Climate & Renewables

E.ON Offshore Wind Energy Factbook

E.ON Climate & Renewables – June 2009

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Dear reader,

hardly any sector in the renewables business receives so much attention these days as offshore wind energy. And yet, so little is known and understood about this young industry and the technology behind it. Views about challenges, opportunities, benefits and risks differ significantly, depending on whom you ask.

E.ON has, for almost a decade, built industry leading experience in this sector and would like to contribute this to the debate on how best to develop this business. With this Offshore Factbook we aim to provide insights on the offshore wind industry and the most important issues to consider, such as technological and logistical challenges. We also give an overview of how E.ON is approaching the offshore wind sector as an area of strategic focus in our renewables agenda.

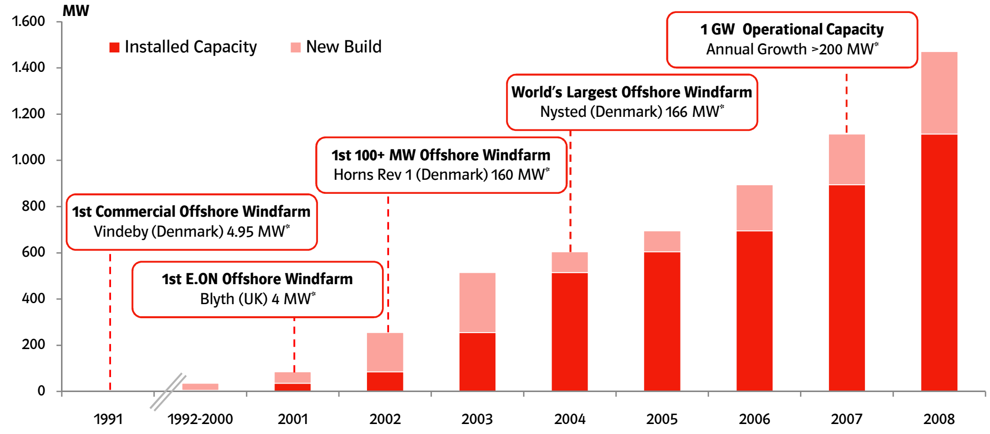
We hope that you find this handbook a useful source and we would be happy to engage in a dialogue with you.

Kind regards,

E.ON Offshore Factbook

1. Offshore – The Industry
2. Offshore – The Challenges
3. Offshore – The E.ON Approach
4. Offshore – The E.ON Project Factsheets
5. Offshore – The Key Learnings

Development and Milestones

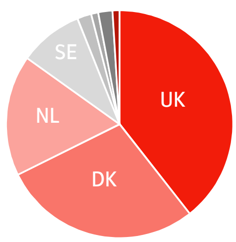


After slow and pilot-project driven development until 2001 the offshore industry has experienced strong capacity growth over recent years. With a constant increase in annual growth rates and in the size of individual offshore wind projects, the trend is set to continue and growth prospects for the offshore industry are looking strong

* Source: European Wind Energy Association

2009 - Snapshot

Global Installed Offshore Wind Capacity *



United Kingdom	39%	590.80 MW
Denmark	28%	409.15 MW
Netherlands	17%	246.80 MW
Sweden	9%	133.30 MW
Belgium	2%	30.00 MW
Ireland	1%	25.20 MW
Finland	2%	24.00 MW
Germany	1%	12.00 MW
Total		**1,471.33 MW**

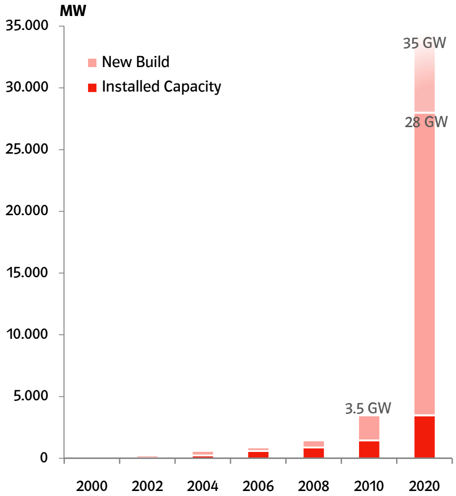
Good to know…

- To date a total of 9 countries host operational offshore wind turbines
- All operational offshore wind farms are located in European waters
- More than 80% of the total installed capacity is located in the UK, Denmark and the Netherlands
- In 2008 a total of 357 MW of offshore capacity was brought online
- The offshore wind market is largely dominated by utilities, who operate about 90% of the installed capacity

