, in most cases, used onshore turbine models with slight adaptations. These ‘demonstration’ projects have paved the way for the more recent projects that are of a much larger size.

There are currently 19 operational offshore wind farms in the world. The 327 installed turbines in these projects provide a total capacity of 617 MW. At the present time, Denmark is the world leader in installed capacity with 426 MW, but the UK is making fast progress and now has 124 MW operational with a further 180 MW to be online before the end of 2005 from the 90 MW Kentish Flats and Barrow offshore wind farms currently under construction.

Europe’s onshore wind industry experience and supply chain coupled with excellent natural resource and supportive government policies make the region the clear leader offshore. Recent activity in South East Asia marked the first offshore wind development outside Europe, with North America expected to install its first offshore turbines this period.

The largest installed offshore wind farm is the 165.6 MW Nysted development off Denmark which was completed in 2003. It has 72 x 2.3 MW Bonus (now Siemens Wind Power) turbines installed 9 km offshore in an average water depth of 8 metres. To date, the greatest water depth that a project has been installed in is 18 metres (Samsø, Denmark).

Just as today’s projects dwarf those built ten years previously, within another decade projects will be installed that are many times greater in size than today’s offshore wind farms and that will be built in substantially deeper locations, further offshore.

3.1.2 Future Activity

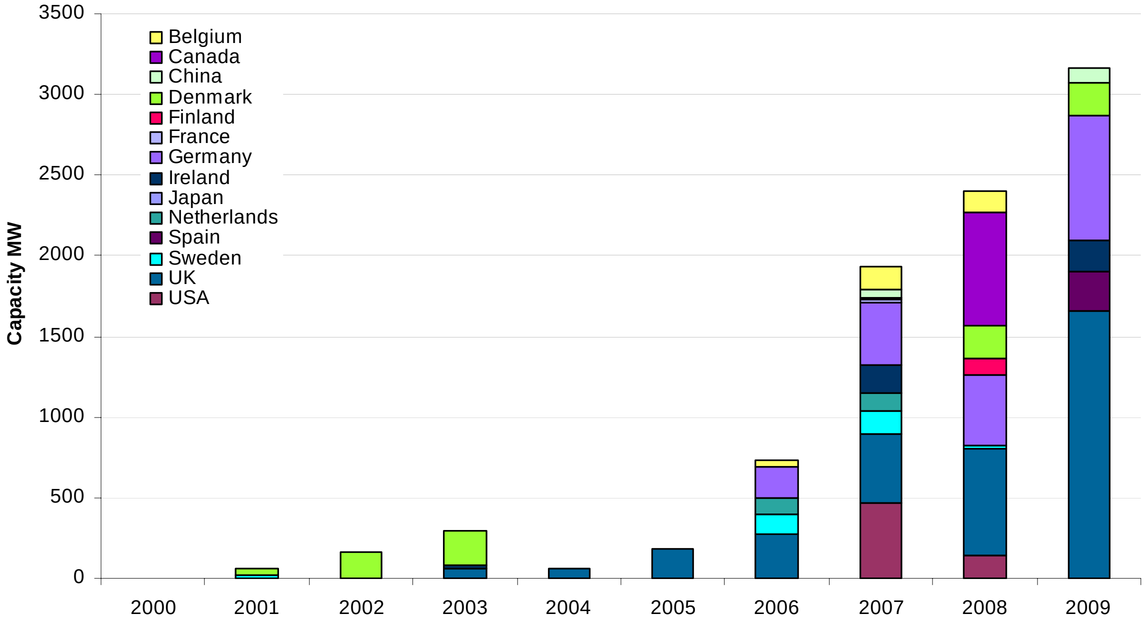

Figure 3-1: World Offshore Wind Capacity 2000-2009 (MW)

Table 3-1: World Offshore Wind Capacity 2000-2009 (MW)

MW	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2005-2009
Belgium							42	145	130		316
Canada							4		700		704
China								50		100	150
Denmark		40	163	213					200	200	400
Finland								5	104		109
France								29			29
Germany					4.5	4.5	198	384	438	771	1,797
Ireland				25				167		190	356
Japan					1.2						0
Netherlands							99	120			219
Spain										250	250
Sweden		21					125	142	18		285
UK	4	0	0	60	60	180	270	424	668	1655	3,197
USA								468	140	2	610
Grand Total	4	61	163	299	66	184.5	738	1,934	2,397	3,168	8,421

A total of 8.4 GW of offshore wind capacity is forecast for installation over the period to 2009. Progress was slow in 2004, with many delays pushing back installation schedules for projects off the UK, Belgium and the Netherlands. With only 66 MW coming online, it was the quietest year since 2001. However, 2004 did see Germany's first installation and, interestingly, the first offshore wind turbines being installed outside Europe.

In 2005, installations increase with 180 MW forecast for completion. This will all be off the UK where two 90 MW projects are scheduled for commissioning before the year's end. The rate of installations is forecast to increase dramatically from there on, with 738 MW expected to be commissioned in 2006. The first commercial German wind farm is expected to be brought online in 2006 as will the first Belgian, Swedish and Dutch projects.

This growth is continued into 2007 when 1.9 GW is forecast. The UK, Germany and Belgium will all build on their progress in 2006. The first US project, Cape Wind, is scheduled for a 2007 completion, although the ongoing planning and political disputes has made this project one of the most unpredictable at present. Sufficient progress was, however, made through 2004 for us to include the project in the 2007 season. The first Chinese project will also be commissioned in 2007.

The leading players will see increasingly higher amounts of capacity installed to the end of the period, with the UK and Germany building dominating positions in the industry. 2008 is significant because it marks Denmark's re-entry to the market it once led so strongly. The 200 MW Horns Rev II wind farm will be built in 2008 and the Nysted II project will follow in 2009. The last two years of the period sees countries such as Finland and Spain entering with their first major developments.

The UK is forecast to have one third of all capacity to be installed over the next five years, illustrating the steady progress made by UK projects. Here, few projects have been cancelled, and the route to construction is more clear-cut than in other countries where a joined-up approach is lacking from the authorities.

Germany has a 21% share of forecast installations, less than was expected just one year ago. Slow progress on the necessary cable permits is one factor that is holding back projects from construction. There is no doubting the importance of the German market, but it is taking much longer to reach fruition than previously thought. The installation of the 4.5 MW Enercon turbine in 2004 is a promising signal. A second 4.5 MW turbine is expected online in the summer of 2005.

Denmark currently has 69% of all installed offshore wind capacity to date so it is disappointing that it has only 5% of the 2005-2009 capacity in prospect.

Regionally, North America has a total of 16% of the market and this comes from relatively few projects. In comparison to the large European market (82% of all capacity) this is small, but it is a significant share and one that will be built upon in the future as the market grows in response to the successes seen both in Europe and the early projects off the USA.

Asia is only a small market at present (2% of all capacity 2005-2009) but in the longer-term has good prospects. Onshore wind has experienced dramatic levels of growth in countries such as China and offshore developments are expected in a number of Asian countries in the future.

3.2 UK Offshore Wind

With the award of licences to develop offshore wind energy, the UK has created one of the world's largest current market places for the deployment of marine renewable technology. With billions of pounds worth of capital required to realise over 7 GW of electrical capacity, a significant opportunity has been presented to develop a strong UK supply chain supporting this emerging industry.

The maturation of the industry over the next five years, moving from the construction of Round 1 projects with 30 turbines in relatively shallow waters close to the coast, to Round 2 projects with hundreds of turbines close to or beyond the 12 nautical mile territorial limit, will also directly affect the opportunities open to UK companies. Project supply chains and principal contractors will be faced with increased logistical demands, growing contractual risks, and pressure on available equipment supplies being countered by opportunities for economies of scale and innovations in equipment design and construction processes.

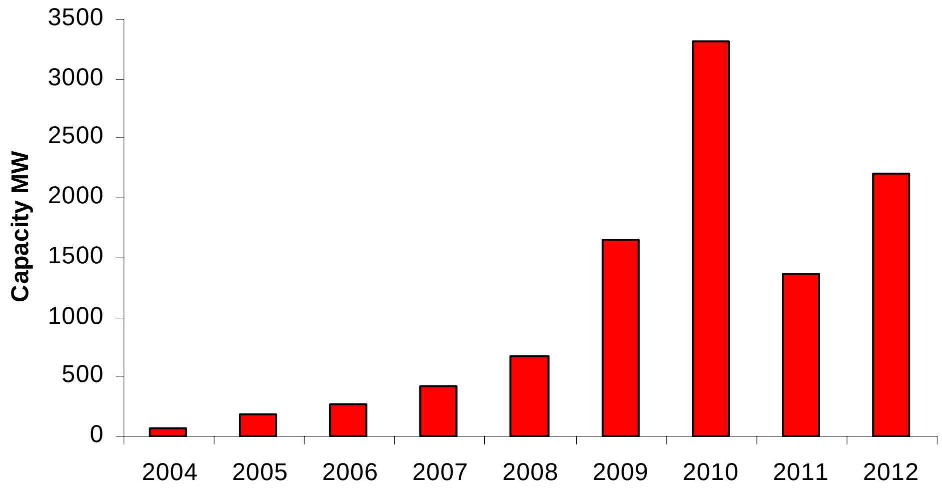

Figure 3-2: UK Offshore Wind Capacity 2004-2012 (MW)

Table 3-2: UK Offshore Wind Capacity 2004-2012 (MW)

MW	2004	2005	2006	2007	2008	2009	2010	2011	2012	2004-2012
UK	60	180	270	424	668	1,655	3,315	1,367	2,200	10,079

The UK is forecast to have the greatest level of activity in offshore wind in the world for mid-term future surpassing more established markets such as Denmark and beating Germany to large-scale offshore wind development.

A total of over 10 GW is in prospect for the UK which would result in over £11 billion of expenditure. Post 2008, the UK market will be worth in excess of £1 billion per year. From 2008 the Round 2 projects off the UK dramatically boost the market and this strong growth will continue into the next decade.

Table 3-3: UK & East of England Projects 2004-2013 - Units

Projects	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2004-2013
E of E	1	1	2	2	1	4	6	2	1		19
Other UK		1	1	3	4	2	3	1		1	16
Total	1	2	3	5	5	6	9	3	1	1	35

A total of 35 projects are planned in the UK, with 19 of these being within the East of England's area of influence. Note that some of these projects are developments with multiple phases such as London Array.

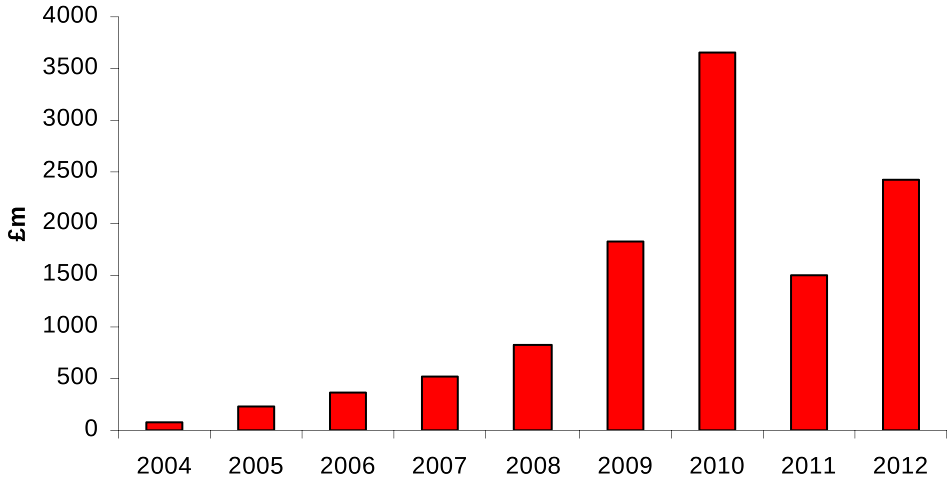

Figure 3-3: UK Offshore Wind Capital Expenditure 2040-2012 (£m)

Table 3-4: UK Offshore Wind Capital Expenditure 2004-2012 (£m)

£m	2004	2005	2006	2007	2008	2009	2010	2011	2012	2004-2012
UK	75	225	363	529	819	1,824	3,646	1,504	2,420	11,330

4 EAST OF ENGLAND OFFSHORE WIND PROSPECTS

4.1 East of England Offshore Wind

For the purpose of this study all projects in The Thames Estuary and The Greater Wash are being considered. Although in some cases the locations of the planned projects in these two areas are geographically distant from the physically defined East of England region (Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk) they fall within its area of influence, East of England companies will be tendering for contracts for these projects and the region's ports are well suited to the requisite construction work.

The East of England has a total of approximately 6 GW of capacity planned which will come from some 1,700 turbines (exact capacity and numbers depend on turbine sizes chosen). Total capital expenditure for all Round 1 and 2 projects is forecast to reach approximately £7.4 billion.

The charts below present the total potential of offshore wind in the East of England for all first and second round projects. This assumes all developments scheduled go ahead as planned.

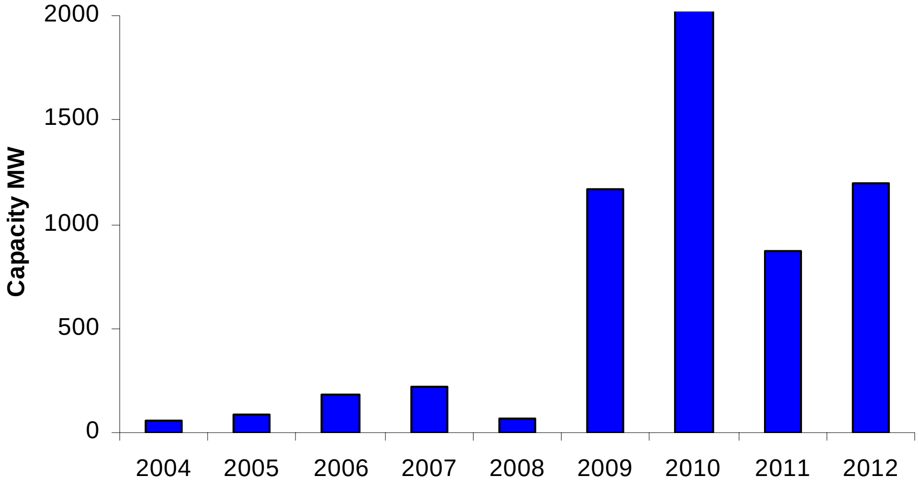

Figure 4-1: East of England Potential Capacity 2004-2012 (MW)

Table 4-1: East of England Potential Capacity 2004-2012 (MW)

MW	2004	2005	2006	2007	2008	2009	2010	2011	2012	2004-2012
E of E	60	90	180	216	64	1,165	2,173	867	1,200	5,955

The East of England has a total of 5,955 MW of capacity planned which will come from approximately 1,700 turbines. The capacity is allocated to the developers' target completion date for their project. Wind farm capacity has not been split across multiple years unless official project phases have been announced. This results in an extremely large increase in installations from 2009 when the second round projects begin construction.

The constraining factors on the above project capacities will be examined in more detail within this report but include the projects gaining planning approval, grid capacity, restructuring, new legislation to allow projects beyond the 12-mile nautical limit to be developed, sufficient turbine and foundation manufacturing capability, installation vessel availability, and most importantly, continued governmental support. These factors could result in project delays and even cancellations. The potential capacity shown above and potential expenditure shown below are, therefore, best-case scenarios.

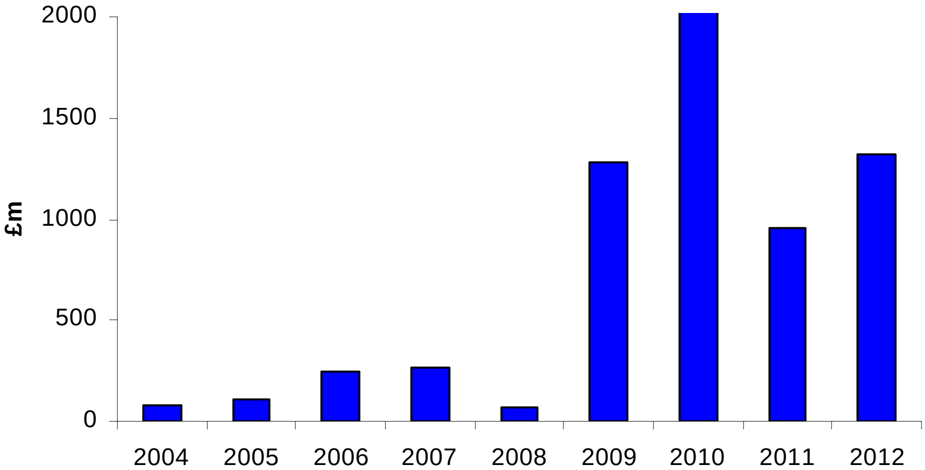

Figure 4-2: East of England Potential Capital Expenditure 2004-2012 (£m)

Table 4-2: East of England Potential Capital Expenditure 2004-2012 (£m)

£m	2004	2005	2006	2007	2008	2009	2010	2011	2012	2004-2012
E of E	75	113	250	270	70	1,285	2,390	954	1,320	6,652

Total capital expenditure relating to the development and construction of regional projects could amount to as much as £6.7 billion. This assumes all projects reach construction. Again, the timing of the projects is based on developers' announced timescales.

4.2 Scroby Sands

The Scroby Sands offshore wind farm, located an average of 3 km off Caister, was developed by EROWL (E.ON Renewables Offshore Wind Ltd – formerly Powergen Renewables Offshore Wind Ltd). The potential for an offshore wind farm site was first investigated in 1995 with government approval given in April 2002. Actual approval was for 76 MW, with EROWL having retained the option to install a further eight turbines at the site at a later date.

Table 4-3: Scroby Sands – Project Data

Scroby Sands			
Location	3 km off Caister, Norfolk	**Developer**	EROWL
Construction	2003	**Owner/Operator**	EROWL
Online	2004	**EPC**	Vestas
Capacity (MW)	60	**Turbine Installation**	A2Sea & Seacore
Number of Turbines	30	**Foundation Installation**	Mammoet Van Oord
Turbine Manufacturer	Vestas	**Total Cost (£m)**	80 (inc. 5 yrs O&M)
Turbine Rating (MW)	2	**Planning Status**	Complete
Foundation Type	Monopiles	**Contracting Status**	Complete
Water Depth (m)	2-10		

EROWL were originally planning construction in 2003 and remained confident this could be achieved when the invitation to tender for the EPIC contract was issued in June 2002, even though contractors had only six weeks to complete bids for the work. Those bidding included Vestas, Mammoet Van Oord, Mayflower Energy/JB Hydrocarbons, A2Sea, SLP/Bouygues and Mowlem/HydroSoil.

Powergen postponed the 2003 offshore construction target to a more realistically achievable 2004, and called for revised bids to be submitted. Vestas had been the firm favourite for the job having been a joint venture partner in Scroby since 1995 and in February 2003 they won the EPIC contract for all the offshore facilities and confirmed the project was to use 30 V-80 2 MW turbines. The contract included responsibility for operation and maintenance on the site over five years.

The first subcontract to be issued by Vestas was to Halliburton KBR to project manage the development on its behalf, while EROWL employed its own project manager, Offshore Design Engineering (ODE), on a 20-month contract valued at around £750,000. ODE were responsible for the management and co-ordination of all aspects of the engineering, manufacture and installation of the development.

In May 2003 Cambrian Engineering were awarded the contract for the supply of 16 piles, with Isleburn Mackay and Macleod winning a contract to supply the remaining 14 piles and approximately 700 tonnes of additional steelwork. The foundations were installed by Mammoet Van Oord's newbuild vessel *Jumping Jack*, between October 2003 and January 2004.

CNS Subsea installed the infield and export offshore cables, which were sourced from AEI Cables, while Nacap UK installed the onshore cables, supplied by Pirelli Cable Limited, over the period October 2003 to January 2004. EROWL also contracted EDF (formerly 24-7) for the onshore grid connection and have on ongoing consultancy contract with Econnect.

Turbines were assembled at Vestas' factory at Campeltown with A2Sea being awarded the turbine installation contract in February 2004 which was completed by their *Ocean Ady* vessel. Seacore were also contracted to install six of the turbines in the shallowest water locations. The turbines / blades were pre-assembled by Vestas Celtic at SLP Engineering's Lowestoft yard.

All turbines were installed by the beginning of June 2004, with a total installation time of 68 days (A2Sea installed 24 turbines in 50 days). The first of the turbines began production on the 20th July 2004. However, bad weather hampered commissioning efforts which meant that all turbines did not complete initial commissioning until the end of October 2004. High winds continued to slow work in November, but all reliability testing was completed by the end of November and after testing was completed all the turbines were online together for the first time on the 14th December 2004, with commercial completion being 31st December.

