



Beatrice Offshore Wind Farm

Flexible. Adaptable. Forward Thinking.

Playing a key part in installing the foundations for Beatrice Offshore Wind Farms – Scotland's largest operational offshore wind farm.

As offshore time is money, placing your trust in the industry's longest-running offshore grouting subcontractor makes perfect business sense.





Project perspective

Beatrice Offshore Wind Farm is operated and maintained from its base at Wick Harbour in the North East of Scotland. Given its vantage point in the North Sea the wind is constant and is the ideal place for a wind farm of this size.

Now fully operational, it has an installed capacity of up to 588MW, supplying enough clean, green energy to power over 450,000 homes.

Located in Moray Firth in the North Sea, 13km from the highest cliffs in Britain, the windfarm is a joint venture between Scottish and Southern Energy (SSE), Copenhagen Infrastructure and Red Rock Power Limited.

FoundOcean managed the onshore logistics and offshore grouting for the 84 turbine and 2 offshore transformer module foundations.

Every offshore project is unique and brings its own set of challenges.

This was the first time a high strength material was stored and transferred via silo storage on this scale. Time to grout was reduced because the material is designed for use with a Super Recirculating Jet Mixer (SRJM) rather than the conventional pan mixer.

WIND FARM FACTS



OWNER/DEVELOPER
 sse
Renewables

84
TURBINES

POWER GENERATION
UP TO 588MW

AREA COVERED
131KM²

WATER DEPTH RANGE
45M

MAIN CONTRACTOR
seaway⁷

Offshore procedures

Foundation connection

The 84 wind turbine and 2 offshore transformer modules all sit on almost identical four-legged jacket foundations. Each jacket was placed over four pre-installed piles.

After pile dredging, cleaning and levelling, grout was pumped into the annulus between the piles and the jacket lower legs via grout lines running through the jacket legs.

Material selection

The project demanded a high-strength grout. The grout was chosen as it met the design requirements, the advantage of using this material was that it was capable of being mixed onshore and could be stored and taken offshore in silos. This significantly decreased mixing times because grout was stored and transported in closed silos.

The equipment maintenance schedule was refined and optimised to ensure that the equipment was ready for operations.

Mixing and pumping large volumes of high strength material always presents challenges, but the team's understanding of the material and its experience overcame these to keep the installation campaign on schedule, grouting three jackets every 24 hours.

A valuable lesson learned from similar long-duration projects is that maintenance and cleaning regimes are as important as grouting itself. Equipment must be kept in good condition to mitigate the risk of a breakdown which could cause unnecessary delays.

Cold weather performance

FoundOcean continued to grout the foundations over the winter months. The DNV-certified material performed well in the harsh, North Sea conditions even when temperatures plummeted.

Health and safety

FoundOcean personnel are experienced, conscientious and understand the rigorous demands offshore. Excellent communication is vital to maintaining a safe working environment. Keeping equipment and the work area clean and tidy is also important for safety.

Onshore logistics

Onshore management

FoundOcean appointed a quayside coordinator to give all stakeholders a single point of contact.

The advantages of having one point of contact meant that all areas were kept up to date and informed and made the transitions smooth.

Material supply

Grouting material was shipped from manufacturing facilities in Germany to the quayside in Rotterdam, where it was stored in FoundOcean's dockside tank farm before loading onto the resupply vessel.

Having the dedicated onshore storage sped up the resupply turnaround time and ensured transparent batch tracking direct from the yards.

GROUTING FACTS

GROUT VOLUME

60m³

GROUT HOURS

400hrs

MEAN COMPRESSIVE STRENGTH

>100MPa

GROUT MATERIAL

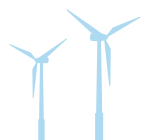
HIGH STRENGTH

NO. OF CUBES TAKEN

6,110

GROUTING RATE

3 nos. structures/day



Beatrice Offshore Windfarm, Outer Moray Firth

13.5km off the coast of Caithness, Scotland



QA and testing

Material tracking

Another project first was FoundOcean's factory-to-foundation grouting material tracking process. This was a manual process during this project but has since been developed into its BatchTrax software.

Material tracking goes over and above the requirements detailed in a material's type approval certification. The software tracks the material from the factory to the precise foundation leg, and all the steps in between. This informs the client which batch of material has been used for each connection for complete QA transparency.

Grout testing

Prior to pumping, grout density measurements were taken and checked to ensure the correct material density. Once confirmed, grouting started.

3No samples were taken during grouting of each pile annulus, start, middle & end. For each sample 5 No. cubes were manufactured with one cube being tested at age 24hours, 3days, 7days, 28days and one remaining as a spare.

A characteristic strength of 80MPa at 28 days was required, curing at 20°C, measured on 75mm x 75mm cube samples. FoundOcean achieved a 109.4MPa mean compressive strength across the 6,100 cubes tested.

GROUTING FACTS FOUNDATIONS 86 NOS. 4-LEGGED STEEL JACKETS (84 WTG & 2 OTM)



About FoundOcean

FoundOcean has more than 50 years' experience of subsea and offshore foundation grouting for the global energy construction industries. FoundOcean also provides life extension solutions for offshore structures which includes structural inspection, repair and maintenance services, freespan correction grout bags, and pipeline/cable support and protection services. This is why, to offshore installation contractors, FoundOcean is the subcontractor of choice for minimising the risks associated with completing projects safely and on time.

FoundOcean was founded in 1966 and is a privately held UK-headquartered company. Its specialist grouting equipment is located for rapid deployment in Europe, the Gulf of Mexico, South East Asia, India and the Middle East. FoundOcean is certified to ISO 9001, ISO 18001 and ISO 45001 by DNV and is an Achilles/FPAL registered company.