* Sources: European Wind Energy Association, Emerging Energy Research

2020 - Outlook

Capacity Development and Forecast*



Good to know…

- The European offshore industry is forecast to grow:
  - → 3.5 GW in 2010*
  - → 28 -35 GW in 2020*
- The prospected capacity growth translates into a compound annual growth rate of 30% between the years 2009 and 2020
- Offshore wind energy is on the renewables agenda of several countries:
  - → UK (14 GW by 2020;33 GW by 2030)*
  - → Germany (10 GW by 2020;25 GW by 2030)*
  - → Netherlands (6 GW by 2020)*
- With a project pipeline of 3,100 MW, E.ON takes a leading role in the offshore industry development

* Sources: European Wind Energy Association, Emerging Energy Research, BMU (Germany), BERR (UK), VROM (Netherlands)

Market Dimensions

Adding 30,000 MW offshore wind capacity requires to build 2 large offshore wind turbines per day until 2020

Picture taken at E.ON Offshore Project - Robin Rigg (UK, 2009)

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"Offshore is more than onshore in the water"

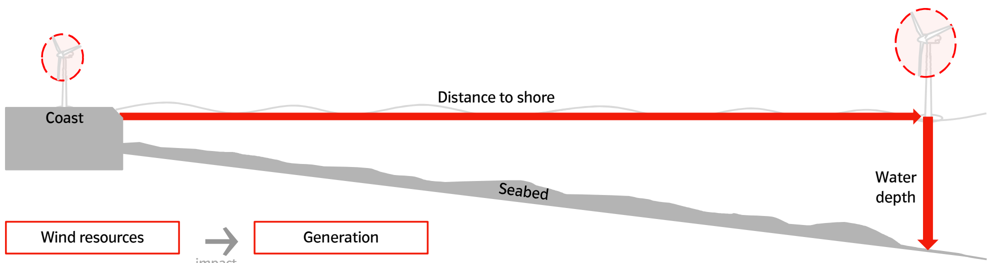
Main factors for onshore and offshore wind energy projects

	Onshore	Offshore
Resources	• 2,000 full load hours • Limited sites available • At full load, one wind turbine produces a household's annual consumption* in 200 minutes	• 4,000 full load hours • Large sites available • At full load, one wind turbine produces a household's annual consumption* in 40 minutes
Dimensions	• 1 – 3 MW wind turbines • Wind farms of 20 – 50 MW • Investment of 30 – 70 million Euros per wind farm	• 3 – 5 MW wind turbines • Wind farms of 100 – 1,000 MW • Investment of 1 – 2 billion Euros per wind farm
Environment	• Smooth conditions • Unrestricted access (24 hours / 7 days a week)	• Rough marine conditions • Distance to shore 1 – 70 km • Access limited by high waves
Foundations	• Built on solid ground • Standard concrete piles and foundations cast on site	• Differing soil conditions (sand, clay, rock) and erosion • Foundation type depends on water depth and soil capacity (e.g. monopiles, gravity, tripod)

*based on average annual consumption of 3,500 KWh

Compared to onshore, offshore wind energy has larger potentials but marine conditions pose great challenges to project delivery – weather, wind and waves are the dominating factors. All things considered, offshore wind energy requires a whole new approach to wind power in terms of wind turbine technology and scale, foundation types, logistics for installation and maintenance, as well as port infrastructure.

"Offshore is not offshore"

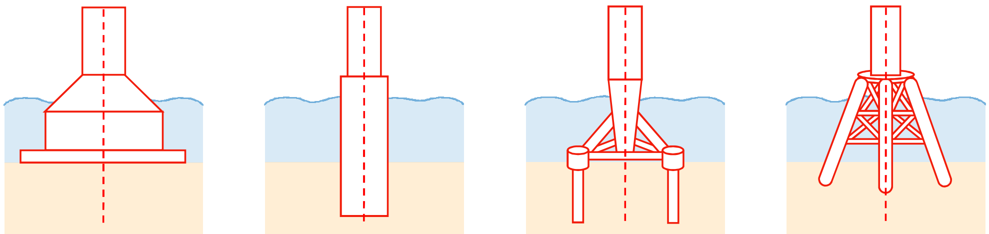


Wind resources	→ impact	Generation
Distance to shore Water depth	→ impact	Foundations Size of wind farm Wind turbines Logistics

Every offshore site has its own specific conditions

The technical requirements for offshore wind projects follow a simple logic: the better the wind resources the higher the electricity generation, the further offshore and the greater the water depth - the bigger and more expensive the foundations that have to be used - the larger the wind turbines that are necessary to make the project economic. In addition to water depth, distance to shore, wind resources and wind turbines an offshore wind project requires the succesful management of logistical challenges, such as vessels and operational concepts.