In August 2004 the £500,000 operations centre was opened in Great Yarmouth, providing the service back- up for the wind farm which Vestas are providing under warranty. The development was formally opened on the 22nd March 2005.

4.2.1 Regional and UK Content in Scroby Sands[4]

The following tables represent the overall project value and associated man-hours broken down by the key project stages of development, construction and operations. The development and construction data being actual historic data obtained from source, whilst the operations data is a prediction for the first five years of operation.

Table 4-4: Scroby Sands – Value by Phase (£'000s)

£'000s	East of England	Other UK	Non UK	Total	E of E %
Development	335	922	480	1,737	19%
Construction	7,415	24,485	39,611	71,511	10%
Operations	5,095	550	1,180	6,825	75%
Total	12,845	25,957	41,217	80,073	16%

Table 4-5: Scroby Sands – Hours by Phase

Hours	East of England	Other UK	Non UK	Total	E of E %
Development	5,189	15,974	8,000	29,163	18%
Construction	130,050	193,680	139,446	463,176	28%
Operations	124,160	10,715	28,855	163,730	76%
Total	259,399	220,369	176,301	656,069	40%

One of the major concerns regarding the offshore wind industry is that non-UK installation contractors will install non-UK equipment, such that minimal benefit will be gained by UK and regional economies. However, an analysis of the contract hierarchy to Scroby Sands shows a high level of actual UK and East of England content, which clearly proves that high UK and regional content can be achieved and as such sets a benchmark against which other projects can be measured.

When analysed by value, the level of East of England and other UK content is very good, however, when expressed as man-hours these percentages increase considerably. The fundamental reason for this differential being that a high proportion of the non-UK value is associated with major component supply and installation vessel contractors, which by their very nature have a low man-hour content relative to actual contract value.

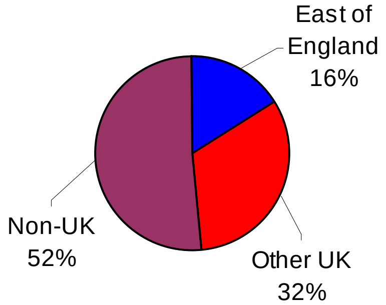

Figure 4-3: Scroby Sands – UK & East of England Content (£'000s)

4 Ref: Scroby Sands Supply Chain Analysis: Renewables East, ODE Limited and Douglas-Westwood Limited

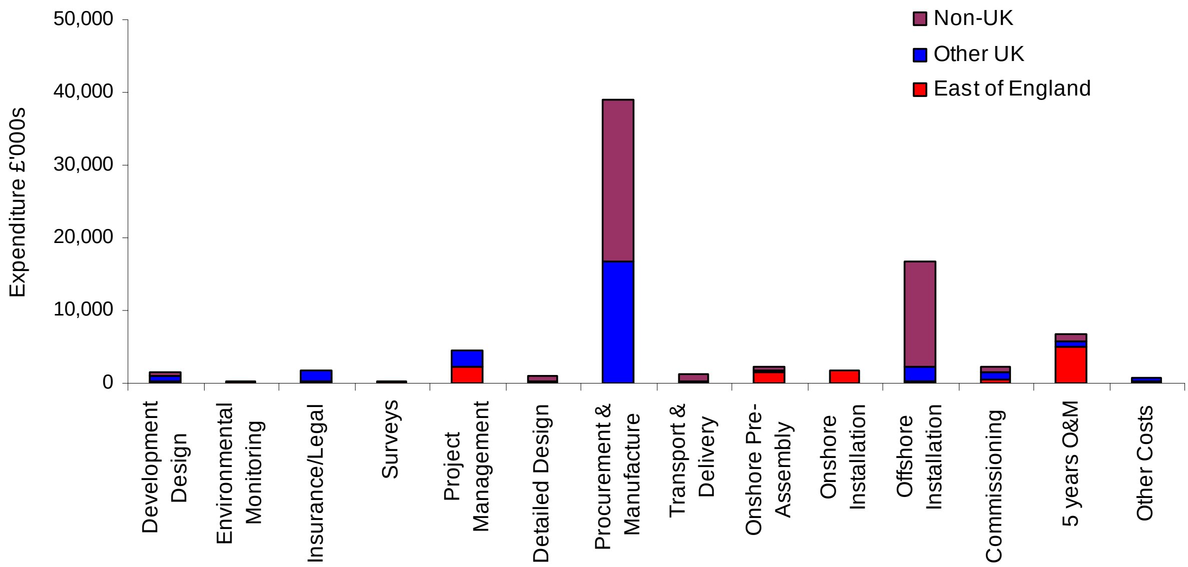

Figure 4-4: Scroby Sands – Value by Tier 1 Category (£'000s)

Table 4-6: Scroby Sands – Value by Tier 1 Category (£'000s)

£'000s	East of England	Other UK	Non UK	Total	E of E %
Development Design	149	780	480	1,409	11%
Environmental Monitoring	162	28	0	190	85%
Insurance/Legal	211	1,568	0	1,779	12%
Surveys	248	12	0	260	95%
Project Management	2,201	2,175	175	4,551	48%
Detailed Design	180	156	775	1,111	16%
Procurement & Manufacture	8	16,821	22,158	38,986	0%
Transport & Delivery	55	235	935	1,225	4%
Onshore Pre-Assembly	1,614	230	356	2,200	73%
Onshore Installation	1,825	0	0	1,825	100%
Offshore Installation	283	1,940	14,478	16,700	2%
Commissioning	613	978	585	2,175	28%
5 years O&M	5,095	550	1180	6,825	75%
Other Misc. Costs	202	486	150	838	24%
Total	12,844	25,957	41,271	80,073	16%

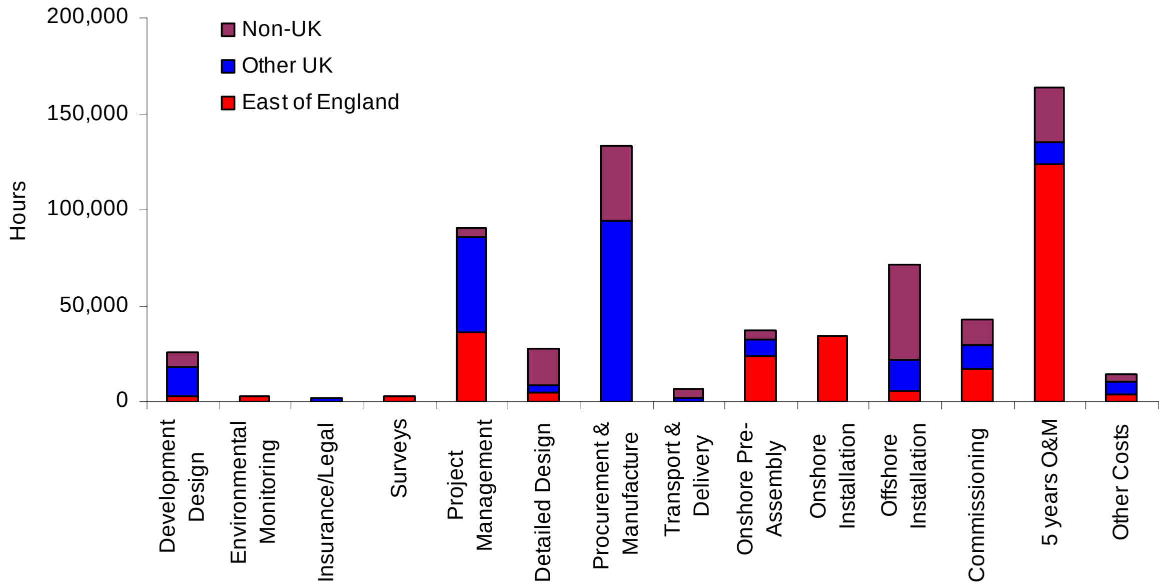

Figure 4-5: Scroby Sands – Hours by Tier 1 Category

Table 4-7: Scroby Sands – Hours by Tier 1 Category

Hours	East of England	Other UK	Non UK	Total	E of E %
Development Design	3,268	14,485	8,000	25,752	13%
Environmental Monitoring	2,860	277	0	3,137	91%
Insurance/Legal	400	1,633	0	2,033	20%
Surveys	2,479	119	0	2,598	95%
Project Management	35,875	50,250	4,375	90,500	40%
Detailed Design	4,500	3,758	19,375	27,633	16%
Procurement & Manufacture	200	94,019	39,261	133,479	0%
Transport & Delivery	400	1,500	4,500	6,400	6%
Onshore Pre-Assembly	24,281	8,422	4,847	37,549	65%
Onshore Installation	34,375	0	0	34,375	100%
Offshore Installation	5,400	16,560	49,500	71,460	8%
Commissioning	17,500	12,072	13,304	42,875	41%
5 years O&M	124,160	10,715	28,855	163,730	76%
Other Misc. Costs	3,702	6,561	4,286	14,548	25%
Total	259,399	220,369	176,301	656,069	40%

4.3 East of England Operational and Planned Offshore Wind Farms

Table 4-8: East of England – Offshore Wind Farms Operational & Planned 2004-2012

Scenario	Project Name	Developer	Location	Target Online	MW	Turbines	Turbine Size	Water Depth
S1	**Scroby Sands**	EROWL	off Caister, Great Yarmouth	2004	60	30	2 MW	2-10m
S1	**Kentish Flats**	GREP	off Whitstable, North Kent	2005	90	30	3 MW	5m
S1	**Inner Dowsing**	Centrica with RES	off Ingoldmells, Skegness	2006	90-108	30	3-3.6 MW	10m
S1	**Lynn**	Centrica	off Skegness, Lincs	2006	90-108	30	3-3.6 MW	10m
S1	**Gunfleet Sands**	GE Wind	off Clacton-on-Sea, Essex	2007	108	30	3.6 MW	8m
S1	**Cromer**	EDF	off Mundesley, Norfolk	2007	90-108	30	3-3.6 MW	23m
S2	**Gunfleet Sands phase II**	GE Wind	off Clacton on Sea, Essex, Thames Estuary	2008	64	16	4 MW	8m
S2	**Humber Gateway**	Eon UK	off Spurn Head, Greater Wash	2009	300	60-100	3-5 MW	12-14m
S2	**Lincs (Inner Dowsing II)**	Centrica with RES	off Skegness, Greater Wash	2009	250	50-83	3.6-5 MW	13m
S2	**London Array – (LAWL) 1**	EROWL and Core	Thames Estuary, London	2009	300	60-100	3-5 MW	8-12m
S2	**Sheringham Shoal**	Scira Offshore Energy	off Cromer, Greater Wash	2009	315	63-105	3-5 MW	15m
S2	**Greater Gabbard**	Airtricity and Fluor	off Orford, Thames Estuary	2010	500	100-139	3.6-5 MW	15m
S2	**Dudgeon East**	Warwick Energy	off Cromer, Greater Wash	2010	300	60-100	3-5 MW	20m
S2	**London Array – Shell**	Shell	Thames Estuary, London	2010	333	66-111	3-5 MW	8-12m
S2	**Thanet**	Warwick Energy	off North Foreland, Kent, Thames Estuary	2010	300	60-100	3-5 MW	18m
S2	**Westernmost Rough**	Total	off Aldbrough, Holderness, Greater Wash	2010	240	60-80	4-5 MW	16m
S2	**Docking Shoal**	Centrica with Amec	off Skegness/Hunstanton, Greater Wash	2010	500	100-125	4-5 MW	15m
S2	**London Array – (LAWL) 2**	EROWL and Core	Thames Estuary, London	2011	367	73-122	3-5 MW	8-12m
S2	**Race Bank**	Centrica with Amec	off Skegness/Hunstanton, Greater Wash	2011	500	100-125	4-5 MW	25m
S2	**Triton Knoll**	Npower Renewables	off Mablethorpe, Greater Wash	2012	1,200	240-300	4-5 MW	28m

The above table provides basic details of the projects in the East of England. To date the region has one operational project – Scroby Sands – which was completed in 2004. Each individual project is profiled below. Whilst only several Scenario 2 projects are located in water depths greater than 25 metres they have been defined as Scenario 2 projects due to the size of the turbines being used and the size of the projects.

Full project profiles are included in Appendix 4.

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5 SURVEY FINDINGS

Note: All commentary contained within Chapter 5 Survey Findings is the opinion and perspective of the individuals contacted for interview as part of the POWER project. Comments provided are intended to provide an insight into the views and experiences of a broad cross section of the supply chain to the offshore wind sector and in no way represent the professional opinion of the authors of this report or any other project partner.

5.1 Company Profile

The interview programme has focused on companies who are either active within the supply chain to the offshore wind sector within the East of England, or have the capability to be so. 95 companies were initially identified for interview encompassing a broad representation of all activities involved in the development, construction and operation of offshore wind farms. Interviews have been completed with 32 companies to date, and while further responses are anticipated it is believed that a thorough representation of the views and experiences of the supply chain has been obtained.

Table 5-1: POWER – Companies Interviewed

Company Name	Primary Phase	Primary Role	Primary Activity
Associated British Ports	Construction	Service	Ports & Supply Bases
Bosch Rexroth Limited	Construction	Manufacture & Supply	Hydraulics & Pneumatics
CBI John Brown	Construction	Engineering	Integrated Services
CEFAS	Development	Research & Development	Environmental Assessment & Monitoring
Centrica	Development	Operator	
Econnect Construction	Development	Service	Cables & Connectors
E-Tech Group	Construction	Engineering	Electrical Equipment, Materials & Services
Fluor	Development	Operator	Integrated Services
Folliard Hydraulics	Construction	Manufacture & Supply	Hydraulics & Pneumatics
Fordham Johns	Construction	Consultants	Fabrication & Construction
GE Energy	Development	Operator	Wind Turbines & Towers
Global Marine Systems	Construction	Engineering	Cables & Connectors
GYPA	Construction	Service	Ports & Supply Bases
Halcrow Group	Development	Consultants	Survey & Positioning
Hiken Limited	Development	Consultants	Feasibility & Front End Studies
Hutchinson Port Holdings	Construction	Service	Ports & Supply Bases
Lamva Limited	Construction	Engineering	Cables & Connectors
Marsh UK	Development	Service	Accountancy, Financial, Insurance & Tax
McNicholas Construction	Construction	Engineering	Cables & Connectors
Norton Peskett	Development	Service	Legal
ODE	Construction	Engineering	Project Management
Offshore Marine Contractors	Construction	Service	Support Vessels
Pager Power Limited	Development	Service	Environmental Assessment & Monitoring
Project Development Solutions	Development	Engineering	Control Systems, Topsides & Subsea
PSL Energy Services	Construction	Service	Inspection & Testing
Resoft Limited	Development	Service	Wind Turbines & Towers
Royal Haskoning Limited	Development	Consultants	Environmental Assessment & Monitoring
Screwfast Foundations	Construction	Manufacture & Supply	Foundations & Piles
SLP Energy	Development	Operator	Fabrication & Construction
Trinity House	Development	Manufacture & Supply	Navigation Aids
TWI Limited	Development	Research & Development	Inspection & Testing
Vestas	Construction	Manufacture & Supply	Wind Turbines & Towers

The geographic cluster of offshore oil and gas related activity in the vicinity of Great Yarmouth and Lowestoft servicing the Southern North Sea has necessitated a focus on suppliers located within Norfolk and Suffolk. However, where possible, attention has been maintained on ensuring a representation of views from throughout the region, as well as stakeholders from outside of the region.

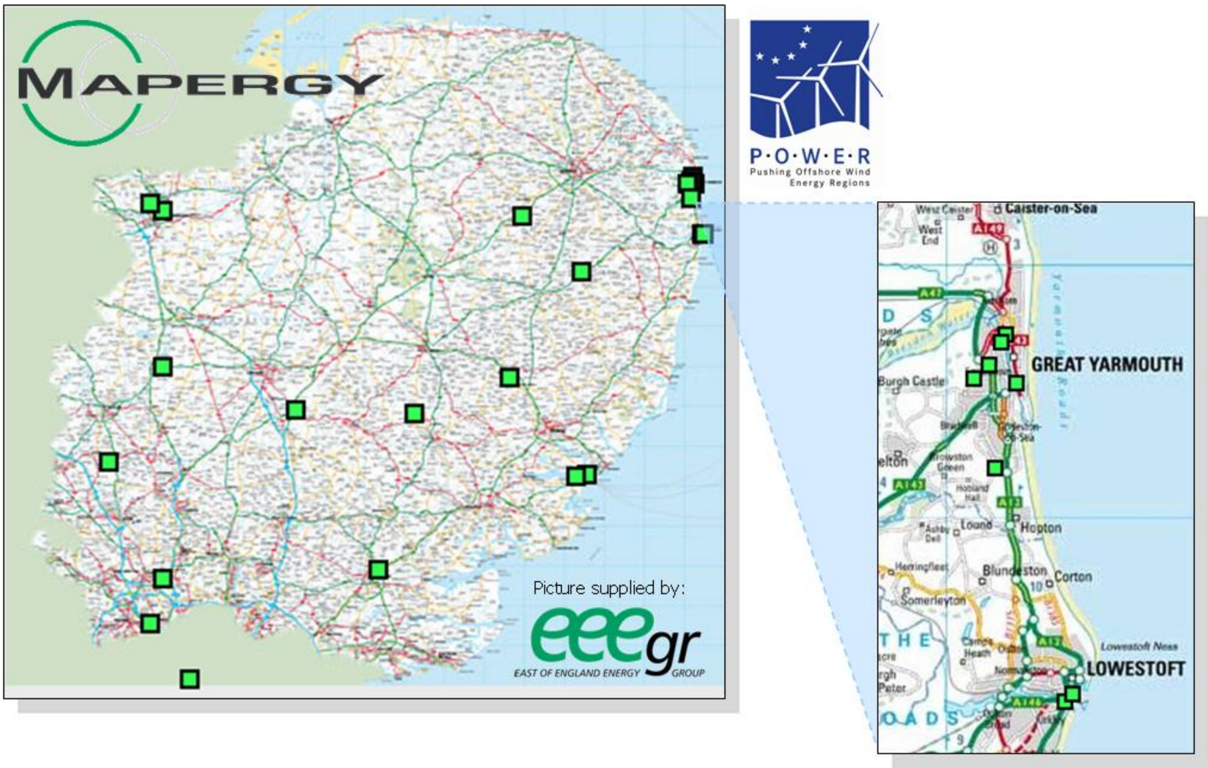


Figure 5-1: Geographical Location of Companies Interviewed

Of those interviewed, 66% (21) had previous experience of working within the offshore wind sector. Of the 11 companies who had no previous experience, all recognised a potential application of their companies' products and services to offshore wind and 7 have definite plans to develop this capability in the foreseeable future (3 are currently tendering for work within UK offshore wind developments).

The total level of employment within these companies directly attributable to offshore wind is difficult to quantify, as those with responsibility for the sector are either temporarily involved as part of a broader renewable energy remit (for instance) or are part of a team monitoring the market prior to potential market entry. The skills sets of such positions are fundamentally multi-disciplinary and encompass: engineering, scientific, marketing, sales, planning, marine piloting, project management, law, financial and computing based competencies.

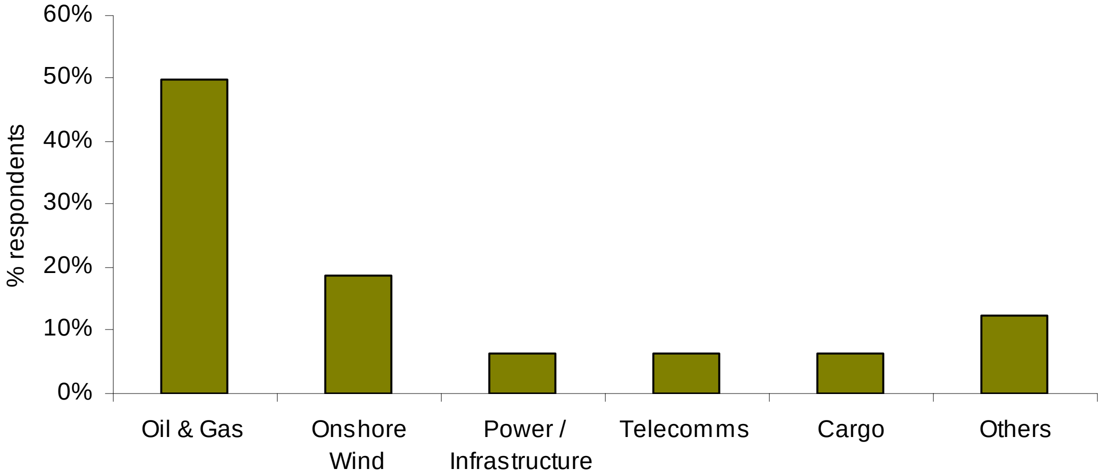


Figure 5-2: Primary Market of Companies Interviewed

The primary market of respondent companies is oil and gas, with 50% of companies questioned listing it as the primary component of turnover. Other key markets included: nuclear, renewable energy (particularly onshore wind, solar, biomass and wave & tidal related activity), water, electricity, marine, food processing, defence, petrochemical, mining, power generation, telecommunications, freight and scientific research for a variety of clients within industrial, commercial and public enterprises. 47% of companies interviewed source in excess of 75% of company turnover from activities undertaken within the East of England.

