



# GUNFLEET SANDS

## OFFSHORE CONSTRUCTION

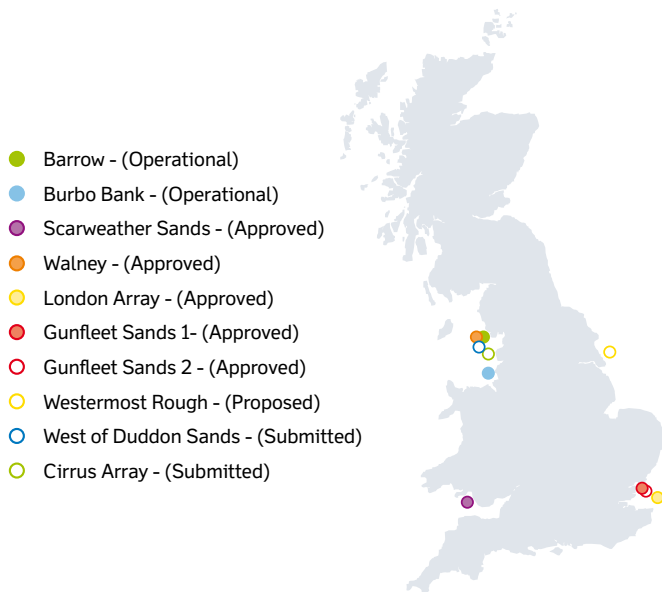
**DONG**  
energy

## Who we are

DONG Energy is one of Northern Europe's leading energy groups. The company was recently formed through a merger of Danish Oil and Natural Gas and the major power utilities in Denmark. The company employs more than 5000 people, and is a fully integrated energy company with activities in oil and gas exploration and production, electricity production, energy distribution and research and development activities.

With more than 30 years experience in the wind power industry, DONG Energy is a world leader in developing; constructing and operating offshore wind farms. We own wind turbines across northern Europe and renewable energy accounts for more than 10% of our electricity generation capacity. Some of the world's largest offshore wind farms are operational in Denmark with DONG Energy involvement in all stages of the development.

DONG Energy is also one of the leading offshore wind developers in the UK. Barrow Offshore Wind Farm, similar in size to the Gunfleet Sands project, became operational in 2006 and is partly owned by DONG Energy. Burbo Bank Offshore Wind Farm near Liverpool, fully owned by DONG Energy, started operation in 2007. DONG Energy has full/part ownership of London Array, Walney, West of Duddon Sands, Cirrus Array, Scarweather Sands, Westermost Rough and Gunfleet Sands Offshore Wind Farms.



## Why offshore wind?

Renewable energy is an integral part of the UK Government's aim of reducing CO<sub>2</sub> emissions by 60% by 2050. To help combat climate change, the Government has set a target of 15% of electricity supply from renewable energy by 2015. In March 2007 the 27 nations of the European Union agreed to a legally binding target of 20% of all energy to be supplied from renewable sources by 2020. Increasing the amount of energy generated from renewable sources also increases the diversity and hence the security of supply.

It is anticipated that wind power will play a dominant role in terms of contributing to the European target. It is a mature renewable technology that is cost competitive with conventional power generation. The UK is endowed with one of the best wind regimes in the world and is estimated to have at least one third of the entire European Union wind resource.

## Project details

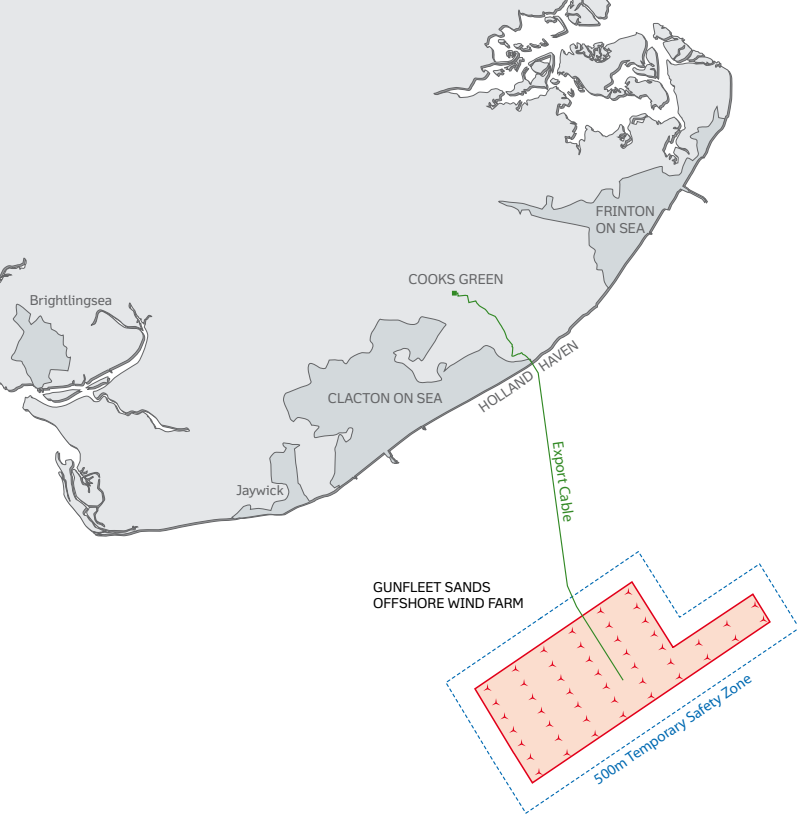
The Gunfleet Sands project is located approximately 7km south-east of Clacton-on-Sea, Essex. The project consists of 48 turbines, each with a capacity of 3.6MW, giving a total capacity of the Gunfleet Sands project of 172MW. The rotor diameter of the turbines is 107m, with a maximum height of 129m from blade tip to sea level.