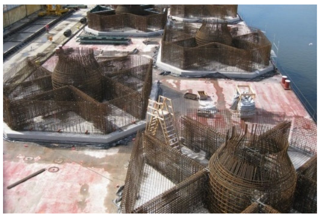
Offshore Foundations - Overview



Gravity Foundation	Monopile Foundation	Tripod Foundation	Jacket Foundation
• Re-enforced concrete	• Steel structure	• Heavy steel structure	• Laterace steel structure
• Max. water depth = 30m	• Max. water depth = 25m	• Max. water depth = 35m	• Max. water depth = 45m
• Suitable for 5 MW turbines	• Limited to 3.6 MW turbines	• Suitable for 5 MW turbines	• Suitable for 5 MW turbines
• Good experience	• Well established	• Little experience	• Little experience

Water depth and consistency of the seabed determine the choice of foundation. So far, there is no universal foundation type suitable for all kinds of seabed conditions. Various foundation concepts have been applied so far, with monopile and gravity foundations playing the biggest role. Other concepts, especially for deep-water application, are still at a prototype stage. Significant research and development efforts are still necessary to develop a cost-efficient concept for production at industrial scale.

Gravity Foundation - Manufacturing


Construction of the steel formwork


Foundations are cast in concrete

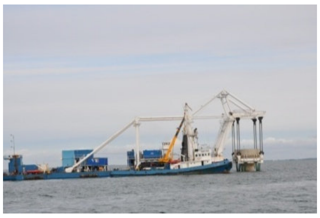

Completed gravity foundation

- Gravity foundations can be used in waters with a maximum depth of 30 meters
- The installation of gravity foundations requires firm ground conditions and good seabed preparation
- Made of reinforced concrete, one gravity foundation can weigh up to 1,400 tons
- To increase weight and stability gravity foundations are often filled with gravel and stones
- From arrival at site the complete cycle of installation of a foundation takes less than 24 hours
- E.ON has gained experience with gravity foundations in its Danish projects Nysted and Rødsand 2
- To date, E.ON has successfully installed more than 80 gravity foundations

Pictures taken at E.ON Offshore Project - Rødsand 2 (Denmark, 2009)

Gravity Foundation - Installation


Foundations being shipped to site


Heavy lift vessel on site


1,300 ton foundation being positioned


Foundation being lowered to seabed

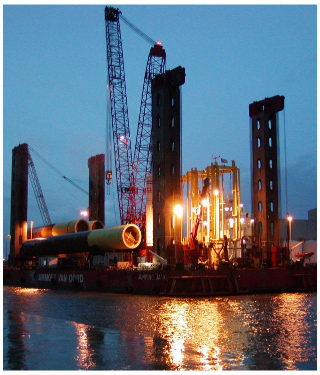

Level checks being taken


Installation completed

Pictures taken at E.ON Offshore Project - Rødsand 2 (Denmark, 2009)

Monopile Foundation - Delivery

Monopile delivered to harbor



Monopiles loaded out on jack-up barge

Monopile being up-ended for installation

- Monopile foundations can be used in waters with a maximum depth of 25 meters
- Made of steel, one monopile foundation weighs up to 300 tons
- About 30 meters of the monopile is driven into the seabed

Pictures taken at E.ON Offshore Project - Scroby Sands (UK, 2003)

Monopile Foundation - Installation

Pile gripper for exact pile positioning

Pile hammer (300t of force) driving monopile

Installation completed

- From arrival at site the complete cylce of installation of a foundation takes less than 24 hours
- E.ON has gained experience with monopile foundations in its UK projects Blyth, Scroby Sands, Robin Rigg
- To date E.ON has successfully installed more than 90 monopile foundations

Pictures taken at E.ON Offshore Project - Scroby Sands (UK, 2003)

Tripod - Manufacturing and Delivery


Tripods being welded in Norway


Tripod up-ended for shipping


Tripods arriving at Wilhelmshaven port

- Tripod foundations can be used in deep waters with a maximum depth of 35 meters
- Made of steel, one tripod foundation weighs up to 700 tons with a total height of up to 50 meters
- The installation of a tripod foundation requires three securing steel piles, each 30 meters long and with 100 tons of weight
- The manufacturing of the tripods is a complicated process due to extensive welding works