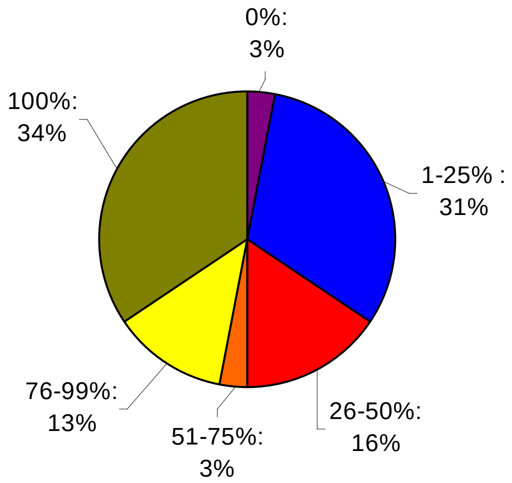


Figure 5-3: Proportion of Respondent Company Turnover Sourced from East of England

"Offshore renewables has only recently emerged having taken 2-3 years to develop, oil and gas will remain the dominant component of company turnover."

However, as traditional markets, such as oil and gas, have declined renewable energy developments have emerged as markets of increasing significance and as associated technologies continue to evolve diversification opportunities will become increasingly commercially attractive. Indeed 81% of companies surveyed expect offshore wind to comprise a growing proportion of their annual turnover over the course of the next 5 years as opportunities emerge throughout the supply chain. Attracted by the relatively high levels of capital expenditure associated with projects that will continue to increase in size and scale, the relatively quick project turnaround and market with relatively few players companies see offshore wind as a vast opportunity.

"The next 5-6 years promises particularly strong potential for offshore wind – however, it has been, and will continue to be, slow to develop to date."

However, to date, levels of research and development activity have been restrained with only 25% of companies surveyed currently conducting some form of offshore wind related research and development. As such, although such activity is vital to the continued development of the sector, the low margins that currently characterise the industrys' and companies' desire for a technological edge is impeding industry collaboration. As such, there are generally fewer research and development packages than there could be and those that exist are more specific and further from the market. However, specific examples of innovation remain, most notably Trinity House's Lidar buoy and the multitude of studies completed within CEFAS and TWI in particular.

5.2 Offshore Wind Activity

5.2.1 Experience

Of those companies active within the offshore wind sector contributions have been made at all levels of the supply chain, with clients to date varying from developers, turbine manufacturers and installation contractors to government agencies, banks, defence agencies and technology holders. The contract strategy under which such work has been completed varies with the nature of the work undertaken, however, to date have predominantly been through one-off contracts for individual pieces of work. To date, 63% of respondent companies have maintained a level of regional content in excess of 75% in offshore wind related contracts.

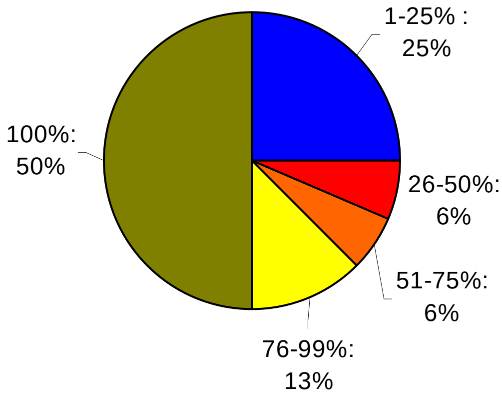


Figure 5-4: Level of East of England Content

In developing such activity local suppliers have been identified as being employed for survey, environmental, cable, diving, port, and support-related competencies, as well as the supply of switchgear, transformers, oceanographic instrumentation and support vessels. Difficulties have been experienced throughout the supply chain in finding the right suppliers in what remains a relatively new market, however, as the flow of projects improves the supply chain is expected to continue to emerge. Until such a time companies within the higher tiers of the supply chain are being forced to use multiple suppliers to combat the current lack of capability and capacity, typically deploying a supplier base of 3-4 companies for each component, with the same sub-suppliers used regardless of project location.

5.2.2 Capability

"Future diversification will be a function of the prosperity of the oil and gas sector – we have been waiting for 4 years for offshore wind to develop into the industry we all hoped for, .however, it is still to materialise."

Of the 11 companies that have not been previously active within the offshore wind sector all have recognised offshore wind as a potential alternative market, principally within the construction phase, 5 are currently actively pursuing an involvement within the sector (with 3 currently at the tender stage for work on offshore wind developments) and the remaining 6 will potentially do so within the foreseeable future. The timing and level of future activity will largely be determined by the prosperity of current key markets, as there remains a degree of scepticism as to the current economics of the sector and the opportunities for UK companies. All 11 companies have experience within related industries, principally oil and gas, onshore wind, telecommunications, infrastructure and other renewable energy sectors (i.e. grid connection).

"Offshore wind is the biggest thing to happen to the Southern North Sea in the last decade, however it is proving difficult for SME's to penetrate the supply chain."

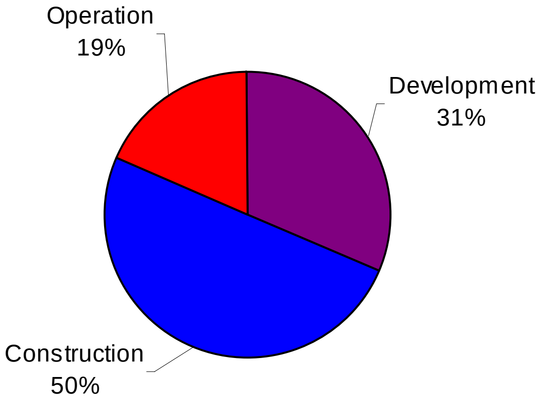


Figure 5-5: Perceived Opportunity for Market Entry Phase

5.2.3 Future Market Potential

The perceived opportunities for companies within the supply chain to the offshore wind sector, or with the potential to be so, are strong. However, expectations for the future market potential will remain uncertain until the sector develops further. For although companies are largely aware of the major growth potential offered by offshore wind, and are attracted by the increasing size and relatively quick turn around of projects, the effort to return ratio remains unbalanced and there are numerous examples of companies making losses on work undertaken in the sector to date.

"While the opportunity is there it becomes a question of timing and market maturity – we will require a return on the time and money we have invested."

Indeed the current low quantity of infrequent orders has meant that the requisite economies of scale are yet to be established, and UK suppliers are struggling to compete with their European counterparts who are believed to be benefiting from a larger quantity of repeat business built upon existing supply chain relationships with the principal turbine manufacturers. As such, the key offshore contracting element of the sector is yet to fully take shape as progress on national developments have been subject to continued delays. The current focus of the supply chain has therefore remained on the development phase of the project lifecycle, and while initial in-roads have been made into the construction phase many companies have preferred to keep a watching brief as the economics of the sector are tested.

5.3 Areas of Concern

5.3.1 Problems Experienced

59% of companies interviewed have experienced some form of problem working on offshore wind related projects. The primary issue to date has been one of economics, as the tight margins which characterise the sector have meant that prices have simply been too low and contractors have subsequently lost money. This is believed to have been partly due to developers not yet fully comprehending the true technological and commercial feasibility of developments.

Furthermore, the continued delays to UK developments have compounded such uncertainties, as while expectations within the supply chain are that 2006 will see the initiation of a steady stream of projects through to the end of the decade and beyond, the current unpredictability of the market has made it increasingly difficult to justify investment decisions. Of the projects that have progressed suppliers are experiencing difficulties in the duration of the tendering process and allocation of risk between the various elements of the project supply chain. Indeed, questions remain as to who will bear the risk in the future in what is an inherently risky process given the continued uncertainties relating to the consenting process and relatively unknown nature of operating in an offshore environment.

The current delicacy of the wind turbine market is characterised by concerns that developers are pushing turbine manufacturers in particular to develop and deploy new systems without the necessary testing. The relatively low level of research and development and perceived lack of interaction between and among developers and contractors is also believed to have prevented the lessons learnt from previous developments, and the oil and gas industry, from being harnessed to allow the evolution of an efficient supply chain.

Suppliers, and particularly small and medium sized enterprises, are also struggling to establish themselves within the tendering process to offshore wind farms. In the absence of a UK-based turbine manufacturer such suppliers have been unable to fully develop relationships with key players which, when coupled with the sporadic nature of work within the sector and perceived changes in client requirements, have restricted the contribution of UK suppliers particularly within the construction phase. Furthermore, smaller suppliers are finding difficulties in establishing their credibility within the tendering process, as they may lack the financial capability and experience contractors require.

Market intelligence has also proved to be a major constraint to supply chain activity as suppliers have found difficulty in establishing industry developments, relevant contacts within the appropriate companies and, perhaps most importantly, how to qualify as a potential supplier. For instance, as developments change hands suppliers can struggle to keep track of who owns what and are therefore restricted in developing the relationships that is fundamental to a business such as this.

Other critical constraints within the supply chain have been identified as: a lack of vessels, insufficient supplier capacity, the price and availability of steel, regional ports currently lacking the capability to service sizable projects and an absence of skilled labour as the oil and gas industry (and other related industries) drive down the skills base.

5.3.2 Anticipated Problems

"We currently have no belief in the economics of offshore wind – seeing is believing."

Such problems are expected to continue and in some case be exacerbated as the market continues to develop. Of the respondent companies 84% expect problems with their further involvement in the sector, however in the main such issues are not believed to be insurmountable. However, there remains an air of scepticism among suppliers as to the short-term business case of an involvement in offshore wind developments, as project economics are not expected to be viable until projects move into deeper waters and make the anticipated increases in size and scale.

5.3.3 Lessons Learnt

The experiences of regional suppliers within the offshore wind sector to date illustrates the current difficulties throughout the supply chain to the sector, however, key lessons can, and have been, learnt by suppliers. The primary area of note has been the need to continue to operate within companies' key competencies when diversifying into related markets. If companies are seeking to move into other areas it is believed to be best done through the formation of strategic partnerships with established or emerging industry players, particularly within a market which is proving unpredictable and slow to develop.

"Market penetration has been eased by collaboration which has allowed us to profile our competencies and develop our products tailored to specific industry requirements."

A further key determinant of the success of suppliers within the offshore wind sector has been the timing of market entry, with particular benefits being seen among those companies who entered the market at its early stages. Early market entry not only allows the development of highly valued industry experience but also facilitates a complete understanding of the market.

"We have benefited greatly from an early involvement in the market and an examination of contract strategies prior to entering the market."

Furthermore, experience in other sectors illustrates the difficulties of entering a market and competing against established market leaders. Indeed there is a prevailing view that the offshore wind market will be dominated by those that are currently active, with a gradual consolidation of contractors and manufacturers alike. Indeed, while it is acknowledged that the supply chain is yet to fully emerge, and will not do so until the market fully develops, the timing of market entry is vital as suppliers may not be in a position to act (i.e. with the requisite experience) when opportunities arise.

A final key lesson has been the need for interaction throughout the supply chain, particularly between developers and the supply chain. However, developers and contractors are faced with a dilemma of finding a balance between meeting the short lead times associated with current projects and educating and developing the supply chain to meet future industry requirements. In achieving such a balance communication is vital between all parties to ensure the efficient leverage of the skills and expertise of the regional supply chain to meet the evolving requirements of future offshore wind developments.

5.3.4 Barriers to Entry

The problems experienced among regional suppliers illustrate the difficulties of working within the offshore wind sector, and these issues will have particular relevance to other regional companies seeking to enter the market. Indeed 59% of companies interviewed believe there to be significant barriers to entry to involvement in the sector, principally in the form of penetrating current and future supply chains, restrictions created by prevailing contract strategies and a lack of equipment and technologies.

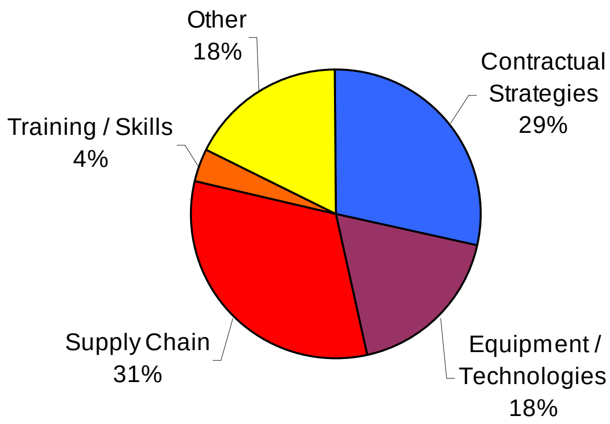


Figure 5-6: Offshore Wind – Barriers to Entry

"As margins remain tight contractors are tending to use tried and trusted suppliers – as there are currently no UK fabricators local suppliers are losing market share."

Difficulties in penetrating prevailing supply chains originate from the perceived insular culture of key contractors within the offshore wind sector, particularly turbine manufacturers, which is illustrated by their currently restrictive procurement policies and compounded by the timely and costly nature of the bidding process. The lack of UK manufacturing capability has also restricted suppliers in building relationships with key industry decision makers which can precipitate market entry. For suppliers entering the market potential clients are often unwilling to be a 'first customer', which can only be broken down by close interaction with potential clients.

"Doubt suppliers know whether they are in a position to work within offshore wind."

There is also a belief that the opportunities open to potential suppliers within the offshore wind supply chain are being masked by the use of EPIC (Engineering, Procurement, Installation and Commissioning) type contracting strategies. Furthermore suppliers are being deterred from attempting to enter the market by perceived limitations in capacity, capability and experience relative to their European counterparts, particularly working on projects of a significant scale in an offshore environment. Even when a viable opportunity has been identified suppliers are unclear as to how best to get on a tender list.

"Offshore wind is not a closed shop and the ongoing work of the likes of EEEGR has helped to remove any that there may have been."

5.4 East of England Supply Chain

5.4.1 Strengths

"Believes suppliers will appear if a market materialises – however, we are currently in a time lag."

In servicing related industries in recent decades, particularly the oil and gas industry, the East of England has developed a capability to support the majority of future offshore wind activity within the region. Indeed it is widely believed that the region has the experience, skills and expertise present within the supply chain to support all aspects of the development and operations phases of an offshore wind farm. Specific areas of regional strength have been identified to be: project management, offshore engineering, environmental consultancy, insurance, surveys, and operation and maintenance developed particularly within the cluster of offshore expertise located within Great Yarmouth and Lowestoft.

"It is only turbines that cannot realistically be manufactured within the East of England; we have the skills and resources here, along with the space and logistics to cater for every requirement of the sector."

The only perceived weakness of the regional offer is seen to be an absence of manufacturing capacity, which will restrict levels of regional content, however, if galvanised effectively the region is believed to be well positioned to support this emerging sector. Such activity has been promoted by the ongoing efforts of the likes of EEEGR and Renewables East in facilitating the required interaction through the supply chain and regional developments such as the planned development of the Offshore Renewable Energy Centre.

"If the region can service and supply the Southern North Sea, and further a field within the oil and gas industry, it can do the same for offshore wind."

5.4.2 Weaknesses

The primary weakness within the supply chain to the offshore wind sector within the East of England is the lack of large scale manufacturing capability (the impact of which has been discussed previously), however, there remain other fundamental areas for concern. The region continues to lack an established base of experienced suppliers to the sector, as, although regional companies have the capability to be active, only a small proportion has been realised to date. As such, the regional supply chain is not believed to be sufficiently visible and lacks an industry leader (as Shell has been for the regional oil and gas industry).

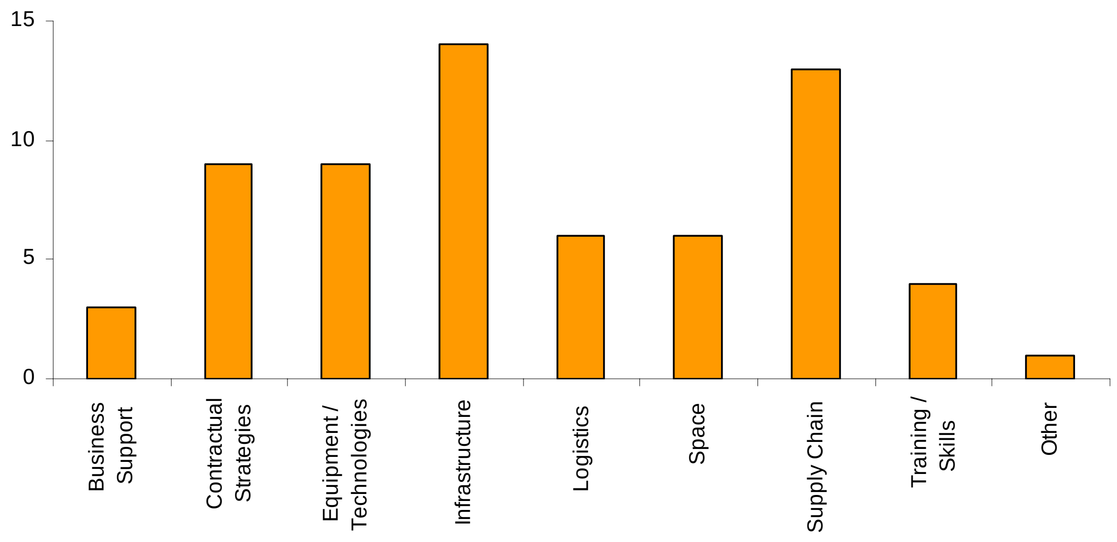


Figure 5-7: Pinch Points for East of England Offshore Wind Activity – Number of Responses

Although geographic proximity can be seen to be an advantage for the supply chain location is incidental within the procurement strategy of the key contractors (although smaller, low value items may be location specific) who will use the same sub-suppliers regardless of project location. Furthermore, offshore wind is a heavily capital intensive process and regional suppliers lack the equipment and technologies (i.e. installation vessels and cable supply) to develop a high level of regional content within the high value components of the supply chain.

"Regional experiences to date illustrate the difficulties of the sector, as although the right noises are being made by developers, these are not yet realised when contract is awarded."

Such flaws are compounded by the region's poor infrastructure, dwindling pool of skilled labour, limited lay-down facilities, restricted port size and poor communication between business support agencies.

5.5 Scenario 2

Respondents were asked to assess the capability and capacity of the regional supply chain to support offshore wind farm under two development scenarios. Scenario 1 developments deploy turbines with a capacity of 3.9 MW or less and are located in water depths of up to 25 metres. Scenario 2 developments deploy turbines with a capacity of 4 MW or more and are located in water depths greater then 25 metres.

5.5.1 The Impact of Scenario 2 Developments

"As regional projects are developed so too will regional industry and the supply chain – becomes a question of positioning the supply chain and timing."

All respondents expect offshore wind activity to grow within the region with the inception of Scenario 2 projects, with the subsequent increased size and scale of developments creating sizeable opportunities for regional companies at all levels of the supply chain. Such developments are expected to provide developers with the opportunity to challenge the economics of the sector and develop a viable supply chain which can place a greater focus on quality rather than cost. The key will be the flow of projects, however, as the number and size of developments increases the market will widen and opportunities will abound.

"Scenario 2 developments will cement the industry as a viable commercial opportunity for the supply chain and as a contributor to renewable energy targets."

Indeed, it is firmly believed that Scenario 2 developments represent an opportunity for the offshore market to finally become a viable economic opportunity for all tiers of the supply chain. There is a widespread optimism that 2006 will see the beginning of a gradual 'ramping up' of regional offshore wind activity which will in turn allow the supply chain to fully mobilise and position themselves.

"The balance may be tipped as developments move into deeper waters and creating larger scale developments – however, seeing is believing, and industry needs a track record of delivering."

The greater volumes implicit within Scenario 2-type developments will facilitate the gradual creation of the requisite economies of scale through the standardisation of equipment and installation techniques, while the required increased length of contracts will create a more secure environment for industry investment. Furthermore, as a flow of such developments is established prevailing contract and financing strategies will be reviewed.