The total area of the development is 17.5km<sup>2</sup>. The turbines will be positioned with a spacing of 435m x 890m.

A temporary 500m safety zone will be established around the Gunfleet Sands Wind Farm site during construction. Once the construction phase has finished both fishing and leisure craft will be permitted to pass through the wind farm site.

When the project is completed, approximately 120,000 homes or approximately 90% of the households in Tendring district and Colchester City could be provided with clean electricity in the years to come. The project makes a considerable contribution to the domestic UK target of reducing CO<sub>2</sub> emissions by 20% below 1990 levels by 2010.



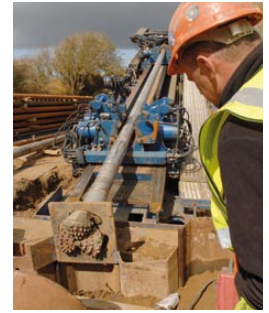


## Onshore construction

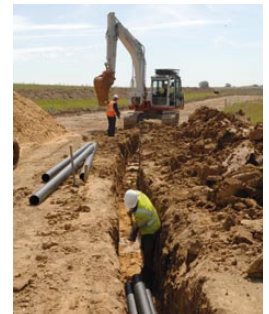
The electricity export cable from the offshore windfarm will come ashore at Holland Haven and will connect to the existing Clacton substation at Cooks Green.

Horizontal Directional Drilling (HDD) is required to install the cable ducting under the seawall at Holland Haven. In agricultural land and along roads a trench is excavated and ducts installed. Then the cables will be pulled through the ducted section in approximately 400m - 800m lengths.

After cable installation has been completed, all the individual cable sections will be joined together and the full cable system tested. When the testing is finished, final reinstatement will take place.



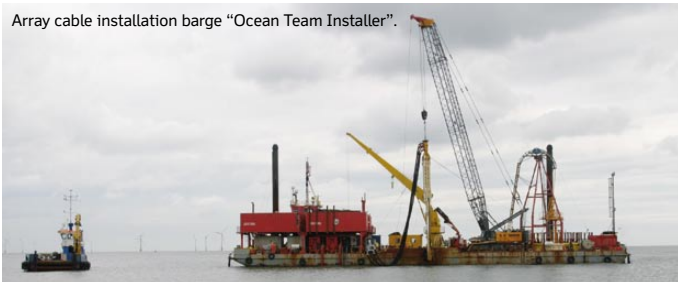
HDD at Holland Haven.



Installation of ducting.

## Offshore cable laying

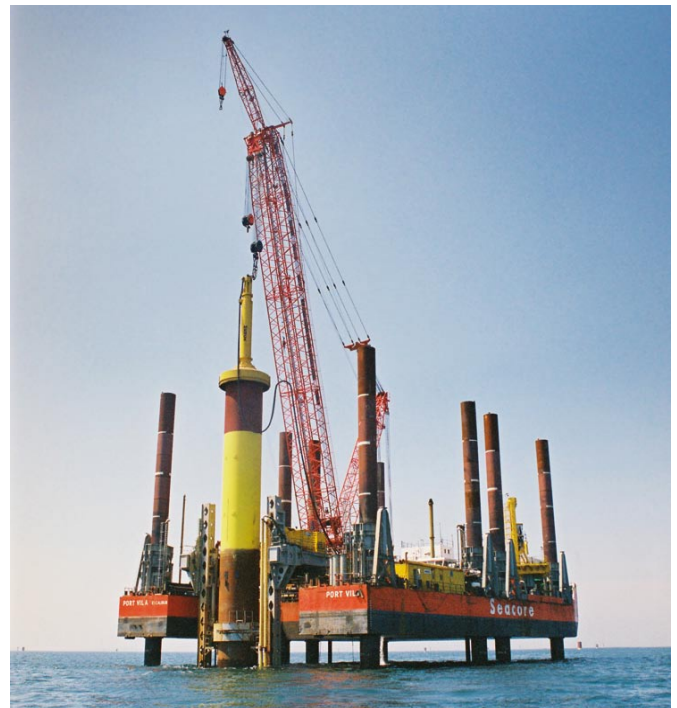
Array cable installation barge "Ocean Team Installer".