Pictures taken at E.ON Offshore Project - Alpha Ventus (Germany, 2009)

Tripod - Installation


Heavy-lift crane ship on site


Tripod foundation being lowered to seabed

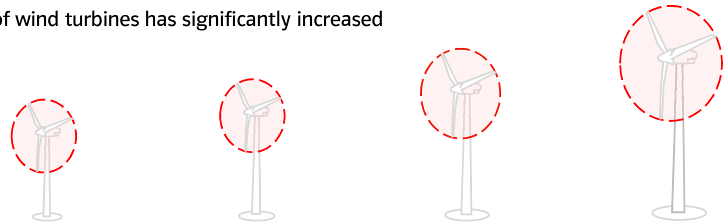

Installation completed

- E.ON has gained experience with the successful installation of six tripod foundations in the German offshore wind project Alpha Ventus
- From arrival at site the complete installation cycle of a foundation takes 2-3 days
- The installation of tripod foundations will benefit from larger capacity jack-up crane vessels
- So far only little experience has been gained with the installation of tripod foundations

Pictures taken at E.ON Offshore Project - Alpha Ventus (Germany, 2009)

Wind Turbines - Development

The size and capacity of wind turbines has significantly increased



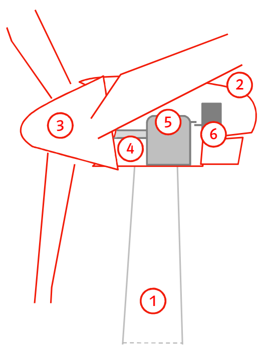
Project	Scroby Sands	Nysted	Robin Rigg	Alpha Ventus
Turbine Type	Vestas V80	Siemens	Vestas V90	REpower/Multibrid
Hub Height	60m	69m	80m	90m
Rotor Diameter	80m	80m	90m	120m
Capacity	2 MW	2.3 MW	3.0 MW	5 MW
Number of Turbines	30	72	60	12

Since the installation of the first offshore wind projects, size and capacity of offshore wind turbines have considerably increased. While at onshore sites the size of wind turbines is often limited by restrictions on height and rotor diameter, offshore wind turbines do not encounter these limits in the open sea. Thus, offshore wind turbines exceed the size of their onshore counterparts.

Wind Turbines - Technology

Most offshore wind turbines have a conventional design that is also used in onshore wind turbines

Main components are:



1. Tubular steel tower
2. Nacelle with main mechanical and electrical components
3. Hub with three rotor blades, rotating at slow speed
4. Main shaft transmitting rotation from hub to gearbox
5. Multistage gearbox with high gear transmission ratio
6. Fast turning generator, producing electricity

- In addition to normal "wear and tear" offshore wind turbines may suffer damage from:
  - → Corrosion due to aggressive salty environment
  - → High wear due to heavy mechanical loads and higher utilization
- Failures may affect gearbox, generator, transformer, blades and transmission cables

Wind Turbines - Pre-Assembly and Installation


Pre-assembled turbine parts in the harbour


Offshore installation of turbine tower


Turbine nacelle being lifted

- Wind turbine components need to be pre-assembled onshore to allow quick installation offshore
- Most important pre-assembly works include mounting blades on nacelle and stacking tower segments
- Greater wind resources mean much higher workloads for offshore wind turbines compared to onshore
- As offshore wind turbines cannot be accessed all the time due to weather and wave conditions they need to be highly robust and reliable to avoid costly standstills

Pictures taken at E.ON Offshore Project - Robin Rigg (UK, 2009)

Wind Turbines - Installation


Turbine nacelle being positioned on tower


Installation of the third turbine blade


Installation completed

- The further offshore wind turbines are installed, the larger they have to be to make up for the increased costs of far-shore components (foundations) and logistics (vessels)
- From arrival at site the installation of a wind turbine takes a minimum of 24 hours
- Offshore wind turbines require special protection against agressive marine conditions
- To date E.ON is operating and installing more than 250 offshore wind turbines in 3 different countries

Pictures taken at E.ON Offshore Project - Robin Rigg (UK, 2009)

Offshore Vessels - Requirements

Jack-up crane vessel during foundation installation

Heavy-lift crane ship during foundation installation

- In order to conform with the requirements for an offshore wind construction process vessels need:
  - → sufficient storage capacity
  - → sufficient height and lifting power
  - → the ability to quickly anchor and jack-up on-site
  - → the ability to operate year-round in a range of water depths, wave heights and currents
- Purpose-built vessels are key to successful offshore construction