5.5.2 Principal Challenges of Scenario 2 Developments

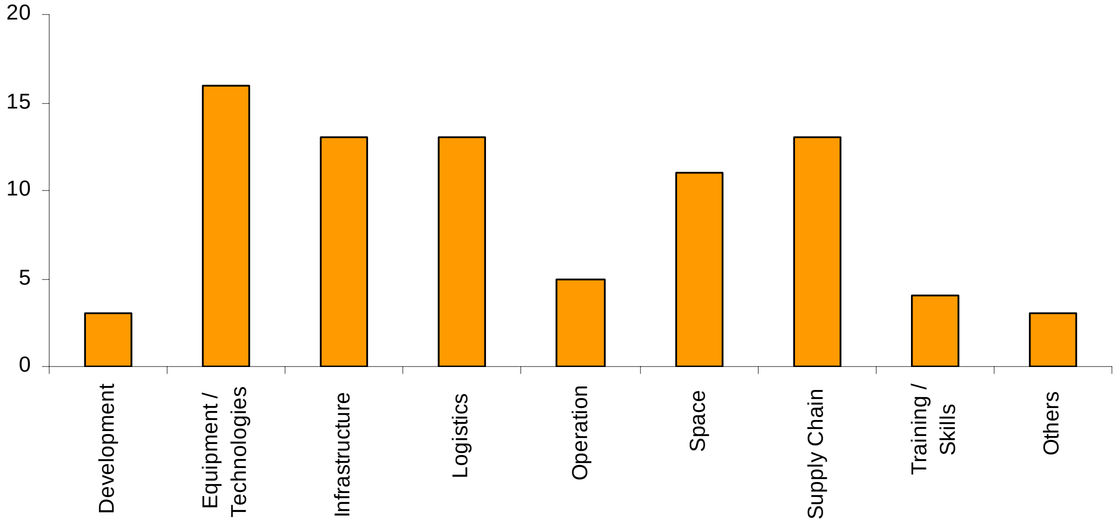


Figure 5-8: Principal Challenges of Scenario 2 Developments

The principal challenge created by the increasing size and water depth of Scenario 2 developments is expected to be the availability of the equipment and technologies capable of facilitating their construction. For while the economies of scale have not yet been proven to work on Scenario 1 developments the technological evolution required to develop the commerciality of Scenario 2 projects will be facilitated by the apparent economic opportunities available at all points of the supply chain. For although the expertise is currently available to develop existing equipment and technologies current tight industry margins have meant no-one has been prepared to finance such developments.

"If it all happens in 2008/9 there will not only be major pinch points but a potential boom and bust scenario as we are unsure what will follow."

There are also expected to be significant capacity restraints. For instance, current market projections suggest a peak of installation activity towards the end of this decade, however, at present there is insufficient manufacturing and installation capacity to service the anticipated levels of activity. The industry therefore requires substantial investment not only to establish feasible project solutions but also to develop the manufacturing and installation facilities to provide the hardware required as well as the supporting infrastructure (roads, grid connection, etc) and logistical bases (ports, etc).

"The east coast is, in principal, the ideal location to base such activity but we are unsure it will be ready for 2010."

A further key challenge within the supply chain to offshore wind developments will come within the evolution of prevailing contract and financing strategies underpinning developments. As the industry develops there is expected to be a gradual movement away from conventional turbine manufacturer-led developments to EPIC and, potentially, alliance style contracting strategies.

"Regional ports require a significant investment, however, cannot be done on a speculative basis - illustrating the problems of the current unpredictability of the market."

Such a trend will be complemented by a movement towards the project financing of offshore wind developments, and will challenge the economics of the sector. Thus as the scale and nature of offshore wind developments increases the opportunities available to regional suppliers will become apparent, however, if they are be successful they will have to be competitive in an increasingly global market place.

5.5.3 The Offshore Wind Supply Chain in the East of England

72% of respondent companies believe the supply chain currently in place within the East of England is equipped to realise the opportunities Scenario 2 developments are expected to create. However it becomes a question of what opportunities are realistically achievable for regional suppliers? The key restraints on regional activity, both directly and indirectly, are the lack of manufacturing and heavy construction capacity in the region and an associated absence of equipment and infrastructure to support the sector.

"The supply chain can only develop if have a continual flow of projects – however, won't be there if present climate continues (i.e. demise of AEI cables)."

Realistically it is not expected that such facilities will be created within the region and, while specific companies can benefit, regional suppliers must begin to position themselves to take advantage of other key opportunities. Developments such as the Offshore Renewable Energy Centre and particularly the Outer Harbour at Great Yarmouth are believed to be vital to the process of maximising the transfer of regional experience generated through the oil and gas and other related industries, to target the specific requirements of offshore wind, particularly within the development and operations phases.

5.5.4 Future East of England Content

"Fearful we will not realise the region's capability and UK content will not reach the levels of Scroby Sands again."

77% of companies believe East of England content will increase within Scenario 2-type developments relative to current activity, principally within the development and operations phases. Such optimism is largely dependent upon the development of a regional port, namely the Outer Harbour at Great Yarmouth, which will be specifically targeted to service the needs of the offshore wind sector. If that were not to be the case expectations of future regional content would recede dramatically, as there would be a danger that as the turbines will continue to be supplied from Europe they will be serviced by a European port and be transported direct to site, therefore severely diluting the opportunities for regional suppliers.

"Projects so marginal will not go ahead with UK equipment."

However, the future competitiveness of regional suppliers, and their long term success in penetrating offshore wind supply chains, remains to be established as they continue to struggle to overcome the insular procurement policies of continental contractors and the variable contracting requirements of developers and owners, and subsequently develop the requisite industry experience. As such regional suppliers are being forced to enter the market at any price, and are accepting project losses inorder to establish industry credentials.

Yet substantial opportunities remain for regional suppliers, both within the UK and beyond, particularly with regard to onshore support and logistics, project management, operations and maintenance, grid integration, onshore cabling and, potentially, even the manufacture of the nacelle (requires standard electrical components which could be supplied by regional suppliers, however, companies are not currently aware of such an opportunity and such a development would be unlikely unless a manufacturing capability is developed within the region).

5.6 Future Development

5.6.1 Supply Chain Wish List

The level and nature of support respondent companies, desire varies with their position within the supply chain, however they fall within 7 key areas:

- Business Support
- Development Assistance
- Manufacturing Capability
- Marketing
- Market Intelligence
- Relationships
- Research & Development.

Business Support – regional support agencies have been recognised as being relatively successful to date in galvanising the supply chain to the energy industry, however further improvements are required. The key desire is for the 'joining up' of regional government bodies and agencies to provide focused support for the sector. Such a process would require an increasingly proactive and cohesive culture between the respective supporting bodies.

"It would be easier to work with 1 account manager and build a single relationship within a single agency rather than having to work between the multitude of partners we have at present."

Development Assistance – government support remains fundamental to offshore wind activity, and will continue to be so for the foreseeable future. As such it is seen to be vital that the UK government show commitment to the sector and initiate the process of developing government support beyond 2010. Such support is believed to be vital to the economics of the sector, both in terms of project financing and creating the confidence among suppliers for the required long-term investments.

"Must leave the renewables obligation untouched, otherwise the industry will lose the ability to project finance as banks will lose interest."

Other areas of suggested assistance at the development phase have been: increased interaction between government, developers and the financial community (potentially in the form of financial forums) so as to develop confidence among financiers as to future government policy, de-mystifying the regulatory hurdles that continue to impede developments and clarifying the involvement of other industry stakeholders (such as fishermen).

Manufacturing Capability – the key weakness of the regional, and indeed UK, supply chain to the offshore wind sector is the lack of manufacturing capability. Companies therefore wish to see attempts be made to bring a manufacturer (particularly a turbine manufacturer) into the region. However, while the associated supply chain opportunities for local companies offering manufacturing support are accepted such a move is unlikely until the flow of regional, Scenario 2 projects has begun to develop in earnest.

Marketing – the marketing of company and regional capabilities requires substantial future development. Regional suppliers continue to require assistance in developing and promoting their position within the market, and must be supported by the continued promotion of the region as having the ability to competently provide a basis for what remains an emerging industry. Not only is such a process invaluable in assisting regional suppliers to penetrate prevailing supply chains, but it will also promote the industry as a potential market to suppliers with a capability of servicing the sector.

"Renewables East's Vestas visit is the first of that type we are aware of within the region – excellent idea in illustrating strength of regional skills and facilities."

Market Intelligence – the offshore wind sector is currently a relatively small community, however, suppliers still have difficulties in keeping up to date with industry developments, particularly if they are seeking to enter the market. Market intelligence is therefore vital in facilitating a proactive supply chain, particularly in developing company awareness of industry activity, project developments and potential contacts within key industry decision makers (potentially in the form of a newsletter profiling tenders released and other market information).

Companies entering the market also require practical advice on entering the market, as small and medium sized enterprises in particular lack the resources to develop the requisite marketing initiatives. Such a service should essentially provide an understanding of the market in the form of identifying the main industry players and the nature of their supply chains, and could be developed to providing companies with assistance in pre-qualifying as a potential supplier to key contractors (through the supply of vendor questions).

Relationships – companies also require assistance in developing relationships, with both clients and suppliers at all points in the supply chain. Such a process centres of the facilitation of access to the supply chain by providing access to the decision makers within key players and facilitating partnerships between companies with mutually benefiting product portfolios. A further required development is the need for a greater culture of transparency between industry participants, principally in the form of shared learnings and experiences with other members of the industry.

"Must connect this young industry by offering one point of contact."

Research and Development – UK government is widely believed to be relatively poor in supplying the funding required to assist technology development throughout the economy. However, in the case of offshore wind it is widely accepted that the market simply will not evolve unless it is able to develop the required investment. However, to do so requires government backing and support, both in the form of long-term support for the sector as a whole and direct support for technological innovation.

5.6.2 Role of Business Support

"Vital in allowing the realisation of synergy between regional companies as facilitate contact."

Perceptions as to the importance of the role of business support agencies varies widely through the supply chain, largely due to varying interpretations of their potential impact and the level at which such intervention can be precipitated. For instance, 39% of respondent companies currently see such agencies as pivotal to the development of a supply chain supporting the offshore wind sector, largely in the form of a provider of market intelligence, facilitator of access to the supply chain and promoter of the regional profile.

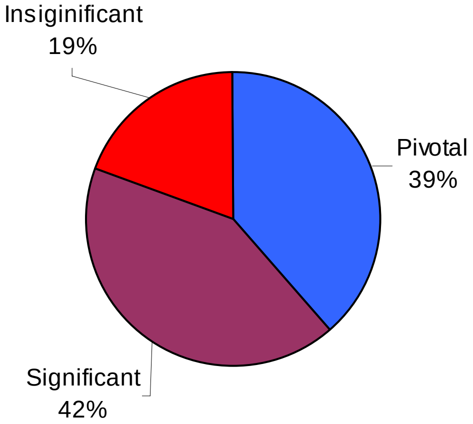


Figure 5-9: Perceived Importance of Business Support Agencies

"The regional business support agencies are highly significant when they are linked up and communicating in advance."

However, 19% believe that such work is incidental in the belief that there is little that can be done to stimulate and support supply chain development. Such opinion is highly subjective, and there remains a consensus that the work that is being done within agencies such as the DTI, EEDA and the likes of EEEGR and Renewables East will continue to develop regional content in future offshore wind developments.

5.6.3 Success to Date

"Increasingly proactive, however, still need a greater cohesion between the respective agencies."

Business support within the East of England to the offshore wind sector is believed to be continuing to develop, however the level, nature and impact of such activity has been widely praised by respondent companies. However, it is vital that such agencies maintain this initiative and continue to progress with the requisite focus, cohesion, funding and support from private enterprise. Key success have been highlighted within the promotional and networking activities of EEEGR and Renewables East, with specific success stories identified, and all indications are that regional suppliers will continue to support such events wherever possible.

"Found networking opportunities and promotional activities of EEEGR and Renewables East to be extremely useful – have indirectly won work on the back of such an event."

A key insight into the success of business support activities within the region is the significant impact suppliers feel not providing such support would have on their activities. For the implied lack of co-ordination would be expected to be a major inhibitor to the development of an efficient regional supply chain, and would severely prohibit the access to small and medium sized enterprises to the market.

"We would not have received the impetus to explore the market potential of offshore wind without the backing of EEEGR and Renewables East."

6 SCENARIO 1 – EAST OF ENGLAND CAPABILITY

6.1 Typical Attributes of a Scenario 1 Project

In assessing current and prospective East of England supply chain capability two different development scenarios were created to take account of the difference between the existing supply chain for smaller turbines in shallower waters and the required future supply chain for large scale, deep water offshore wind farms.

Scenario 1 considers projects typical of the current first round projects currently operational, under construction or in planning in the UK. Scenario 1 projects are defined as using turbines with a capacity of up to 3.9 MW and being located in water depths of up to 25 metres.

6.2 Scenario 1 Capability Assessment and Analysis

In servicing related industries, most notably offshore oil and gas, the East of England has developed a strong base of suppliers who have the capability to be possible contributors to all phases of Scenario 1 offshore wind developments. Indeed assuming the region's infrastructure can be developed appropriately the sector is expected to emerge as a major opportunity as an alternative market for regional companies. The sector has provided a new area of focus for the regional offshore supply chain which has recently been shaken by Shell's departure and subsequently sought to safeguard against the vagaries of the oil and gas sector.

However, at present the region lacks a consolidated base of experienced suppliers to the offshore wind sector as little of the potentially substantial regional capability has been realised to date. Indeed, questions remain among regional companies over the economics of the sector as, in spite of substantial initial interest, the difficulties of small and medium sized enterprises in particular in winning work on Scroby Sands has created a perception that contracts on future projects may be unobtainable.

Although the skills and expertise are in place, the region lacks the equipment and infrastructure to fully support even Scenario 1 developments, particularly in the construction phase. Therefore regional suppliers are not currently as well positioned to take advantage of sectoral opportunities as some of their European competitors. This has been compounded by difficulties in breaking established supply chains which has created a sense that while specific companies can benefit the regional supply chain as a whole can only compete for lower value opportunities.

Table 6-1: Scroby Sands – Value (£'000s)

£000s	Total	East of England	Other UK	E of E %
Procurement & Manufacture	38,986	8	16,821	0%
Offshore Installation	16,700	283	1,940	2%
5 years O&M	6,825	5,095	550	75%
Project Management	4,551	2,201	2,175	48%
Onshore Pre-Assembly	2,200	1,614	230	73%
Commissioning	2,175	613	978	28%
Onshore Installation	1,825	1,825	0	100%
Insurance/Legal	1,779	211	1,568	12%
Development Design	1,409	149	780	11%
Transport & Delivery	1,225	55	235	4%
Detailed Design	1,111	180	156	16%
Other Misc. Costs	838	202	486	24%
Surveys	260	248	12	95%
Environmental Monitoring	190	162	28	85%
Total	80,073	12,844	25,957	16%

As an example of the proven contribution of the East of England supply chain to Scenario 1 type developments, data from an analysis of the Scroby Sands project off Cromer has been provided by Renewables East (as presented in *Scroby Sands – Supply Chain Analysis* completed by Douglas-Westwood Ltd and ODE Ltd for Renewables East in May 2005). The respective contributions of UK and East of England suppliers to the development, construction and operation of Scroby Sands gives a clear indication of the key strengths and weaknesses of national and regional suppliers, and infrastructure, as well as an indication of key areas of future content.

70% of the value of contracts awarded for Scroby Sands related to the procurement and manufacture of components and offshore installation. However, of a total value of approximately £56 million only £19 million was sourced from within the UK and just £291,000 from within the East of England. Indeed the majority of the East of England's 16% content has been sourced from relatively low value, service-based activities, with the region providing high levels of project management, surveys, environmental monitoring, onshore pre-assembly and operations and maintenance activities.

Table 6-2: Scroby Sands – Hours

Hours	Total	East of England	Other UK	E of E %
5 years O&M	163,730	124,160	10,715	76%
Procurement & Manufacture	133,479	200	94,019	0%
Project Management	90,500	35,875	50,250	40%
Offshore Installation	71,460	5,400	16,560	8%
Commissioning	42,875	17,500	12,072	41%
Onshore Pre-Assembly	37,549	24,281	8,422	65%
Onshore Installation	34,375	34,375	0	100%
Detailed Design	27,633	4,500	3,758	16%
Development Design	25,752	3,268	14,485	13%
Other Misc. Costs	14,548	3,702	6,561	25%
Transport & Delivery	6,400	400	1,500	6%
Environmental Monitoring	3,137	2,860	277	91%
Surveys	2,598	2,479	119	95%
Insurance/Legal	2,033	400	1,633	20%
Total	656,069	259,399	220,369	40%

An analysis of the hours spent worked within each of the key contracts awarded for the development, construction and operation of Scroby Sands illustrates the relatively low value nature of East of England content within the project. For while regional content relates to 16% of the value of contracts awarded on Scroby Sands it accounts for 40% of the hours spent on the project, with UK content growing from 48% to 73% respectively.

6.3 East of England Supply Chain Profile

In profiling the supply chain to the offshore wind sector within the East of England reference is made to the East of England Energy Group's (EEEGR) ongoing development of its internet-based supply chain mapping system 'Mapergy'. 'Mapergy' is driven by an underlying database of some 2,500 companies and enables their actual distribution by geographic location (postcode) to be clearly displayed.

In developing this system it has become necessary to classify regional companies according to their activities, with for example 'project management' companies servicing the 'Oil & Gas' and / or 'Offshore Wind' industries being displayed as such. As such a set of keywords classifying company activities within the supply chain to the energy industry have been created within the Catalogue of Energy Industry Classifications (see Appendix 2).

6.3.1 The Catalogue of Energy Industry Classifications

The Catalogue has sought to create a “pragmatic” coding system to be applied to all companies identified as, seeking to be or with the capability to be working within the supply chain to the energy industry. The framework created will act as a means of facilitating the identification of specific capabilities of companies servicing one or more sectors and enable the effective segmentation of the industry through the creation of three independent, relational datasets, structured as a keyword listing. The three independent relational datasets are;

1. **Industry Sectors** – Oil & Gas, Offshore Wind, Onshore Wind, etc
2. **Industry Roles** – Operator, Service Provider, Support Organisation, etc
3. **Industry Activities** – Project Management, Installation & Commissioning, etc

116 categories have been created, comprising 11 Sectors, 10 Roles and 95 Activities. Companies are allocated the **Sector** they are servicing (i.e. Oil & Gas), the **Role** they perform (i.e. Engineering) and the **Activity** which best describes their activities (i.e. Fabrication & Construction).

In creating such a system care has been taken to deliver upon the specific project brief provided by EEEGR. However, given the depth of knowledge and experience within the energy industry, as soon as any list is prepared for use, others will seek to redefine or amend. It is therefore acknowledged that any coding or classification system will never be completely accurate or practically usable.

6.3.2 East of England Supply Chain Profile

Having established an appropriate framework of use The Catalogue of Energy Industry Classifications has been integrated into ‘Mapergy’ and applied to all relevant companies within the supporting database. At this stage priority has been given solely to analysing companies who are located within the East of England (or have a direct link to regional industry) and those who have a direct capability to work within the Energy industry.

1,275 regional companies have been identified as being either active or having the capability to be directly involved in the supply chain to the energy industry. A preliminary analysis of the capabilities of each of these companies has now been completed, with specific focus being given to establishing company’s industry roles and activities. However, the results of this analysis must, at this stage, be treated with caution as the dataset requires further analysis and should be supplemented by primary contact with the companies in question to verify classifications. It is also recognised that amendments are required within the Catalogue of Energy Industry Classifications to better represent the broader scope of the industry.

Table 6-3: Top 10 Activities of East of England Companies

Activity	Regional Companies
Training	127
Business Development	123
Safety, Security & Firefighting	89
Computing & Information Technology	73
Marketing	73
Instrumentation	65
Electrical Equipment, Materials & Services	61
Project Management	59
Personnel	58
Media	54

An analysis of the primary areas of focus for regional companies within the energy industry illustrates the bias towards service-based activities, with the highest weighting of companies active in the training of industry personnel and provision of business development related services. Interestingly of those tasks with specific relevance to the offshore wind sector there are a particularly high proportion of regional companies with a capability of manufacturing and supplying instrumentation and electrical equipment, materials and services, the provision of project management and health and safety expertise and the supply of personnel.

When analysing the number of companies within the East of England with the capability to provide the key activities inherent within the development, construction and operation of offshore wind farms the current strengths and weaknesses of the regional supply chain become clear. For the relatively high proportion of companies with capabilities within the Accountancy, Financial, Insurance & Tax, Cables & Connectors, Environmental Assessment & Monitoring, Project Management, Maintenance, Modification & Operation and Survey & Positioning activities support the perception of regional strength in such areas.