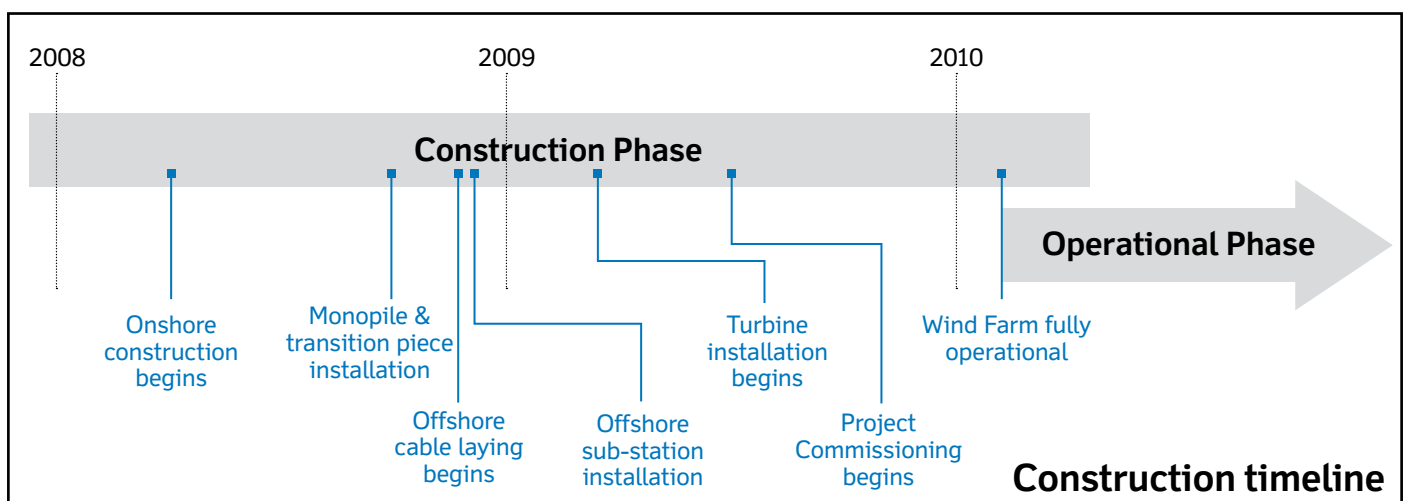
The export cable will run from the offshore transformer station to landfall at Holland Haven and will be buried in a trench approximately 2m deep. The cable installation barge, "EIDE-28" will commence installation during Autumn 2008. The array cables connecting the wind turbines and offshore sub-station will be installed during winter 2008.

## Monopile and transition piece installation

The 48 monopiles will be installed using the crane barge "Svanen", working in deeper water, and jack-up barge "Excalibur", working in shallower water. The barges will arrive in early September and late October 2008 respectively.



Jack-up barge Excalibur - monopile installation.



Each monopile is up to 50m tall and weighs 400 tonnes, they will be driven up to 40m into the seabed by hydraulic hammer it takes between two and four hours per monopile. The total time to install a monopile and transition piece is under two days. The Transition pieces are then mounted on top of the monopile by crane, they are painted yellow to assist with navigation. Each transition piece weighs 230 tonnes and is 23m tall.

## Offshore sub-station

The wind turbines generate electricity at a voltage of 33kV. The offshore sub-station collects the electricity from all the wind turbines and steps the voltage up to the local grid voltage of 132kV. The monopile and transition piece will be installed by the crane barge "Svanen" and the offshore sub-station will be installed during November 2008 by the crane barge "Rambiz".

## Turbine installation

The 48 3.6MW wind turbines will arrive in large component form directly by barge from Esbjerg, Denmark. The main tower is assembled first, followed by the turbine nacelle and finally the three blades are fitted. The total weight of the turbine is 800 tonnes. Turbine installation will commence in spring 2009.

## Marine operations

The large cranes and jack-up barges will be positioned using tugs which utilise state-of-the-art positioning systems for pin-point accuracy. These tugs will be working out of local ports in the Thames Estuary area. A number of smaller vessels will be working out of Brightlingsea on the River Colne, these boats will be carrying out surveys and continuing environmental monitoring studies, they will also be used to ferry personnel to and from the wind farm.

## Project commissioning

The wind farm will be commissioned in phases as the turbines become available for energy production. Commissioning will start during summer 2009, and the wind farm will reach full production during 2010.

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Crane barge "Svanen" - installation of transition piece.



Crane barge "Rambiz" - installation of offshore sub-station.



Three 52m long blades awaiting installation.



Construction of wind farm nearing completion.