Pictures taken at E.ON Offshore Project s - Robin Rigg (UK, 2009) and Alpha Ventus (Germany, 2009)

Offshore Vessels - Characteristics

Heavy-lift crane ship

- Very limited storage capacity
- Strong lifting power, low height
- Slow, hauler needed
- Susceptible to waves

Jack-up barge

- Limited storage capacity
- Sufficient lifting power and height
- Slow, hauler needed
- Less susceptible to waves

Jack-up crane vessel

- Large storage capacity
- Sufficient lifting power and height
- Fast, flexible and independent
- Less susceptible to waves

- Jack-up crane vessels are the ideal solution, but do not yet exist for turbines greater than 3.6 MW
- The world market for offshore installation vessels is very tight with only a few ships available worldwide

→ 3 vessels for turbines up to 3 MW → 1 vessel for 3.6 MW turbines → 3 crane-ships/barges for 5 MW turbines (no vessels)

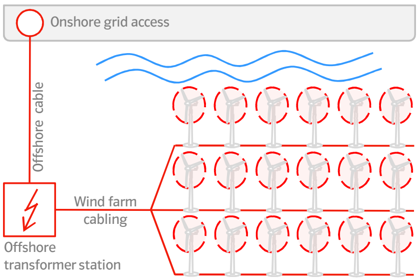
Pictures taken at E.ON Offshore Projects - Robin Rigg (UK, 2009) and Alpha Ventus (Germany, 2009)

Cabling

Cable plowing on shore

Cable pulling to foundation

Installation completed



- Offshore cables are installed on seabed and need to be designed to withstand offshore conditions
- Cables used for offshore wind farms consist of three phases and one communication line
- For safe operations, offshore cables need to be buried 1 – 3 meters deep into the seaground

Pictures taken at E.ON Offshore Project - Scroby Sands (UK, 2004)

Offshore transformer stations

700 ton jacket foundation being transported

Transformer topside installation

Installation completed

- Offshore wind farms need to be equipped with a transformer station for the connection to the local power grid – they are often installed at the offshore site with a sub-sea cable linking it to the onshore grid
- Transformer substations need to be completely fitted out onshore and installed as a single unit offshore
- Heavy lift crane ships are required for the installation of both, foundation and transformer station
- At Alpha Ventus, the transformer station has a height of 30 meters above sea level, standing on a jacket foundation of 700 tons weight

Pictures taken at E.ON Offshore Project - Alpha Ventus (Germany, 2009)

Port Infrastructure

Port storage for towers and nacelles

Port storage for monopiles

Offshore components awaiting shipment

- Offshore success comes from doing as much as possible onshore - every working step completed onshore saves time and money during offshore installation
- Port facilities have to allow for storage and pre-assembly of foundations and wind turbine components
- Development of the offshore business requires heavy investment in port infrastructures

Pictures taken at E.ON Offshore Project - Robin Rigg (UK, 2009)

Operations and Maintenance (O&M)

O&M vessel arriving on site

Preparing boat landing at site

Accessing the offshore wind turbine

- Quick O&M site access is crucial to avoid costly stand-stills
- Offshore access is constrained by weather and waves and can be impossible in winter or during storms
- Travel time is a big issue: small boat access to far-shore wind farms can take up to 6 hours
- New O&M concepts for far-shore projects including manned platforms and daily helicopter or speed boat transfer need to be developed

Pictures taken at E.ON Offshore Projects - Various Projects

E.ON Offshore Factbook

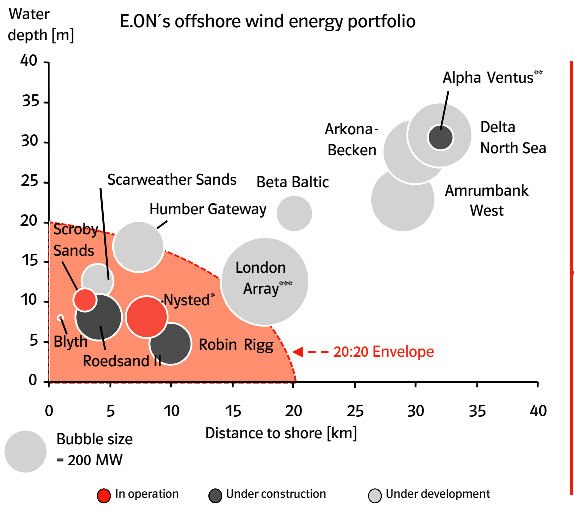
E.ON has a leading competence in offshore wind energy