Table 6-4: Regional Companies with Capability within Key Offshore Wind Activities

Activity	Regional Companies
Accountancy, Financial, Insurance & Tax	30
Cables & Connectors	38
Control Systems, Topsides & Subsea	20
Diving & Underwater Services	15
Electrical Equipment, Materials & Services	61
Electronics	29
Environmental Assessment & Monitoring	38
Fabrication & Construction	52
Feasibility / Front End Studies	15
Foundations & Piles	6
Freight, Logistics & Transportation	29
Gears & Gearboxes	4
Hydraulics & Pneumatics	23
Inspection & Testing	33
Installation & Commissioning	33
Instrumentation	65
Integrated Services	17
Land & Premises	41
Legal	14
Legislation & Regulations	21
Maintenance, Modification & Operation	43
Material & Product Handling	24
Navigation Aids	4
Personnel	58
Ports & Supply Bases	4
Project Management	59
Research & Development	21
Rotor Blades	1
ROVs	12
Safety, Security & Firefighting	89
Scour Protection	2
Steel & Metal Materials	46
Support Vessels	18
Survey & Positioning	24
Wind Turbines & Towers	15

The picture is, however, somewhat blurred by the high number of companies shown to have a capability within the key Fabrication & Construction and Installation & Commissioning disciplines where regional suppliers are known to be less competitive. Such a discrepancy illustrates the point that having established the nature of company capabilities it then becomes necessary to establish their capacity and potential future capabilities (i.e. potential opportunities for and openness to the transfer of capability between sectors). However, the region's lack of companies with a capability within the key activities relating to the manufacture and installation of Wind Turbines & Towers, Rotor Blades and Foundations & Piles is illustrated (a full listing is given in Appendix 3).

7 SCENARIO 2 – EAST OF ENGLAND CAPABILITY

7.1 Typical Attributes of a Scenario 2 Project

Scenario 2 type developments represent a step change in the sector into the realisation of larger and more technologically sophisticated offshore wind farms. Such projects would be typified by the use of a larger number of turbines of a capacity of 4 MW and above (higher capacities than have not yet been installed offshore in commercial-scale developments). Scenario 2 considers projects that are sited in water depths in excess of 25 metres.

Such developments may require differing installation vessels and equipment to that required for Scenario 1 projects due to implied increases in the size and weight of turbine topsides and foundations. Furthermore these larger projects will in many cases require the use of an offshore substation and HVDC cabling.

7.2 The Key Challenges of 'Scaling-up'

The UK Offshore Wind Market – The UK will soon be the world leader in total offshore wind capacity when further first round projects are installed in the coming years. The first of the second round UK projects are set to begin construction in 2007/8. UK waters are forecast to see a substantial amount of activity providing the key challenges of the industry can be overcome.

Some of the major challenges facing UK offshore wind relate to the sheer growth of the industry that is expected, specifically in the issues surrounding the supply and demand of turbines, foundations, installation vessels and suitable ports.

Contract Strategy – The way projects are contracted is set to change as developments increase in size and value and experience is gained. The principal issues that need addressing within a contract involve risk, project costs and securing supplies. At present, contractors are faced with much risk and little reward. The offshore wind industry is immature and in many cases the true cost of offshore development is not being fully realised, leading to pressure on contractors to bid low resulting in financial losses for some companies keen to enter the market.

Scenario 1 projects have an approximate cost of £75 million each, while the average cost of developing and constructing an offshore wind development is expected to rise to approximately £550 million for Scenario 2 type developments. The current trend of balance sheet financing will be superseded by project financing, although there is a great deal of caution amongst financers who are concerned over the levels of associated risk. This confidence will improve as further projects are built and are successful.

At present, individual supply and installation contracts are placed very late in the development process. With only a small number of projects approaching construction this year it has not caused any serious problems. However, within a year the problem could be significantly exacerbated as a larger number of projects are initiated within a climate of limited contractor capacity and availability. Scenario 2 type projects will therefore have to adopt a contracting strategy where contracts are awarded with a longer lead time if they are to secure the limited fabrication resources and busy installation contractors in the high-demand market place.

Development contracting is expected to move from the current focus on the turbine supplier to being EPIC-based for the remainder of the Scenario 1 projects. This approach will be employed for some Scenario 2 projects but it is anticipated that a partnership/alliance type strategy will increasingly be adopted.

Logistics – For Scenario 2 type projects, such as those proposed in the Greater Wash and Thames Estuary strategic areas, the ports in the East of England are ideally located for logistical and construction bases. Lowestoft and Great Yarmouth are the two main ports that are actively seeking involvement in the offshore wind industry, having already been the construction bases for the Scroby Sands project. A significant proportion of the content for Scroby Sands derived from the use of Lowestoft and Great Yarmouth as logistical bases for the project.

Great Yarmouth has long been planning the construction of an Outer Harbour. This development would make the port an extremely capable construction base for Scenario 2 type projects. Construction must be complete by 2008 for the project's finance to be issued. There is, however, some doubt within industry as to whether this timescale is realistic (although it should be noted that many of the UK's round two projects for instance are themselves facing delays). A further area of potential future development within the region is the realignment of activity at Lowestoft, where a more efficient use of the potential synergies between its Inner and Outer harbours would greatly enhance its viability for use within future developments.

If the East of England is to gain full value from Scenario 2 type projects the Outer Harbour is essential. No other regional ports can realistically support the construction of projects of this scale scheduled for construction post 2007. The need for deepwater ports with significant laydown and pre-assembly facilities is very high. Mainland Europe has a selection of high-quality ports that are currently more suitable for an offshore wind base. The work will go to Europe if the UK and East of England cannot offer comparative facilities.

Turbines – Scenario 2 type projects will make use of the cutting edge in wind turbine design in an attempt to maximise a site's total installed capacity and, therefore, output.

There are a number of important issues surrounding the use of 4-5 MW class turbines. The first of these concerns the supply of the turbines. Commercial production has yet to begin on any 4 MW or above turbine, the only installed models are prototypes – one 4.5 MW turbine has been installed at a near-shore location off Germany for instance. There is therefore a concern as to whether the leading turbine manufacturers will have advanced their designs to commercial production by the time Scenario 2 type projects are at a contracting stage.

Secondly, the demand on the manufacturers to produce enough turbines will be extremely high. Many of the Scenario 2 projects will feature hundreds of turbines and there will be multiple projects entering construction simultaneously. With key European countries competing for turbine supply contracts (Germany's offshore wind industry will pick-up at the same time as the UK's second round is being built), there is a real question over the ability of the leading manufacturers to scale up production.

The turbine manufacturers are therefore faced with huge technological and production demands because of the combination of the growing market and the industry's constant drive for bigger and better turbines. Although the industry is still relatively inexperienced there has been a tremendous drive to use the highest capacity turbines available. Project developers are so concerned with maximising site output that they are pushing manufacturers to rapidly develop and manufacture the next generation of turbines. This is creating a large amount of risk as the turbine manufacturers are effectively selling turbines straight off the design board without sufficient testing.

Foundations and Towers – The majority of Scenario 2-type developments will use steel monopile and steel tripod foundations. Monopile foundations are well proven in the industry whereas steel tripods have yet to be used. Monopiles can be used for sites up to approximately 25-30 metres of water depth. Steel tripods are required for deeper waters.

Manufacturing capacity for rolled steel offshore wind foundations and towers in Europe is low. There are only a small number of manufacturers currently working in the sector, creating a potential future pinch point for the industry. Early contracting will be required to secure scarce manufacturing capacity, especially as many of the plants will have their total annual output filled by a single wind farm.

Installation Vessels – The installation requirements of the large-scale, Scenario 1-type wind farms of the last four years has been met by the turbine and foundation installation vessels available in the marketplace. Jack-up rigs from established oil and gas contractors installed the first projects, then saw specialist offshore wind installation contractors such as A2Sea, Mammoet Van Oord and Marine Projects International enter the market with purpose built vessels. These vessels have proved extremely efficient at installing the 2-3 MW turbines on current waters.

Scenario 2 type projects will be far more challenging. The sites themselves will be further offshore in deeper waters, while the increased size, weight, and required lifting height of the next generation of turbines will add to the complexity for installation contractors. Some of these contractors are planning to upgrade their vessels to cope with the deeper waters and larger turbines whilst others are building new vessels.

With larger numbers of higher capacity turbines being installed and a larger total number of projects being installed each season the demands on the installation contractors will be extremely high.

Steel – The price of steel is particularly important to the offshore wind industry, being the principal raw material used in the manufacture of steel towers, monopile and tripod foundations and transition pieces. Any change in steel prices therefore has a considerable impact on manufacturing costs and as such project economics.

As the offshore wind sector really begins to take off, it will have a strong effect on the steel market. As an example, the UK's Beatrice project is expected to use over 250,000 tonnes of steel for the fabrication of the towers and foundations. Beatrice is a 1 GW project that will use tripod foundations. Although it is someway off construction, and seems like a very large project, it is wind farms of this size that will be the future of offshore wind. 5 MW turbines and tripod foundations will in time become common. The factor of steel price (and perhaps more importantly, steel supply) will be extremely relevant to the industry.

At the time of writing, steel prices have breached $700 per tonne, more than double the price two years ago. The gradual price rises steepened at the start of 2004 and grew at an increased rate throughout the year. Many construction companies and manufacturers have been hit hard, with the increased prices of their primary raw material affecting balance sheets significantly.

Current price rises follow a period of cheap steel supplies with steel famously having been quoted as being cheaper than potatoes in the past. Indeed the price of steel had risen slower than the rate of inflation since the 1980s. Current trends are a result of growing steel demand from Southeast Asia, in particular China, where huge increases for the last few years are driving the high prices. Demand increased by nearly 40 million tonnes in 2003.

There are few signs that demand for steel has slowed in light of the higher prices. UK structural steel fabrications are at their highest levels of output since 1990. Availability of steel rather than its cost is the prime concern of manufacturers.

7.3 Key Areas for Future Content

The East of England can attain a high level of content in future offshore wind developments, however, the region is limited in terms of the areas in which it has the capabilities to work. Development design, surveying and project management are, for example, strong areas for the region. It is, however, the high-value areas, such as fabrication and offshore installation, where the East of England has not presently capitalised on the opportunities open to it. While the East of England is home to some highly capable installation contractors, it lacks contractors with a track record in foundation and turbine installation in particular. However, the region has a strong history of servicing the oil and gas industry, and has developed a substantial base of skills and expertise in this sector.

Fabrication – Manufacturing capacity for offshore wind in the East of England is, at present, limited. The region lacks a turbine supplier or any turbine component (e.g. blades) suppliers. Foundation and tower manufacture is possible in the future, from companies such as SLP, but requires high levels of investment. Cable manufacturing is not currently undertaken in the region and the fierce competition that characterises this market segment makes market entry for regional suppliers unlikely.

Fabrication is an extremely high value area and it is for that reason that East of England companies should be targeting market entry here. However, it is the most difficult sub-sector in which to work because of the competition from the continent and the problems trying to enter already established supply chains.

Port Use and Pre-Assembly – One crucial determinant of future regional content will be the use of a regional port as a pre-assembly and construction base for projects. These tasks were completed in Lowestoft and Great Yarmouth on the Scroby Sands project and resulted in a high level of local content. However, the region's ports face tough competition from Europe for future Scenario 2 type projects and without major improvements, such as Great Yarmouth's Outer Harbour, the work will simply go elsewhere.

Onshore Installation – The East of England has strong capabilities for the associated onshore installation works which includes onshore cable laying and grid connection. It is, therefore, expected that region will continue to perform well in this area on future projects.

Offshore Installation – Other than offshore cable installation the East of England lacks a proven regional capability to perform the key offshore installation activities. UK-wide there are contractors that can perform foundation and turbine installation, but they will be tested as the Scenario 2 type projects reach installation. There is such a supply and demand issue facing the offshore wind sector in the future that this is a key area for future content, the only question being whether the East of England can attain any involvement within it. There is much offshore experience in the region, but to attain any foothold in the highly competitive market a major installation contractor needs to establish itself in the region.

Operations and Maintenance – Operations and maintenance has been proven to be an area of high regional content, and carries high future potential. It is accepted to be more efficient for operations and maintenance to be conducted within the locality of offshore wind developments, although some non-regional and international content is to be expected because of the lack of UK-based turbine manufacturers.

Five year operations and maintenance contracts to the turbine manufacturer are currently standard on offshore projects and are expected to be continued for the foreseeable future. Once a project has been operational for five years it is likely that the operations and maintenance contract would not be undertaken by the manufacturer, instead being taken up by a specialist contractor.

Commissioning – Commissioning is a labour intensive task and as such is an ideal activity for regional work. However, the level of regional content will be largely dependent on any preference among turbine manufacturers to base their European staff in the region for the duration of the work.

Both operations and maintenance and commissioning could, therefore, be key future areas for regional content but this largely depends on the turbine manufacturers used for projects and the location of pre-assembly and offshore installation activities.

8 EAST OF ENGLAND CAPABILITY ASSESSMENT

8.1 Strengths & Gaps in East of England Supply Chain

The relatively high level of East of England content within the development, construction and operation of Scroby Sands has illustrated the potential contribution of regional suppliers to the offshore wind sector. However, as developments increase in number, scale and complexity the capability and capacity of regional suppliers to service the increasing demands of the sector will be challenged. As such if a comparable level of regional content is to be maintained, or indeed developed, in future offshore wind developments it is vital the regional supply chain is galvanised to fully develop its established capabilities to service this emerging sector and the required levels of investment are realised.

Table 8-1: Proven East of England Offshore Wind Capability

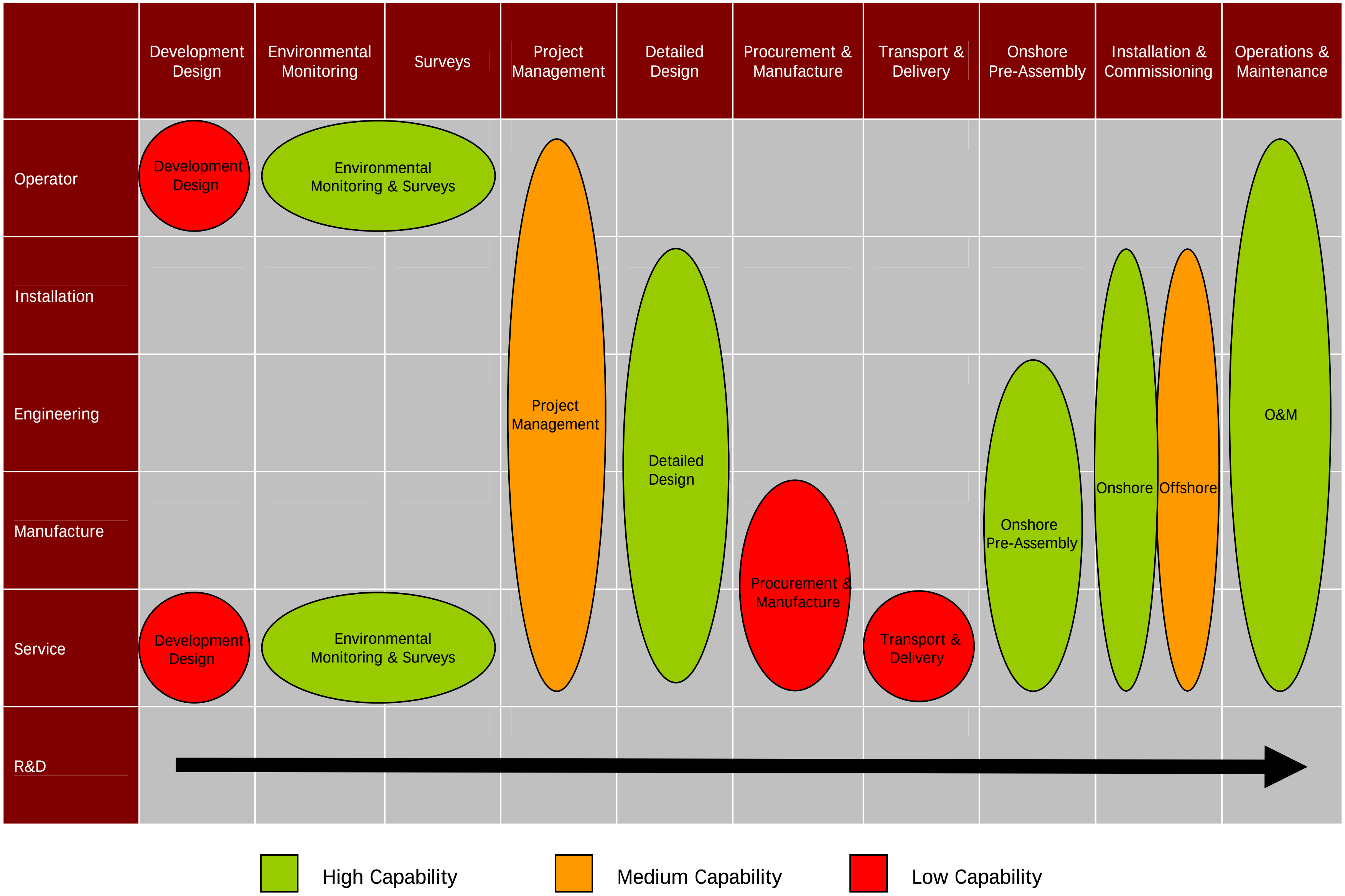
High	Medium	Low
Environmental Monitoring Onshore Installation Onshore Pre-Assembly Operations & Maintenance Surveys	Commissioning Project Management	Detailed Design Development Design Insurance / Legal Procurement & Manufacturing Offshore Installation Transport & Delivery

Although specific opportunities are available within the construction phase, most notably with regard to onshore installation, onshore pre-assembly and project management, the principal strengths of the regional supply chain lie in the service orientated activities of the development and operations phases. For at present the region lacks a consolidated base of experienced suppliers to the sector, largely as a result of the continued delays to national offshore wind developments and subsequent unpredictability of the market (most notably within offshore contracting). However, if the current lack of manufacturing capability and offshore installation equipment and technologies is not confronted the region will continue to lose out in these key segments of the market.

Such gaps in the supply chain are compounded by key constraints, both generic and region specific, to regional activity within the offshore wind supply chain. As previously mentioned the ongoing market uncertainty caused by project delays has restricted the market entry of a number of potential suppliers, and when combined with the continuing difficulties with sectoral contracting strategies and the lack of market transparency such issues have created a degree of scepticism among regional suppliers towards offshore wind. However, levels of East of England activity have been, and may continue to be, inhibited by region specific factors such as: the particular restrictions of regional ports, poor infrastructure, insufficient laydown facilities and lack of equipment and technologies (particularly those required for Scenario 2 developments).

Table 8-2: Potential East of England Capability – Tier 1 Component

High	Medium	Low
Environmental Monitoring Surveys Insurance / Legal Detailed Design Onshore Installation Onshore Pre-Assembly Commissioning Operations & Maintenance	Project Management Offshore Installation	Development Design Procurement & Manufacturing Transport & Delivery


Development Design
Environmental Monitoring
Surveys
Project Management
Detailed Design
Procurement & Manufacture
Transport & Delivery
Onshore Pre-Assembly
Installation & Commissioning
Operations & Maintenance
Operator
Installation
Engineering
Manufacture
Service
R&D
Development Design
Environmental Monitoring & Surveys
Project Management
Detailed Design
Procurement & Manufacture
Transport & Delivery
Onshore Pre-Assembly
Onshore
Offshore
O&M
Development Design
Environmental Monitoring & Surveys
High Capability
Medium Capability
Low Capability

8.2 Forecast Regional Content in a Typical Scenario 2 Project

For a typical Scenario 2 project, of an assumed capacity of 500 MW, three alternative levels of East of England content are presented below to show high-case, proven-case, and low-case scenarios. A forecast is then presented to show forecast regional content in all prospective East of England Scenario 1 and 2 type developments (as awarded within the UK's second licensing round), taking into account the high, proven, and low-case scenarios identified.

Table 8-3: Typical Scenario 2 Project Characteristics

Factor	Details
Project Capacity	500 MW
Number of Turbines	100 +
Turbine capacity	4-5 MW
Water Depth	25 metres +
Distance from Shore	10 miles +
Cable Type	HVDC
Substation	Yes, offshore
Year Online	2010
Project Cost	£586 million (inc. 5 yrs O&M)

Table 8-4: Potential East of England Value in a Typical Scenario 2 Project (£'000s)

£000s	Total	High	High %	Proven	Proven %	Low	Low %
Development Design	4,000	400	10%	423	11%	422	11%
Environmental Monitoring	500	492	98%	426	85%	427	85%
Insurance/Legal	12,000	11,652	97%	1,423	12%	1,424	12%
Surveys	750	750	100%	715	95%	716	95%
Project Management	11,000	5,929	54%	5,320	48%	4,776	43%
Detailed Design	6,000	6,000	100%	972	16%	540	9%
Procurement & Manufacture	301,250	773	0.3%	62	0%	0	0%
Transport & Delivery	7,500	1,425	19%	337	4%	0	0%
Onshore Pre-Assembly	16,000	13,360	84%	11,738	73%	0	0%
Onshore Installation	30,000	30,000	100%	30,000	100%	30,000	100%
Offshore Installation	130,000	49,970	38%	2,203	2%	0	0%
Commissioning	16,000	14,352	90%	4,509	28%	2,575	16%
5 years O&M	45,000	35,235	78%	33,593	75%	29,176	65%
Other Misc. Costs	6,000	5,286	88%	1,446	24%	805	13%
Total	586,000	175,624	30%	93,169	16%	70,862	12%

High-Case Content – The high-case level of East of England content presented assumes: a regional project manager, use of an East of England port and use of regional contractors throughout the entire development cycle where capabilities exist. With current capabilities the maximum potential content for a Scenario 2 type project for the East of England is £176 million. This represents 30% of the total project expenditure being secured by East of England companies.