Offshore plays a key role in E.ON´s strategy

- E.ON is one of the world leading companies in the offshore wind business
  - → 3 operational offshore wind farms (100 MW) in UK and Denmark
  - → 3 offshore wind farms (400 MW) under construction in UK, Denmark and Germany
  - → Green light for London Array* (1,000 MW) in UK
  - → Unique, diversified project pipeline of 3.1 GW
- E.ON has so far invested about 1 billion Euros into its offshore activities
- E.ON´s experience from its various projects sums up to a strong offshore wind expertise

*Joint Venture of E.ON (30%), DONG (50%) and Masdar (20%)

E.ON - Strategic Approach



The 20:20 Envelope marks an important frontier in the offshore wind business and requires a step-change in technology and logistics

E.ON´s strategy for offshore wind energy is based on a stepwise approach:

- Develop offshore wind energy on a wide range of projects
- Build capability in less challenging conditions
- Daily learning and improvement from real projects out in the sea
- Develop improvements and solutions across the whole value chain
- Translate all learnings into development of the next level of the offshore wind industry

*Joint Venture (JV) of E.ON (20%) and DONG (80%), **JV of E.ON (26.25%), EWE (47.5%) and Vattenfall (26.25%), ***JV of E.ON (30%), DONG (50%) and Masdar (20%),

E.ON - Offshore Map

Projects — E.ON Offshore wind farm in operation

Projects — E.ON Offshore wind farm under construction

Projects — E.ON Offshore wind farm in development

E.ON Offshore Project Pipeline → more than 3,100 MW

E.ON Offshore Focus Countries → UK, Germany, Denmark, Sweden

E.ON - Offshore Portfolio

Country	Project	Status	Start of Operation	Capacity (MW)	E.ON Share
UK	Blyth	Operational	2001	4	100%
UK	Scroby Sands	Operational	2004	60	100%
Denmark	Nysted*	Operational	2004	166	20%
UK	Robin Rigg	Construction	2009	180	100%
Germany	Alpha Ventus**	Construction	2009	60	26.25%
Denmark	Rodsand 2	Construction	2010	207	100%
UK	London Array***	Consented	2013	1,000	30%

E.ON has the most extensive and diversified portfolio of offshore assets and projects. We already operate 3 wind farms in Denmark and the UK with a combined capacity of 100 MW and have a further 400 MW of projects under construction. We are working in the regions of North-West Europe with the best offshore wind resources. These regions constitute the offshore wind energy market for the next decade. Our regional spread and the variety of conditions gives us a great platform of experience to turn our industry leading offshore wind pipeline of more than 3,100 MW into actual offshore capacity.

*Joint Venture (JV) of E.ON (20%) and DONG (80%), **JV of E.ON (26.25%), EWE (47,5%) and Vattenfall (26.25%), ***JV of E.ON (30%), DONG (50%) and Masdar (20%),

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Blyth (UK, North Sea)

Picture taken at E.ON Offshore Project - Blyth (UK, 2004)

Blyth (UK, North Sea)

Wind Farm

Capacity (MW)	4
Status	Operational
Start of Operation	2001
Distance to Shore (km)	1
Max. Water Depth (m)	8

Foundations

Type	Monopile
Material	Steel
Weight (t)	110
Height (m)	25
Diameter (m)	4

Wind Turbines

Type	Vestas V66
Capacity (MW)	2
No. of Turbines	2
Hub Height (m)	60
Rotor Diameter (m)	66

Good to know….

- Built in 2001, Blyth marked the start of E.ON's activities in the offshore sector
- Blyth was a prototype build and the first offshore wind project in UK waters
- Monopiles at Blyth were drilled 10 meters deep into a rock seabed
- The total investment for the completion of Blyth amounted to about 6 million Euros

Scroby Sands (UK, North Sea)

Picture taken at E.ON Offshore Project - Scroby Sands (UK, 2005)

Scroby Sands (UK, North Sea)

Wind Farm

Capacity (MW)	60
Status	Operational
Start of Operation	2004
Distance to Shore (km)	3
Max. Water Depth (m)	15

Foundations

Type	Monopile
Material	Steel
Weight (t)	200
Height (m)	50*
Diameter (m)	4.2

* Up to 8m above sea level; buried up to 30m into ground

Wind Turbines

Type	Vestas V80
Capacity (MW)	2
No. of Turbines	30
Hub Height (m)	60
Rotor Diameter (m)	80

Good to know….