Proven-Case Content – The proven East of England content takes the proportion of East of England content achieved on Scroby Sands and scales them up to a typical Scenario 2 project. This assumes that the level of content achieved on Scroby Sands is replicable on such a Scenario 2 development. If contracts were placed on a typical Scenario 2 in the same way that they were on Scroby Sands the value of contracts placed within the East of England would be over £93 million. Whilst this scaling up is unlikely to be replicated piece-by-piece on an actual project the potential has been established.

Low-Case Content –The low-case scenario assumes that a non regional port is used and that there is no manufacturing and installation content on the offshore components of the project (i.e. turbines, foundations and cabling are made on the continent and installed by non-East of England contractors). This low-case scenario does, however, assume that the majority of operations and maintenance is conducted from the East of England and a local base of operations is established within the region. Of a total expenditure on the project of £586 million this low-case scenario would result in only £71 million, or 12%, of the total value of the project being sourced in the East of England.

8.2.1 Man-Hours on a Typical Round 2 Project

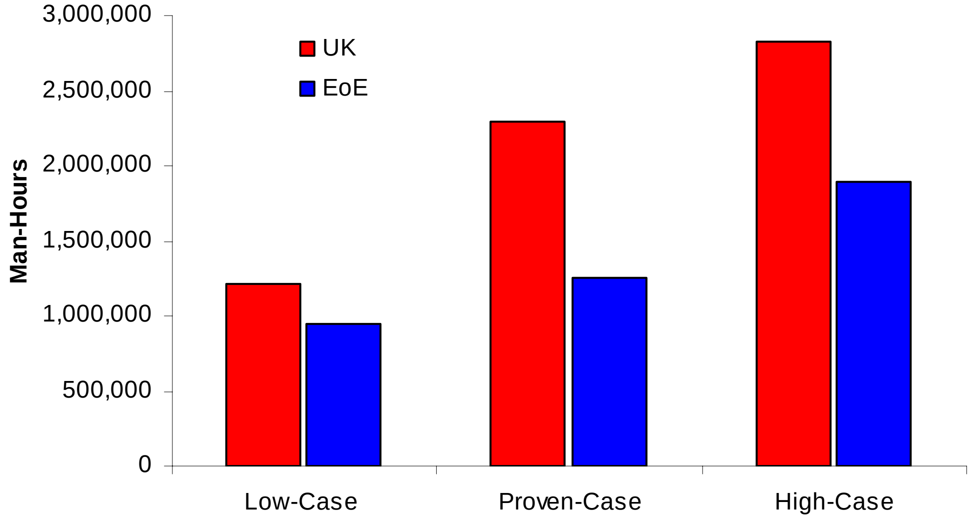


Figure 8-1: UK and East of England Man-Hours for a Typical Scenario 2 Project

Table 8-5: UK and East of England Man-Hours for a Typical Scenario 2 Project

Hours	E of E	UK
High-Case Content	1,899,152	2,826,570
Proven-Case Content	1,259,425	2,291,745
Low-Case Content	945,577	1,216,236
Total Typical S2 Project	3,199,433	

Table 8-6: Potential East of England Man-Hours in a Typical Scenario 2 Project

Hours	Total	High	High %	Proven	Proven %	Low	Low %
Development Design	73,118	9,286	13%	9,279	13%	9,277	13%
Environmental Monitoring	8,250	8,162	99%	7,522	91%	7,521	91%
Insurance/Legal	3,428	3,260	95%	674	20%	674	20%
Surveys	7,500	7,500	100%	7,156	95%	7,156	95%
Project Management	218,743	101,808	47%	86,712	40%	73,116	33%
Detailed Design	149,284	149,284	100%	24,311	16%	13,506	9%
Procurement & Manufacture	773,557	17,018	2%	1,159	0.2%	0	0%
Transport & Delivery	39,184	8,307	21%	2,449	6%	0	0%
Onshore Pre-Assembly	204,813	165,284	81%	132,442	65%	0	0%
Onshore Installation	423,801	423,801	100%	423,801	100%	423,801	100%
Offshore Installation	417,207	299,555	72%	31,527	8%	0	0%
Commissioning	236,552	201,069	85%	96,552	41%	36,847	16%
5 years O&M	539,770	421,020	78%	409,319	76%	356,750	66%
Other Misc. Costs	104,226	83,798	80%	26,522	25%	16,928	16%
Total	3,199,433	1,899,152	59%	1,259,425	39%	945,577	30%

Total man-hours on the development, construction and operation of a typical Scenario 2 project are forecast to total approximately 3.2 million, of which the East of England is forecast between 0.9 and 1.9 million hours work on a typical project. As such the total man hours for all Round 2 projects around the region is forecast to total approximately 32.4 million hours (assuming all 12 projects go ahead). Proportionally these figures are much higher than those for the value presented above. The key areas in which the region can achieve maximum content are mainly the most time-consuming ones such as surveys, component design and onshore installation.

8.3 Forecast Regional Content in East of England Projects

Using the three scenarios for alternative levels of East of England content in all regional Scenario 1 and 2 projects, market forecasts have been created for all offshore projects defined as being within the East of England's area of influence. The forecasts below show forecast development and construction costs, no data for operations and maintenance has been included at this stage. Cost is attributed to the year the project is scheduled to come online.

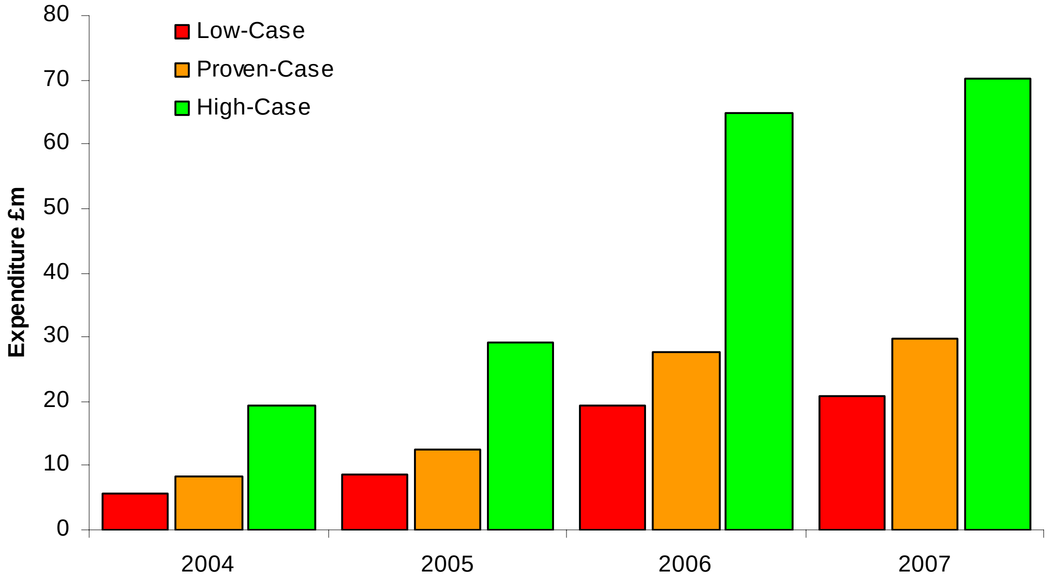


Figure 8-2: Forecast East of England Content in Regional Scenario 1 Projects (£m)

Table 8-7: Forecast East of England Content in Regional Scenario 1 Projects (£m)

£m	2004	2005	2006	2007	Total
Low-Case	6	9	19	21	55
Proven-Case	8	12	28	30	78
High-Case	19	29	65	70	184
Total E of E S1	75	113	250	270	708

The above chart shows total expenditure for regional Scenario 1 projects. Using market forecasts for future offshore wind developments in the East of England's area of influence (the Thames Estuary and the Greater Wash), total value for regional Scenario 1 developments is expected to be approximately £708 million.

The level of East of England content has been assessed under the high, proven and low cases presented previously. From the total forecast expenditure on regional Scenario 1 projects, the East of England value is forecast to be between £55 million and £184 million. Scaled up levels of regional content achieved within Scroby Sands on all Scenario 1 projects in the two strategic areas would result in a forecast total spend of £78 million within the region for the 2004 to 2007 period.

Forecasts for Scenario 2 projects coming online post-2007 are presented below.

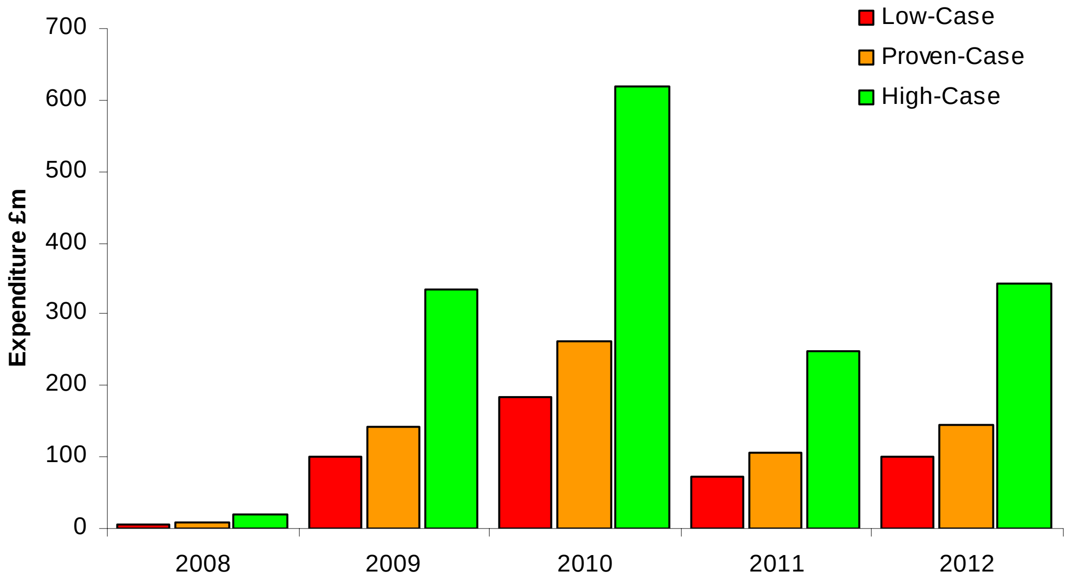


Figure 8-3: Forecast East of England Content in Regional Scenario 2 Projects (£m)

Table 8-8: Forecast East of England Content in Regional Scenario 2 Projects (£m)

£m	2008	2009	2010	2011	2012	Total
Low-Case	5	99	184	73	102	464
Proven-Case	8	142	263	105	145	663
High Case	18	333	620	247	343	1,562
Total E of E S2	70	1,285	2,390	954	1,320	6,019

The East of England can attain between £464 million and £1.56 billion of a forecast total spend of approximately £6 billion on the Scenario 2 developments planned within the region through to 2012. Proven-case value for these projects amounts to £660 million. Addressing the difference between the low-case and the high-case must be the key focus for the region in order to attain maximum value.

The potential scale of such expenditure becomes evident when compared with annual expenditure relating to the development of and production from Southern North Sea gas reserves, which is forecast to average approximately £700 million through to 2008[5].

8.4 Regional Action Plan

The capability of the regional supply chain in supporting the development, construction and operation of an offshore wind farm has been established through EROWL's successful development of Scroby Sands, and while specific strengths and weaknesses exist significant opportunities are open to regional suppliers. However, in order to harness this potential it is vital the region proceeds in an increasingly proactive and cohesive manner as key questions remain for the development of both the regional supply chain and the supporting framework of business support agencies. For if the region is to realise the higher levels of projected regional content vital improvements are required to regional ports and infrastructure in particular, while it is essential regional support agencies continue to develop their work in galvanising the regional supply chain.

8.4.1 Business Support

The nature and manner of business support for the offshore wind sector within the East of England will continue to develop as the market evolves, and varies with the level at which such intervention is attempted. First and foremost it is vital that the government implements a sustainable and coherent

[5] Ref: UKOOA 2004 Activity Report

framework to incentivise offshore wind investment (most notably through the forthcoming review of the Renewables Obligation). If the current uncertainty and incoherency is maintained the established gaps within the regional, and indeed national, supply chain to the sector (and other renewable energy markets) will be exacerbated and the perceived opportunities for suppliers lost.

Regional business support frameworks to the energy industry, both in the form of local authorities and particularly business support agencies, are well established and in many instances (most notably within the work of EEEGR and Renewables East) have pioneered a degree of industry best practice in developing the regional supply chain. Indeed the success of business support within the region is widely acknowledged, however it is vital the respective business support agencies within the region seek to work together in an increasingly proactive and coherent manner complementing rather than duplicating one another's activities.

8.4.2 Supply Chain Development

Regional supply chain development activities should broadly fall within four categories:

- **Knowledge Holding and Transfer** – provision of market intelligence
- **Relationship Building** – facilitating business to business linkage
- **Innovation Support** – funding and support for small and medium sized enterprises
- **Strategic Support** – inward investment and public sector infrastructure development.

Although government policy will continue to be the key determinant of the level of offshore wind activity the continued development of the supply chain to the sector will play a significant role in facilitating the improved future commerciality of developments. At present the emerging nature of the offshore wind sector is reflected in its somewhat disparate supply chain, which is presently characterised by a high cost base and relatively static capacity. If the sector is to fully develop it is vital the supply chain achieve the requisite cost reductions and increases in capacity. Regional suppliers naturally have a part to play in this process, and must be supported through their continued stimulation by regional business support agencies.

Such support must begin in assisting regional companies to understand how to enter the supply chain to offshore wind developments and develop both their position within the supply chain and offering to industry. This can be achieved through the dissemination of information as to market opportunities and potential means of market entry, through initiatives such as the development of a regional resource to monitor OJEC notifications. The continued profiling of company and regional capabilities through further events similar to Renewables East's forthcoming Vestas visit is also vital.

Further initiatives are also required in facilitating the capture and dissemination of lessons learnt throughout the supply chain in both project implementation and product innovation. To such an end it is recommended that initiatives such as retrospective studies of all Round 1 UK studies are completed to fulfil the aims and objectives as established within Renewables East's recent analysis of the supply chain to Scroby Sands.

It is also essential that business support agencies continue to seek to bring together the supply chain within this emerging industry by facilitating a high level of business to business contact and initiating dialogue throughout the supply chain. Such relationship building will not only facilitate regional supplier's access to project supply chains but also assist in developing the various synergies that are apparent throughout the supply chain to offshore wind and other related industries. Furthermore, such initiatives can also facilitate increases in the currently inadequate levels of sectoral innovation, however, they must be supplemented by the provision of funding where required.

The final fundamental area of business support required within the region relates to the facilitation of potential inward investment into the region and the development of public sector infrastructure. The key area of required inward investment relates to the potential location of manufacturing capability within the region and specifically, in the case of offshore wind, turbine manufacturing. Such investment decisions are by their very nature fraught with intricacy, however, while unlikely until the industry has established a flow of commercial developments such a move remains the key determining factor of future levels of regional content.

However, the development of regional infrastructure is perhaps the most likely means of strategic support within the region. Key to such developments is the construction of Great Yarmouth's Outer Harbour and the Offshore Renewable Energy Centre in Lowestoft. The Outer Harbour holds particular significance, as without the implied significant investment in regional ports the East of England runs the risk of losing a significant proportion of the content realised within Scroby Sands where the ports of Great Yarmouth and Lowestoft were used as construction bases. However, there remain concerns as to the timing and nature of the development of this new facility, not least among regional developers.

8.4.3 Further Research Requirements

Three key areas of further research have been identified:

- Supply chain analyses of all UK Round 1 developments fulfilling the aims and objectives as established within Scroby Sands Supply Chain Analysis.
- In depth analysis of the true life costs of operating and maintaining offshore wind farms.
- Further analysis of the breakdown of expenditure relating to the procurement of component parts and manufacture of nacelles utilised within past, present and future offshore wind developments.

9 APPENDICES

Appendix 1:

POWER Interview Programme Questionnaire

The questionnaire below was used for the POWER interview programme. Whilst it is a structured set of questions, in many cases the interviews themselves evolved beyond the set questions when specific areas of interest arose.

Company Profile

1) What products and services do your company offer? To what markets?

2) Do you have any experience of working within the offshore wind sector? Plans for?

3) Which sector is currently the major contributor to your company's turnover? What proportion (%) of your turnover is derived from;

   i. Offshore wind / Energy (others?)
   ii. Work carried out within East of England / UK
   iii. Clients within East of England / UK

4) How has this changed over the past 5 years? How do you expect it to develop in the future (with particular reference to offshore wind)?

5) Who are your main clients (top 3)? Suppliers (top 3)?

6) What offshore wind/energy/offshore specific facilities/technologies do you operate?

7) How many people do you employ on offshore / offshore wind related work *(% workforce)*? What skills set do these employees have?

8) Are you currently, or planning on, conducting any R&D in offshore wind related industries?

Company Offshore Wind Experience (if yes to Q.2)

9) What has been the nature of your work within the offshore wind sector? What was the specific role your company performed and what services were provided?

10) Who were your clients? Suppliers? Where are/were they located?

11) Under what contract strategy were these projects completed?

12) What was the approximate value of these contracts? How many people were employed within their completion?

13) What level (%) of regional content was maintained throughout the contract's execution?

14) How do you perceive the offshore wind sector as a future market for your company?

Company Offshore Wind Capability (if no to Q.2)

15) How do you perceive the offshore wind sector as a potential future market for your company?

16) Which aspect of the industry is most appealing (development, construction &/or operations)? What would be the nature and scale of your activities?

17) What progress have you made to date? How do you intend to further progress this interest?

18) What experience do you have working within related industries (i.e. offshore oil & gas, marine, renewables, etc).

Areas of Concern

19) Have you experienced any problems working / attempting to work within the offshore wind sector? What? What problems do you anticipate in the future?

20) What lessons have you learnt from your experiences within the sector?

21) What do you believe to be the strengths and weaknesses of the regional supply chain to the offshore wind sector?

22) What specific pinch points to offshore wind related activity do you believe there to be within the region? How would you rank them in order of significance?

- Business support
- Contractual strategies
- Equipment/Technologies
- Infrastructure
- Logistics
- Space
- Supply Chain
- Training/Skills
- Other (define)

23) Do you believe there to be any barriers to entry into the offshore wind sector? What?

Scenario 2

Scenario 1*: < to 3.9 MW turbines, up to 25 m water depth;*

Scenario 2*: > 4 MW turbines, more than 25 m water depth.*

24) How do you see the offshore wind sector developing within the region and beyond *(growing, flat, declining?)*? What do you believe will be the impact of Scenario 2 type developments?

25) What do you see as the principal challenges for the supply chain of Scenario 2 type developments? And the opportunities? How would you rank each in order of importance?

- Business support
- Construction
- Development
- Equipment/Technologies

- Infrastructure
- Logistics
- Operation
- Space
- Supply chain
- Training/Skills
- Others

26) Do you believe the supply chain currently in place within the East of England is equipped to realise such opportunities? Why?

27) Do you think East of England content will increase within scenario 2 type developments relative to current activity? What level of regional content do you think is realistic within such developments?

Future Development

28) If you were asked to submit a wish list for the nature and means of business support for your company how would it read? And for the supply chain as a whole?

29) How do you perceive the role of business support agencies within this process (pivotal, significant, insignificant)? How successful have they been to date?

30) What would be the impact of not providing the required support to the sector?

31) Are there any other areas for research that are underway that may be relevant? Any that you would suggest to be necessary?

Appendix 2:

Catalogue of Energy Industry Classifications

"Offshore Oil & Gas Regional Information Gap Analysis", a study produced by Douglas-Westwood Limited (DWL) for DTI in January 2004, showed there to be a considerable variation in the amount and quality of information available on the energy industry both in the regions and indeed the UK as a whole – issues that DTI are seeking to address.

One specific problem that was identified was a lack of comparable information on companies active within the energy industry, the business sectors they specialise in and their geographic distribution. Therefore, it is difficult to determine with any accuracy the economic importance of the energy industry to regions and communities. Some level of mapping has been undertaken for the upstream oil & gas sector, however, this is primarily based around determining the number of companies located in political constituencies and does not indicate their nature and true geographic distribution.

At present, the UK Standard Industry Classification of Economic Activities (UK SIC(92)), provides a broad coverage of supply chain activity, however, in seeking to capture the full range of company capabilities serving each and every industry it lacks the level of detail to fully reflect the specific competencies of the supply chain to the energy industry.

In contrast, current energy industry directories maintain a level of detail which while useful when searching for a highly specialised product are impractical for other purposes. For example, one such directory subdivides "cables" into 58 different products and services, while "consultants" are divided by subject sub-divisions. In total, this directory has 7,000 company entries in 3,200 categories, with the majority of categories populated by just a single company (possibly caused by companies' own definition of their activities).

An example of how the information need may be met is the internet-based supply chain mapping system 'Mapergy', established by the East of England Energy Group (EEEGR) for the East of England energy industry. This is driven by an underlying database of some 2,500 companies and enables their actual distribution by geographic location (postcode) to be clearly displayed. In order to further develop this system, it was thought necessary to code the companies according to their activities, with for example 'project management' companies servicing the 'Oil & Gas' or 'Wind' industries being displayed as such. However, for this to happen there is a need to produce a set of keywords to classify activities of companies in the energy supply chain in a pragmatic fashion. This could begin in oil & gas and extend through to renewables and nuclear related activities.

Aims & Objectives

This study was commissioned by the EEEGR and completed by DWL in December 2004. The project required the creation of a "pragmatic" coding system to be applied to all companies identified, or seeking, to be working within the supply chain to the energy industry. The framework created will act as a means of facilitating the identification of specific capabilities of companies servicing one or more sectors and enable the effective segmentation of the industry.

This is to be achieved through the creation of three independent, relational datasets, structured as a keyword listing based on a maximum of 150 categories, with each dataset to be supplemented by a glossary defining keywords where appropriate. The three independent relational datasets will be:

1. **Industry Sectors** – Oil & Gas, Wind, Solar, Nuclear, etc
2. **Industry Roles** – Operator, Service Provider, Support Organisation, etc
3. **Industry Classification** – Drilling & Wells, Installation & Commissioning, etc.

The coding system will be supplemented by suggestions of the key industry metrics that should be recorded within supporting databases to facilitate attempts to perform a consistent and repeatable analysis of the nature and scale of activity within any supply chain to the energy industry (full details of which are available from EEEGR upon request).

Application

Having established an appropriate framework of use the catalogue of categories will then be integrated into EEEGR's 'Mapergy' system and made available to all POWER project partners as a means of providing a common terminology in completing their country specific supply chain studies. It is also envisaged that such a system will be complementary to work being developed to better identify skills sets against the capabilities of the industry.

In creating such a system care has been taken to deliver upon the specific project brief provided by EEEGR. However, given the depth of knowledge and experience within the energy industry, as soon as any list is prepared for use, others will seek to redefine or amend. It is therefore acknowledged that any coding or classification system will never be completely accurate or practically usable.

Whilst we would caution against wholesale additions, both DWL and EEEGR positively encourage good and critical feedback to improve the initial listings. Any such feedback would be tackled thus:

1. Acknowledge feedback.
2. Review proposed addition against definitions.
3. If definitions change add appropriate activity.

The Energy Industry

Having outlined the background of, and the aims and objectives for, the Catalogue of Energy Industry Classifications, as well as discussed potential areas of application for the system it becomes necessary to establish our understanding of the definition of the energy industry. In the simplest of terms the starting point for the work is one of supply and demand;

> **Supply** – Business and income generated by finding, exploiting and developing the means of production of energy, its conversion to generate electricity, heat and fuel and its transmission to point of use. This is the supply chain to the energy industry.
>
> **Demand** – The way in which an entity uses energy to achieve its final objective (i.e. to power, heat and/or drive) and captures the ethos of good resource management and thus improves efficiency, productivity and competitiveness. This should be undertaken as best practice by all business and is a key tenant of the Energy White Paper which promotes the wise use of energy.

Implementation

116 categories have been created, comprising 11 Sectors, 10 Roles and 95 Classifications. A listing of categories follows, and a glossary of the terms used and example of the system in operation can be obtained from EEEGR upon request. Companies are required to select (or be placed within) the **Sector** they are servicing (i.e. Oil & Gas), the **Role** they perform (i.e. Engineering) and the **Classification** which best describes their activities (i.e. Fabrication & Construction).

Following further testing the categories are currently being applied to all companies within the East of England identified, or seeking, to be working within the supply chain to the energy industry as part of DWL's ongoing work within the POWER project. Once successfully applied to the East of England, and fully integrated with Mapergy, it is intended the system be made available for use in other regions, both within the UK and further a field with further potential to transfer the framework to other national and European Regional Development Agencies and Trade Associations envisaged.

Category Listing

Sector	Role	Classification
Bio Fuels	Consultant	Academic Institution
Biomass	Design	Accountancy, Financial, Insurance & Tax
Geothermal	Engineering	Anchors & Moorings
Hydro	Installation	Architectural / Building Materials
Hydrogen / Fuel Cell	Manufacture / Supply	Bearings & Transmissions
Nuclear	Operator	Bio Feedstock
Offshore Wind	Research & Development	Bolting, Fixing & Fasteners
Oil & Gas	Service	Buoys & Buoyancy Materials
Onshore Wind	Support Organisation	Business Development
Solar	Training & Education	Cables & Connectors
Wave & Tidal		Cases & Packaging
		Certification
		Chemicals, Oils & Paints
		Communication Systems
		Compressors
		Computing & Information Technology
		Control Systems, Topsides & Subsea
		Cooling, Heating, Ventilation & Air Conditioning
		Corrosion Protection
		Decommissioning & Abandonment
		Diving & Underwater Services
		Drilling & Wells
		Dynamic Positioning Systems
		Electrical Equipment, Materials & Services
		Electronics
		Energy Conservation
		Energy Conversion Processes
		Engines
		Environmental Assessment & Monitoring
		Exploration & Production
		Explosives
		Fabrication & Construction
		Feasibility / Front End Studies
		Foundations & Piles
		Freight, Logistics & Transportation
		Gas Turbines
		Gears & Gearboxes
		Generators
		Hazardous Area Equipment & Services
		Heaters, Heat Exchangers, Furnaces, Boilers etc.
		Hoses & Fittings
		Hydraulics & Pneumatics
		Hydroelectric Turbines
		Inspection & Testing
		Installation & Commissioning
		Instrumentation
		Insulation
		Integrated Services
		International Trade
		Land & Premises
		Legal
		Legislation & Regulations

Sector	Role	Classification
		Local Authority Machine Shops Maintenance, Modification & Operation Market Research Marketing Material & Product Handling Media Navigation Aids Networking & Events Non-Metal Materials (Plastics, Composites, etc.) Patent, Trademark & Copyright Personnel Photovoltaic (PV) Systems & Supplies Pipes, Pipelines & Risers Ports & Supply Bases Process Control Project Management Propulsion Systems Publications & Technical Manuals Pumps & Accessories Research & Development Reservoir Engineering Ropes (Wire & Synthetic) Rotor Blades ROVs Safety, Security & Firefighting Scour Protection Seals & Gaskets Seismic Signs Steel & Metal Materials Subsea Production & Control Supply Chain Management Support Vessels Survey & Positioning Technology Services Trade Association Training Valves & Accessories Waste Management Welding Wind Turbines & Towers Workshop & Hand Tools

Appendix 3:

Preliminary Company Database Output

Classification	Regional Companies
Academic Institution	22
Accountancy, Financial, Insurance & Tax	30
Anchors & Moorings	6
Architectural / Building Materials	22
Bearings & Transmissions	4
Bio Feedstock	17
Bolting, Fixing & Fasteners	4
Buoys & Buoyancy Materials	2
Business Development	123
Cables & Connectors	38
Cases & Packaging	3
Certification	17
Chemicals, Oils & Paints	40
Communication Systems	27
Compressors	13
Computing & Information Technology	73
Control Systems, Topsides & Subsea	20
Cooling, Heating, Ventilation & Air Conditioning	16
Corrosion Protection	13
Decommissioning & Abandonment	15
Diving & Underwater Services	15
Drilling & Wells	47
Dynamic Positioning Systems	0
Electrical Equipment, Materials & Services	61
Electronics	29
Energy Conservation	26
Energy Conversion Processes	9
Engines	9
Environmental Assessment & Monitoring	38
Exploration & Production	23
Explosives	0
Fabrication & Construction	52
Feasibility / Front End Studies	15
Foundations & Piles	6
Freight, Logistics & Transportation	29
Gas Turbines	6
Gears & Gearboxes	4
Generators	9
Hazardous Area Equipment & Services	12
Heaters, Heat Exchangers, Furnaces, Boilers etc.	7
Hoses & Fittings	20
Hydraulics & Pneumatics	23
Hydroelectric Turbines	1
Inspection & Testing	33
Installation & Commissioning	33
Instrumentation	65
Insulation	6
Integrated Services	17
International Trade	19
Land & Premises	41
Legal	14
Legislation & Regulations	21

Classification	Regional Companies
Local Authority	14
Machine Shops	10
Maintenance, Modification & Operation	43
Market Research	39
Marketing	73
Material & Product Handling	24
Media	54
Navigation Aids	4
Networking & Events	22
Non-Metal Materials (Plastics, Composites, etc)	14
Patent, Trademark & Copyright	6
Personnel	58
Photovoltaic (PV) Systems & Supplies	7
Pipes, Pipelines & Risers	52
Ports & Supply Bases	4
Process Control	24
Project Management	59
Propulsion Systems	1
Publications & Technical Manuals	8
Pumps & Accessories	20
Research & Development	21
Reservoir Engineering	0
Ropes (Wire & Synthetic)	8
Rotor Blades	1
ROVs	12
Safety, Security & Firefighting	89
Scour Protection	2
Seals & Gaskets	4
Seismic	14
Signs	14
Steel & Metal Materials	46
Subsea Production & Control	13
Supply Chain Management	23
Support Vessels	18
Survey & Positioning	24
Technology Services	34
Trade Association	31
Training	127
Valves & Accessories	25
Waste Management	39
Welding	24
Wind Turbines & Towers	15
Workshop & Hand tools	11

Appendix 4:

East of England Offshore Wind Project Profiles

East of England Scenario 1 Projects

Cromer

Cromer			
Location	7km off Mundesley, Norfolk	**Developer**	Norfolk Offshore Wind (EDF)
Construction	2006	**Owner/Operator**	Norfolk Offshore Wind (EDF)
Online	2007	**EPC**	n/a
Capacity (MW)	90-108	**Turbine Installation**	n/a
Number of Turbines	30	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	130
Turbine Rating (MW)	3-3.6	**Planning Status**	Fully approved
Foundation Type	Tripod	**Contracting Status**	Initial tendering June 2004. Award expected Q2 2005
Water Depth (m)	23		

Norfolk Offshore Wind Limited (NOW), owned by EDF Energy, are developing the Cromer site approximately 7 km off Mundesley in water depths averaging 23 metres. The original development plan called for approximately 100 MW of capacity from 30 turbines rated at 3 MW or above. Construction was initially scheduled for 2004 and the project was due online in 2005, however this schedule has slipped and a construction date of 2006 is currently planned.

Cromer is an interesting site because it has many of the characteristics of the 2nd round UK developments. Unlike the shallow water UK sites which are opting for monopile foundations, NOW has decided to use 600 tonne tripod foundations, for each turbine. This design is understood to be driven by poor soil conditions down to around 20 metres below the mud line.

The project calls for three 33 kV cables to shore each bringing power from groups of 10 turbines. The cables would link to a new substation on shore. There will be a single 132 kV line to take the produced power to the local grid.

Radar interference from the wind farm was initially a concern to the UK Ministry of Defence (MoD). By moving the location of the site slightly this has been overcome and the Cromer project was subsequently approved by Norfolk District Council in January 2003 with a unanimous vote to support the project. In October 2003 Cromer gained full governmental approval and a £10 million capital grant.

Costs for the development could run as high as £130 million because of the challenging nature of the site. These characteristics have drawn bidders from the offshore industry, both on the fabrication side (including McNulty and Samsung) and also heavy lift and installation contractors such as Heerema and Seaway Heavy Lifting, with more than 50 companies pre-qualifying for the development.

In June 2004, Norfolk Offshore Wind invited companies to express interest in a turnkey contract, as part of which an option for vendor financing means the future winner could also offer NOW project financing. The notice calls for 30 turbines for 90+ MW, however, a contract for 12 months offshore monitoring issued in the summer of 2004 meant that construction could not begin for at least a year, and effectively pushed the project back to the 2006 season.

The main issue affecting the project at present is the turnkey contract. Bids received are thought to be higher in value than EDF anticipated (because of the technically challenging nature of the site). Once the contract is awarded work can begin in 2006 as planned.

Gunfleet Sands I

Gunfleet Sands I			
Location	Thames Estuary - 7km off Clacton-on-Sea, Essex	**Developer**	GE Gunfleet Limited
Construction	2006	**Owner/Operator**	Project will be sold
Online	2007	**EPC**	GE Wind (with ?)
Capacity (MW)	108	**Turbine Installation**	n/a
Number of Turbines	30	**Foundation Installation**	n/a
Turbine Manufacturer	GE Wind	**Total Cost (£m)**	130
Turbine Rating (MW)	3.6	**Planning Status**	Fully approved
Foundation Type	Monopile	**Contracting Status**	Contracting underway
Water Depth (m)	8		

GE Wind are developing the Gunfleet Sands site 7 km off Clacton-on-Sea. The wind farm will use 30 GE Wind 3.6 MW turbines, giving a 108 MW total capacity. The closest turbine to the shore will be 7 km, and the turbines themselves will have an 80 metre hub height and a rotor diameter of 110 metres. Developers originally planned for construction and commissioning in 2004.

The sand bank was allocated a Non-Fossil Fuels Obligation 4 (NFFO4) contract by the DTI in 1997. This was an obligation established by the government whereupon both parties (regional electricity company and generator) agreed that subject to planning permission the site has a guaranteed electricity customer who will buy the output at the agreed bid price, index-linked, for 15 years. This contract was originally obtained by WindMaster Developments Limited and was finally acquired by GE Wind Gunfleet Ltd. in November 2000.

In April 2001, permission was granted by the Crown Estate to develop the bank. As part of the Environmental Impact Assessment (EIA) a number of studies were commissioned by Metoc who carried out the EIA including coastal processes, fisheries, archaeology, radar, marine mammal, socio-economic, noise and ship collision studies, and showed the wind farm to have no particular threat to the ecosystem in the area. On completion of the EIA, a full application was submitted. Gunfleet Sands gained approval in October 2003 and was awarded a £9 million capital grant.

Pre-qualification began in January 2004 with the aim to begin construction in 2005. Foundation installation was planned for the 2005 installations season, with the turbines to follow in 2006 – an approach also undertaken at the Kentish Flats development. With the contracts not yet placed (March 2005) it would appear that this strategy will not be undertaken or will be pushed back with offshore construction to begin in 2006. The EPC contractor has not yet been confirmed – although it is thought that GE Wind may take the role in conjunction with a further contractor.

This schedule is dependent upon GE Wind finding a buyer for the project. Until financing can be found work on the wind farm will not begin.

Inner Dowsing

Inner Dowsing			
Location	Greater Wash - 5 km off Ingoldmells, Lincs	**Developer**	Centrica / RES Limited
Construction	2006	**Owner/Operator**	Centrica
Online	2006	**EPC**	Vestas & MT Hojgaard or Siemens Wind Power
Capacity (MW)	90-108	**Turbine Installation**	n/a
Number of Turbines	30	**Foundation Installation**	n/a
Turbine Manufacturer	Vestas or Siemens	**Total Cost (£m)**	125
Turbine Rating (MW)	3-3.6	**Planning Status**	Fully approved
Foundation Type	Monopile	**Contracting Status**	EPC announced mid-2005
Water Depth (m)	10		

Offshore Wind Power Ltd (OWP), a joint venture company formed by Renewable Energy Systems Limited (RES) and British Energy Renewables Limited (BER), was the original developer of Inner Dowsing. In December 2003, Centrica bought the Inner Dowsing offshore wind farm from Offshore Wind Power, paying £3.5 million as an initial cash consideration (with a further £1 million due once construction is complete). Centrica subsequently retained the services of RES to help develop the site, a 90 MW wind farm which will be situated an average of 5 km off the coast at Ingoldmells.

30 turbines rated at 3 MW are planned for use, with the wind farm to be connected via a buried subsea cable to an onshore substation, and from there to the nearby grid connection. OWP originally planned for construction to commence in 2004 subject to necessary permits being achieved, with construction planned to be completed within a single season. However, Inner Dowsing missed the second round of capital grants and construction subsequently slipped to 2006. Inner Dowsing eventually won approval on the 22nd October 2003 and was awarded a £10 million capital grant.

The Inner Dowsing site is close to that of Lynn and prior to Centrica's purchase of the two sites, the development companies at each (OWP and Amec) were working together on the studies required to apply for the necessary consents for construction, including a thorough Environmental Impact Assessment.

Centrica is now effectively treating the Lynn, Inner Dowsing, Lincs, Docking Shoal and Race Bank developments as phases in one major development and aims to get the projects built as quickly and cost effectively as possible by grouping contracts together, as their geographic proximity means the projects can, for instance, benefit from environmental work already carried out. Any contractor awarded work for Lynn/Inner Dowsing is therefore expected to be well set for future work in all local developments.

To date, Centrica have awarded Fugro a contract for geographical survey work for the Inner Dowsing and Lynn sites. The work was conducted in May 2004. By June 2004, a shortlist of turnkey bidders had been drawn up and invitations to tender sent out. The contract covers design, supply and installation of 60 turbines (30 at Inner Dowsing and 30 at Lynn), along the necessary infrastructure, operations, maintenance and decommissioning. The contract is worth around £200-250 million to the winning bidder.

Bids had been submitted by mid October 2004, with three consortia having bid for the work. Siemens and GE Wind would use their 3.6 MW turbine, while Vestas would use the 3 MW turbine which will be installed at Kentish Flats in the summer of 2005. GE partnered with CB&I John Brown and Vestas with MT Hojgaard for the job. The contract for this work is expected to be awarded within the first half of 2005, and would allow first works to begin in 2005 and offshore construction and commissioning of the sites in 2006.

As of May 2005 the contract race was between Siemens and Vestas.

Kentish Flats

Kentish Flats			
Location	Thames Estuary - 8.5 km off Whitstable, Kent	**Developer**	GREP
Construction	2004/5	**Owner/Operator**	Elsam
Online	2005	**EPC**	Vestas
Capacity (MW)	90	**Turbine Installation**	A2Sea A/S
Number of Turbines	30	**Foundation Installation**	Marine Projects International
Turbine Manufacturer	Vestas	**Total Cost (£m)**	105
Turbine Rating (MW)	3	**Planning Status**	Fully approved
Foundation Type	Monopile	**Contracting Status**	Contracting complete – construction underway
Water Depth (m)	5		

Kentish Flats is a UK round one project and started the development cycle under the leadership of Global Renewable Energy Partners (GREP), a subsidiary of turbine manufacturer NEG Micon. The full planning application for the wind farm was submitted by GREP in August 2002, with approval granted in March 2003 at which point £10 million in capital grants was awarded.

In November 2003 NEG sold the project to Danish utility Elsam, who also own the two largest operational projects in the world at Horns Rev and Nysted. Original plans were for the installation of 30 NEG Micon NM92 2.75 MW turbines. However, following the takeover of NEG Micon by Vestas, 3 MW Vestas V90 turbines were chosen, making the 90 MW project the largest in the UK when it comes online in 2005. In December 2004 the turbine installation contract was awarded to A2Sea A/S of Denmark, with work beginning in May 2005 for A2Sea's *Sea Energy* vessel.

The project chose early on to adopt a two-season installation schedule, installing the foundations in the summer of 2004, and the topsides from the beginning of April 2005. AEI Cables were awarded the cable supply contract for the project in May 2004. The project required three 33 kV cables to shore with a total length of 28.2 km in addition to 20.8 km of interconnector cables. The 33 kV-PEX cable consists of copper conductors as well as a number of fibre optics for communication and control purposes.

Global Marine Systems won the cable installation contract, and started work on the site in November 2004. There will not be an offshore substation instead connection will be by 33 kV AC cable to an existing substation at Herne Bay (which will have to undergo a 50% increase in size).

Geotechnical surveys at Kentish Flats showed that the seabed consists of layers of sand and not too dense clay, which made monopile foundations particularly attractive. After successfully performing jack-up trials at the site, the contract for foundation installation went to Marine Projects International, who bought Mayflower Energy and their *Resolution* turbine and foundation installation vessel. Installation of the 30 monopile foundations began in August 2004 and by October 2004 (within 61 days) all foundations had been installed successfully on time and within budget. The foundations were manufactured by Sif Group, with approximately 7,800 tonnes of steel used for the 30 monopile tubular structures.