- Scroby Sands was E.ON's first commercial offshore wind farm
- Through the project E.ON gained valuable experience in installing a large series of offshore wind turbines with monopile foundations, even in the unfavourable winter season
- Operational improvements have lead to a continuously high generation performance
- With an annual production of 171 GWh the farm supplies 41,000 homes with electricity
- The total investment for the completion of Scroby Sands amounted to 109 million Euros

Robin Rigg (UK, Irish Sea)

Picture taken at E.ON Offshore Project - Robin Rigg (UK, 2009)

Robin Rigg (UK, Irish Sea)

Wind Farm

Capacity (MW)	180
Status	Construction
Start of Operation	2009
Distance to Shore (km)	10
Max. Water Depth (m)	9

Foundations

Type	Monopile
Material	Steel
Weight (t)	260
Height (m)	50*
Diameter (m)	5

* about 30m burried in the sea bed

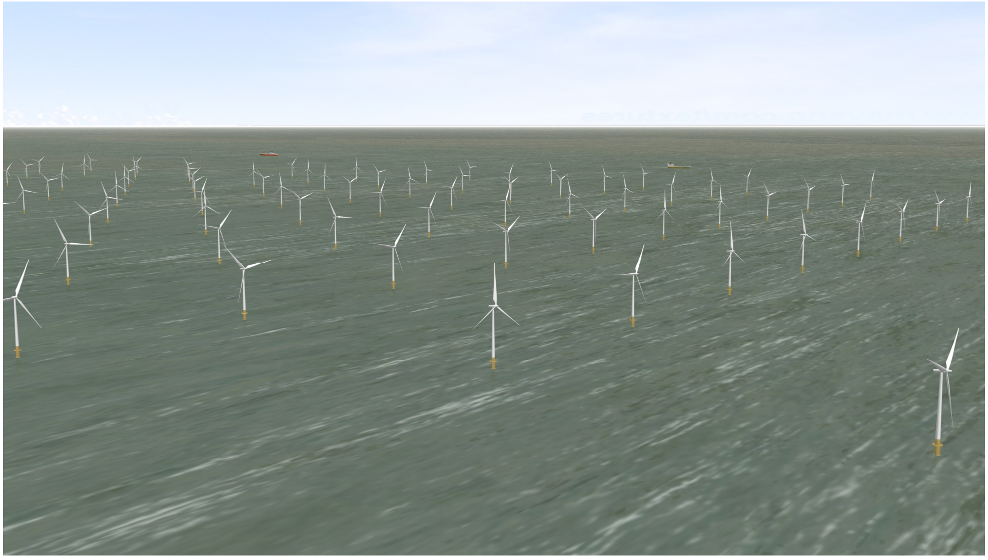
Wind Turbines

Type	Vestas V90
Capacity (MW)	3
No. of Turbines	60
Hub Height (m)	80
Rotor Diameter (m)	90

Good to know….

- After its completion in 2009 Robin Rigg will be E.ON's biggest offshore wind farm
- The project builds on the experience gained at Scroby Sands, employing similar monopile foundations and wind turbines
- The realization of Robin Rigg benefits from the use of jack-up crane vessels that allow E.ON to install foundations all year-round
- With an annual production of 550 GWh the farm will supply 155,000 homes with electricity
- The total investment for the completion of Robin Rigg amounts to about 400 million Euros

London Array (UK, Thames Estuary)



Artist Impression of E.ON Offshore Project - London Array (UK, 2009)

London Array (UK, Thames Estuary)

Wind Farm

Capacity (MW)	1,000
Status	Consented
Start of Operation	2013*
Distance to Shore (km)	22*
Max. Water Depth (m)	25*

* Phase 1 (630 MW)

Key Facts

Foundation Type	Monopile
Foundation Material	Steel
Turbine Type	Siemens*
No. of Turbines	175*
Turbine Capacity (MW)	3.6*

* Phase 1 (630 MW)

Good to know….

- London Array will be built in two phases (phase 1 = 630 MW; phase 2 = 370 MW) and will, upon completion, be the world's largest offshore windfarm
- The project is being developed jointly by Dong Energy (50%), E.ON (30%), and Masdar (20%)
- London Array will benefit from E.ON's experience at Scroby Sands and Robin Rigg in the installation of foundations, turbines and cable laying
- After full completion**, London Array will provide enough power for up to 750,000 homes
- The total investment cost of Phase 1 of London Array will be around 2.2 billion Euros

*Phase 1 (630 MW) **Including phase 1 and phase 2 of the project

Nysted (Denmark, Baltic Sea)

Picture taken at E.ON Offshore Project - Nysted (Denmark, 2004)

Nysted (Denmark, Baltic Sea)

Wind Farm

Capacity (MW)	166
Status	Operational
Start of Operation	2004
Distance to Shore (km)	8
Max. Water Depth (m)	12

Foundations

Type	Gravity
Material	Concrete
Weight (t)	1,200
Height (m)	15
Diameter (m)	15

Wind Turbines

Type	Siemens 2.3-82
Capacity (MW)	2.3
No. of Turbines	72
Hub Height (m)	90
Rotor Diameter (m)	82

Good to know….

- Nysted is a joint project between E.ON (20%) and Dong Energy (80%)
- At the time of completion Nysted was the largest offshore wind farm in the world
- The project benefits from a perfect offshore combination: good wind yield, closeness to shore, shallow waters and good soil conditions
- With an annual production of 600 GWh the farm supplies 170,000 homes with electricity
- The total investment for the completion of Nysted amounted to about 200 million Euros

Rødsand 2 (Denmark, Baltic Sea)

Picture taken at E.ON Offshore Project - Rødsand 2 (Denmark, 2009)

Rødsand 2 (Denmark, Baltic Sea)

Wind Farm

Capacity (MW)	207
Status	Construction
Start of Operation	2010
Distance to Shore (km)	4
Max. Water Depth (m)	10

Foundations

Type	Gravity
Material	Concrete
Weight (t)	1,300
Height (m)	15
Diameter (m)	15

Wind Turbines

Type	Siemens 2.3-93
Capacity (MW)	2.3
No. of Turbines	92
Hub Height (m)	68
Rotor Diameter (m)	93

Good to know….

- Rødsand II builds on E.ON's joint venture project at Nysted 1, using established technology and repeat installation contractors
- The project benefits from a perfect offshore combination: good wind yield, closeness to shore, shallow waters and good soil conditions
- With an annual production of 800 GWh the farm will supply 229,000 homes with electricity
- The total investment for the completion of Rødsand 2 amounts to about 400 million Euros

Alpha Ventus (Germany, North Sea)

Picture taken at E.ON Offshore Project - Alpha Ventus (Germany, 2009)

Alpha Ventus (Germany, North Sea)

Wind Farm

Capacity (MW)	60
Status	Construction
Start of Operation	2009
Distance to Shore (km)	45
Max. Water Depth (m)	33

Foundations

Type	Tripod/Jackets
Material	Steel
Weight (t)	700*
Height (m)	45
Diameter (m)	30

* plus 300 tons for securing-piles

Wind Turbines

Type	Multibrid M5000 Repower 5M
Capacity (MW)	5 MW
No. of Turbines	6 6
Hub Height (m)	90 90
Rotor Diameter (m)	116 126

Good to know….

- 45 kilometers off the coast in waters more than 30 meters deep, Alpha Ventus is Germany´s first far-shore project and represents a further step-change in offshore wind
- Alpha Ventus is being developed by a consortium of E.ON (26.25%), EWE (53.5%), and Vattenfall (26.25%)
- The deep-water pilot project will yield important experience for the development of future far-shore wind projects
- The total investment for Alpha Ventus amounts to at least 250 million Euros

E.ON Offshore Factbook

Offshore is a whole new approach to wind energy

Picture taken at E.ON Offshore Project - Alpha Ventus (Germany, 2009)

Offshore - Key Learnings

"Offshore is more than onshore in the water"
Offshore wind energy requires substantially different technologies and processes compared to onshore wind energy

"Offshore is not offshore"
Every offshore site has its own specifications and requirements, especially when moving from near-shore to far-shore

WWW - weather, wind and waves are the dominating factors in offshore wind
Access to offshore sites is strongly restricted or even impossible in times of bad weather, strong winds and high waves

Offshore success comes from doing as much as possible onshore
Every work step carried out on land saves time and money in the offshore installation process

Far-shore projects require a step-change in technology and logistics
The realization of offshore wind projects beyond the frontier of 20 km distance to shore and 20 meters of water depth requires larger turbines, bigger foundations and new logistical approaches that still require strong development efforts

Offshore wind energy plays a key role in E.ON's renewables strategy
Since 2001 E.ON has invested about 1 billion Euros in building up capacity and capabilites in a variety of offshore projects and will extend its activites on the basis of an extensive project pipeline of more than 3,100 MW

E.ON has a leading competence in offshore wind energy
With 500 MW of offshore projects in operation or under construction, E.ON has gained outstanding expertise to master the challenges of offshore wind energy

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