The turbines will be installed by A2Sea A/S of Denmark in the summer of 2005. The project is due to be fully commissioned and operating by the end of the year.

Lynn

Lynn			
Location	Greater Wash – 5 km off Skegness, Lincs	**Developer**	Centrica
Construction	2006	**Owner/Operator**	Centrica
Online	2006	**EPC**	Vestas with MT Hojgaard or Siemens Wind Power
Capacity (MW)	90-108	**Turbine Installation**	n/a
Number of Turbines	30	**Foundation Installation**	n/a
Turbine Manufacturer	Vestas or GE Wind	**Total Cost (£m)**	125
Turbine Rating (MW)	3-3.6	**Planning Status**	Fully approved
Foundation Type	Monopiles	**Contracting Status**	EPC bids submitted, decision due Summer 2005
Water Depth (m)	10		

Amec Offshore Wind Power Limited was the original developer of this site, an average of 5 km off the coast of Skegness. 30 turbines are planned for construction, each up to 3.6 MW, giving a maximum total capacity of 108 MW. The developers originally expected to start construction in 2004, with total project costs estimated to be approximately £90 million.

Lynn had needed to be sanctioned by the 14 March 2003 in order to qualify for the second round of capital grants, however, approval was not obtained in time and construction was subsequently pushed back to 2005, with approval gained on the 22nd October 2003 and a £10 million capital grant awarded.

In December 2003, Amec announced the sale of its 100% stake in Amec Offshore Wind Power Limited to Centrica, for an initial cash consideration of just under £3.5 million and deferred consideration of up to £1 million. Amec will continue to support the project, under contract to Centrica, through the provision of environmental, technical and management services. In buying out OWP, Centrica has also taken shares in the second round projects Lincs and Race Bank, while the sale of Lynn follows the announcement that AMEC and Centrica are teaming up to develop the Docking Shoal and Race Bank projects.

Centrica awarded Fugro a contract for geographical survey work for the Inner Dowsing and Lynn sites, which was conducted in May 2004. By June 2004, a shortlist of turnkey bidders had been drawn up and invitations to tender sent out. The contract covers design, supply and installation of 60 turbines (30 at Inner Dowsing and 30 at Lynn), the necessary infrastructure, operations, maintenance and decommissioning. The contract is worth around £200-250 million to the winning bidder, who would also be a prime contender for Centrica's other nearby developments.

Bids had been submitted by mid October 2004, with three consortia having bid for the work. Siemens and GE Wind would use their 3.6 MW turbine, while Vestas would use the 3 MW turbine which will be installed at Kentish Flats in the summer of 2005. GE partnered with CB&I John Brown and Vestas with MT Hojgaard for the job. The contract for this work is expected to be awarded within the first half of 2005, and would allow first works to begin in 2005 and offshore construction and commissioning of the sites in 2006.

As of May 2005 the contract race was between Siemens and Vestas.

East of England Scenario 2 Projects

Docking Shoal

Docking Shoal			
Location	Greater Wash - 19km off Hunstanton, Norfolk	**Developer**	Centrica / Amec
Construction	2009	**Owner/Operator**	Centrica
Online	2010	**EPC**	n/a
Capacity (MW)	550	**Turbine Installation**	n/a
Number of Turbines	100-125	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	750
Turbine Rating (MW)	4-5	**Planning Status**	Licence - Dec 2003
Foundation Type	Monopile/Tripod	**Contracting Status**	Not begun
Water Depth (m)			

The initial licence for this 500 MW project was awarded in December 2003 as part of the UK's second licensing round. Centrica are to be the owner of the wind farm and will co-develop the project with Amec, who may take an EPC role on the wind farm.

Centrica will effectively be treating the Lynn, Inner Dowsing, Lincs, Docking Shoal, and Race Bank as phases in one development and aim to get the projects built as quickly and cost effectively as possible by grouping together key contracts. Any contractor awarded work for Lynn/Inner Dowsing is therefore expected to be well positioned to gain future work in other local projects. Their close proximity also means the projects can benefit from prior environmental work already carried out on other Centrica assets.

Recent details suggest that Docking Shoal will be developed as two phases, Docking Shoal 1 and Docking Shoal 2. No further details have been made available – the two 'blocks' could be developed simultaneously or as separate developments.

Dudgeon East

Dudgeon East			
Location	Greater Wash - 28km off Cromer, Norfolk	**Developer**	Warwick Energy Ltd
Construction	2009	**Owner/Operator**	Warwick Energy Ltd
Online	2010	**EPC**	n/a
Capacity (MW)	300	**Turbine Installation**	n/a
Number of Turbines	60-100	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	350
Turbine Rating (MW)	3-5	**Planning Status**	Initial licence granted. Application 2006
Foundation Type	Steel tripod	**Contracting Status**	Not begun
Water Depth (m)	17 - 22		

Warwick Energy were awarded a licence for the Dudgeon East site in December 2003 as part of the UK's second licensing round. However, this site is outside of the UK's territorial waters and therefore requires the current Energy Bill to be passed by parliament if they are to proceed. The 300 MW site, located in water depths of between 17 and 22 metres over a seabed of sand on chalk, is considering 100 3 MW turbines, or 60-75 4-5 MW machines. Warwick hope to submit an application in 2006.

Warwick is considering synergies between wind and gas production for the Dudgeon site, as the project is sited on a gas discovery of an estimated 50 billion cubic feet of the same name held by the company. Whilst not previously judged as commercial, the gas may be recoverable in the future as technology improves and costs fall. Development of the gas field could ease the later development of the wind farm and vice versa, in terms of infrastructure, operations and maintenance.

Greater Gabbard

Greater Gabbard			
Location	Thames Estuary - 26 km off Felixstowe, Suffolk	**Developer**	Greater Gabbard Offshore Winds (Airtricity & Fluor)
Construction	2008	**Owner/Operator**	Greater Gabbard Offshore Winds (Airtricity & Fluor)
Online	2010	**EPC**	Fluor
Capacity (MW)	500	**Turbine Installation**	n/a
Number of Turbines	100-139	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	550
Turbine Rating (MW)	3.6-5	**Planning Status**	Initial licence granted. EIA underway. App - Q3 2005
Foundation Type	Monopile	**Contracting Status**	Not begun
Water Depth (m)			

The Greater Gabbard wind farm is under development by Airtricty and Fluor (under the name Greater Gabbard Offshore Winds Limited). The project was a successful bidder in the UK's second round of offshore wind farm leases.

The Greater Gabbard project is located approximately 26 km from the Suffolk coast and comprises one site located in the outer Thames Estuary, on two sand banks known as the Inner Gabbard and The Galloper, an area currently used for the dumping of material dredged from shipping channels. These two thin strips of turbines are right on the 12 mile territorial limit.

Work on the EIA began in early 2004 and will take 15 months to complete. An application to build will subsequently be lodged in the summer of 2005. Initial consultations have already begun with the local community, the fishing industry and environmental experts over the scheme. Consultations are due to end in 2005.

Assuming 3.6 MW turbines are used, the site will have 139 turbines, however, it must be assumed that the developers are considering larger machines which should be available at that time. A phased development strategy is likely, with Fluor likely to take on an EPC role (possibly in a joint role with a turbine manufacturer). No detailed information about these phases has been released at present.

If approval is successful the team expect work to begin on the site in 2008.

Gunfleet Sands II

Gunfleet Sands II			
Location	Thames Estuary - 7km off Clacton-on-Sea, Essex	**Developer**	GE Gunfleet Ltd
Construction	2007	**Owner/Operator**	Project will be sold
Online	2007-8	**EPC**	GE Wind (with ?)
Capacity (MW)	64	**Turbine Installation**	n/a
Number of Turbines	16	**Foundation Installation**	n/a
Turbine Manufacturer	GE Wind	**Total Cost (£m)**	77
Turbine Rating (MW)	4	**Planning Status**	Initial licence granted. Full app being prepared
Foundation Type	Monopile	**Contracting Status**	Contracting not begun – may carry over phase 1
Water Depth (m)	8		

Current plans for GE Wind's 64 MW extension to the Gunfleet Sands project suggest 16 turbines each rated at 4 MW will be installed in 2007. The development of Gunfleet Sands II is expected to be closely linked to the development and construction of the first phase project.

Gunfleet Sands I is currently in the contracting phase and GE are looking for an owner for the wind farm before construction begins. Any future owner would presumably be offered Gunfleet Sands II as part of any deal made. A joined-up approach to the construction of the two projects would be beneficial in terms of cost, although Gunfleet Sands II has not yet submitted a full application. GE Wind are fully expected to be using their own turbines on the project as they will on the first phase, but on this project a 4 MW machine is expected.

Gunfleet Sands II has the potential to be the first round two project installed in the UK, depending upon GE's success in finding a buyer for the first phase of the project.

Humber Gateway

Humber Gateway			
Location	Greater Wash - 10km off Spurn Head, Yorks	**Developer**	Eon UK
Construction	2008	**Owner/Operator**	Eon UK
Online	2009	**EPC**	n/a
Capacity (MW)	300	**Turbine Installation**	n/a
Number of Turbines	60-100	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	350
Turbine Rating (MW)	3-5	**Planning Status**	Initial licence granted. App. under preparation.
Foundation Type	Monopile	**Contracting Status**	Not begun
Water Depth (m)	13		

United Utilities and GREP, were awarded this 300 MW licence in December 2003 as part of UK's second licensing round, under the name Humber Wind Ltd.

In May 2005, Vestas sold GREP's 50% share of the Humber Gateway project to Eon UK. GREP was previously owned by NEG Micon who was recently taken over by Vestas. Eon bought United Utilities' share of the project earlier in 2005. It is understood that Eon are likely to sell GREP's share to Energi E2 in the near future in an attempt to share some of the risk inherent in such a big development. E2 already has construction phase experience from the Nysted project in Denmark.

Construction was initially planned for 2007, but is expected to slip into 2008/9, with the developer aiming for a one season installation of the 60-100 turbines.

The water depth at the site is shallow (12-14 metres) meaning monopiles are likely, although GBS foundations could also be possible. The project will be built on the seabed (a firm boulder clay), rather than a sandbank and at the nearest point the coast will be just 8 km away (visual impact could be a problem as Spurn Head is a Heritage Coast site).

Two offshore substations are initially planned, and power will be exported to the grid at 132kV. A full application is expected by the end of 2005, with environmental impact assessment studies already underway.

Lincs (Inner Dowsing II)

Lincs (Inner Dowsing II)			
Location	Greater Wash - 8 km off Skegness, Lincs	**Developer**	Centrica
Construction	2008	**Owner/Operator**	Centrica
Online	2009	**EPC**	n/a
Capacity (MW)	250	**Turbine Installation**	n/a
Number of Turbines	50-83	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	300
Turbine Rating (MW)	3-5	**Planning Status**	Initial licence granted. App. under preparation
Foundation Type	Monopile	**Contracting Status**	Not begun
Water Depth (m)	10-15		

Offshore Wind Power (OWP) initially won the 250 MW licence for the Lincs site, which is effectively an extension to the Inner Dowsing project. Centrica assumed total ownership of the project in December 2003 after buying out OWP, and will effectively be treating the Lynn, Inner Dowsing, Lincs, Docking Shoal, and Race Bank as phases in one development.

The recently completed environmental impact assessment work on Centrica's other assets will aid the development of this project, with construction on this site potentially beginning as early as 2007. The application to build will be submitted in Q1 2005, with Centrica currently looking at between 50-80 3-5 MW turbines. Grid improvements are necessary, and one offshore substation will be built.

London Array – Phase 1 (LAWL)

The London Array development is a 1 GW offshore wind farm planned for the Thames Estuary. The wind farm was originally proposed by EROWL (formerly Powergen) and Shell, in association with Core (a private-equity consortium between Energi E2 and Farm Energy). The initial timetable called for construction in 2007, however, the project has now been split into three phases and will be developed individually by two teams.

London Array –Phase 1 (LAWL)			
Location	Thames Estuary	**Developer**	London Array West (EROWL & Core)
Construction	2007/8	**Owner/Operator**	London Array West (EROWL & Core)
Online	2009	**EPC**	n/a
Capacity (MW)	300	**Turbine Installation**	n/a
Number of Turbines	100	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	360
Turbine Rating (MW)	3	**Planning Status**	Licence granted. EIA complete. Application June 05.
Foundation Type	Monopile	**Contracting Status**	Pre-qualification begun.
Water Depth (m)	8		

The project was designed for 300 wind turbines, each up to 300ft tall, which would generate 1,000 megawatts of electricity. Although the wind farm is to be built 12 miles offshore, the project will include an onshore substation, proposed for Cleve Hill, which will collect the generated power and feed it into the electricity grid.

By August 2004, two full years of bird studies had been completed at the site. A met mast to record wind speed data was erected at the site by Seacore in October 2004 using Seacore's own purpose built eight legged jack-up platform *Excalibur* as a stable working platform to install the 1.62m diameter tubular steel foundation monopile. The met mast tower is equipped with anemometry, temperature probes and electronic recording and transmitting equipment.

London Array – Phase 2 (LAWL)			
Location	Thames Estuary	**Developer**	London Array West (EROWL & Core)
Construction	2009/10	**Owner/Operator**	London Array West (EROWL & Core)
Online	2011	**EPC**	n/a
Capacity (MW)	367	**Turbine Installation**	n/a
Number of Turbines	73-122	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	440
Turbine Rating (MW)	3-5	**Planning Status**	Licence granted. EIA complete. Application June 05.
Foundation Type	Monopile	**Contracting Status**	Pre-qualification begun
Water Depth (m)	8		

The consultation process for the wind farm began in September 2004 with EROWL contacting community and industry groups in the region. The consultation exercise is a precursor to seeking planning approval from Kent and Essex councils in 2005. By engaging with the community the development team will hope to pre-empt any opposition to the project.

While the full application to build the wind farm is scheduled for submission mid 2005 there have recently been major changes to the development strategy. In January 2005, the project partners on London Array split the development and will progress as two separate development teams. EROWL and Core have formed London Array West Limited (LAWL) and will build the first phase of up to 300 MW and a further phase of 367 MW at a later date. Shell will focus on a 333 MW phase of the project.

LAWL have begun the pre-qualification process for their first phase calling for up to 100 turbines, 60 km of 33 kV infield cabling, 50 km of 200 kV export cable and a substation. Invitations to tender will be sent out in the first week of April 2005.

London Array – Phase 3 (Shell)			
Location	Thames Estuary	**Developer**	Shell
Construction	2009	**Owner/Operator**	Shell
Online	2010	**EPC**	n/a
Capacity (MW)	333	**Turbine Installation**	n/a
Number of Turbines	111	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	400
Turbine Rating (MW)	3	**Planning Status**	Initial licence granted. EIA complete.
Foundation Type	Monopile	**Contracting Status**	Not begun
Water Depth (m)	8		

Race Bank

Race Bank			
Location	Greater Wash - 24 km off Hunstanton, Norfolk	**Developer**	Centrica
Construction	2009	**Owner/Operator**	Centrica
Online	2011	**EPC**	n/a
Capacity (MW)	500	**Turbine Installation**	n/a
Number of Turbines	100-125	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	600
Turbine Rating (MW)	4-5	**Planning Status**	Initial licence granted
Foundation Type	Steel tripod	**Contracting Status**	Not begun
Water Depth (m)			

The licence for this 500 MW project was awarded in December 2003 as part of the UK's second round, and was one of two new awards for Amec. This project lies outside of the UK's territorial waters, however, new legislation due will allow development.

Amec later announced the sale of its 100% stake in Amec Offshore Wind Power Limited to Centrica for an initial cash consideration of just under £3.5 million and deferred consideration of up to £1 million. Amec will continue to support the project under contract to Centrica, through the provision of environmental, technical and management services.

Sheringham Shoal

Sheringham Shoal			
Location	Greater Wash - 18 km off Cromer, Norfolk	**Developer**	Scira Offshore Energy (Ecoventures & SLP)
Construction	2009	**Owner/Operator**	Developer to sell to owner
Online	2009	**EPC**	n/a
Capacity (MW)	315	**Turbine Installation**	n/a
Number of Turbines	63-105	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	380
Turbine Rating (MW)	3-5	**Planning Status**	Initial licence granted. App under preparation
Foundation Type	Monopile	**Contracting Status**	Not begun
Water Depth (m)	15		

Ecoventures and SLP Energy (under the joint venture Scira Offshore Energy) were awarded this 315 MW site as part of the UK's second round of offshore wind farm licences in December 2003. Scira will develop the project up to construction at which point it is likely to sell the asset to a long-term owner.

The project will consist of between 60 and 80 turbines, located in the Greater Wash, about 20 km north of the Norfolk coast, in water depths of between 10 and 20 metres. The original tender was based upon 80 4 MW turbines, however, this remains flexible at this stage. The developers expect planning permission in 2006, with the survey work necessary for the EIA having begun in 2004. The project is already targeted as a one season installation.

Thanet

Thanet			
Location	Thames Estuary - 11 km off North Foreland, Kent	**Developer**	Warwick Energy
Construction	2009	**Owner/Operator**	Warwick may sell on
Online	2010	**EPC**	n/a
Capacity (MW)	300	**Turbine Installation**	n/a
Number of Turbines	60-100	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	360
Turbine Rating (MW)	3-5	**Planning Status**	Initial licence granted. App. being prepared.
Foundation Type	Monopile	**Contracting Status**	EIA awarded May 2004 Contracting not begun
Water Depth (m)	12		

Warwick Energy was awarded a licence for this 300 MW site off North Foreland in the Thames Estuary as part of UK's second round. The developer was initially targeting a 2007 construction date although this is believed to be somewhat optimistic, and is expected to slip into 2009.

In March 2004, the UK Department of Transport published a report showing that many of the second round projects will be located in areas of heavy shipping traffic. Although many sites were selected to avoid traffic some, including Thanet, are located in high-traffic locations, which may cause problems during the approvals process.

Warwick Energy awarded the environmental consultancy contract for the Thanet project in May 2004 to Posford Haskoning.

Triton Knoll

Triton Knoll			
Location	Greater Wash - 30 km off Mablethorpe, Lincs	**Developer**	Npower Renewables
Construction	2010	**Owner/Operator**	Npower Renewables
Online	2012	**EPC**	n/a
Capacity (MW)	1,200	**Turbine Installation**	n/a
Number of Turbines	240-300	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	1,450
Turbine Rating (MW)	4-5	**Planning Status**	Initial licence granted
Foundation Type	Steel tripod	**Contracting Status**	Not begun
Water Depth (m)			

One of the biggest proposed projects in the world, this 1,200 MW giant is under development by Npower Renewables (formerly National Wind Power). It is located in the Greater Wash area, but outside of territorial waters and will therefore require the current Energy Bill to be passed by parliament if the project is to proceed. The Energy Bill would also be a requirement for the required grid capacity to be made available, while development will also depend on a favourable outcome of the 2006 review of the Renewables Obligation.

Realistically, this project belongs very much in the next decade and Npower Renewables will concentrate on other projects first. Npower is aiming for consent in 2007, a bird study is underway, and a met mast is due for installation before the end of 2005. The very earliest construction could take place is 2009 (although 2010 is forecast by DWL), and it may be split over several seasons (e.g. 250 MW a year).

In March 2004 the UK Department of Transport published a report showing that many of the second round projects will be located in areas of heavy shipping traffic. Although many sites were selected to avoid traffic, some, including Triton Knoll, are located in high-traffic locations, which may cause problems during the approvals process. In Triton Knoll's case a large section of the southwest part of the project lies in a main shipping channel where over 1,500 ships a year pass.

The MoD have objected to the Triton Knoll project (along with many other second round developments).

Westernmost Rough

Westernmost Rough			
Location	Greater Wash - 18 km off Aldbrough, Yorks	**Developer**	Total
Construction	2009	**Owner/Operator**	Total
Online	2010	**EPC**	n/a
Capacity (MW)	240	**Turbine Installation**	n/a
Number of Turbines	60-80	**Foundation Installation**	n/a
Turbine Manufacturer	n/a	**Total Cost (£m)**	290
Turbine Rating (MW)	3-4	**Planning Status**	Initial licence granted
Foundation Type	Monopile or Steel tripod	**Contracting Status**	Not begun
Water Depth (m)			

Total make their entry into offshore wind with this 240 MW licence awarded in December 2003 as part of the UK's second licensing round. The site will use turbines between 3 MW and 4 MW in size, making a one season installation possible. It will be interesting to see the contracting strategy that Total adopt for the project, coming from and oil and gas background.

In March 2004 The UK Department of Transport published a report showing that many of the second round projects will be located in areas of heavy shipping traffic. Westernmost Rough is one of these sites, and such issues may cause problems during the approvals process.

The MoD have objected to this project because of perceived radar issues.