THE PROJECT
With a capacity of up to 277MW, able to supply carbon-free power to nearly 285,000 German households annually, Borkum Riffgrund 1 is one of the largest offshore wind farms consented in German Waters.

In 2013 Baker Consultants was awarded the tender by GeoSea, part of DEME Group, for the environmental package of DONG Energy’s Borkum Riffgrund 1 wind farm construction. This consisted of monitoring the underwater noise levels and harbour porpoise activity during the installation of the wind farm foundations, as well as assessing the efficiency of the noise mitigation strategy.

Baker Consultants’ marine team was involved from the early stages of the project, designing a methods statement for the monitoring campaign during installation that could be approved by the German government. The project team then worked closely with the installation company (GeoSea), the piling company (IHC Hydrohammer) and the consent managers at DONG Energy, to ensure that mitigation protocols were followed and to advise on how to optimise the piling strategy whilst minimising the noise emissions.

CHALLENGES
The project was subject to very strict licence conditions to monitor noise emissions during construction; the success of the noise mitigation strategy was critical to obtaining a release for the installation of all the planned monopiles.

The German government, through its BSH (Bundesamt für Seeschifffahrt und Hydrographie) maritime agency, has stringent regulations on noise emissions, with a threshold set at 160 dB (re 1µPa² s) for the Sound Exposure Level (SEL), which had to be adhered to in order to ensure the success of the project. Initially, the licence consented the installation of the first twelve monopiles, further release was subject to the outcome of the noise measurements. Baker Consultants was required to produce timely reports so that BSH could approve further monopile release without causing delays to the client.

Servicing of acoustic recorders in the North Sea is extremely challenging when a specific schedule must be adhered to, particularly in the winter months, because the instruments used are very sensitive and need to be treated with care. To ensure safe working conditions and avoid accidents, servicing must usually be carried out in sea state 2 or lower. Therefore, Baker Consultants had to maximise the work carried out in the short time available before weather conditions changed, whilst simultaneously fitting around the piling schedule to ensure no data was lost.

Federica Pace, marine technical director at Baker Consultants said “This is the first time that a non-German company has been contracted to carry out the noise monitoring work for a German windfarm and Baker Consultants had had no previous interactions with the regulator BSH; therefore our work was scrutinised from the onset of the project.
to ensure we followed all the right protocols and that the quality of the work met the client’s standards.”

METHOD

Passive acoustic monitoring (PAM) devices were installed at set distances from each monopile and rotated on a regular basis strictly following the methodology outlined in the BSH guidance.

Baker Consultants and GeoSea worked closely to optimise the logistics and minimise the costs involved with the monitoring campaign. We found there was a trade-off between ensuring all the necessary data was collected and retrieved in time to meet the reporting deadlines, whilst also minimising the servicing trips.

Autonomous PAM recorders were used both for measuring noise and for recording any harbour porpoise activity in the area. Baker Consultants proposed and implemented a real-time monitoring system to allow the monitoring of noise levels (SPL and SEL) during piling with direct feedback to the piling engineers. This ensured that the information received could be used as a mitigation strategy to keep the levels as close as possible to the threshold and protecting marine mammals.

In addition, Baker Consultants proposed an innovative method for monitoring porpoise activity using full-spectrum recordings instead of click detectors; this allowed investigation of the data waveforms to minimise the level of uncertainty in the results. Baker Consultants’ specialist bioacousticians designed their own automatic classifiers to detect the porpoise clicks more efficiently and then all the detections were manually inspected and verified by experienced observers.

Mitigation strategy

The aims of the mitigation strategy were to reduce the noise propagating underwater away from piling and also to keep harbour porpoises outside of the piling zone. The former was achieved by using the IHC Noise Mitigation System, a double walled cylinder filled with a bubble layer, and also by finding the right trade-off between piling energy and blow count.

Regular and effective communication between the operations team, monitoring team and daily feedback to the client was crucial in achieving this.

The marine mammals mitigation strategy consisted of applying a ramp-up procedure that is now very common in European waters. This entailed increasing the piling energy and rate gradually, and deploying acoustic deterrent devices (ADDs) to warn animals about the anthropogenic activity that was about to take place and encourage them to leave the area.

WHY BAKER CONSULTANTS?

Andrew Baker, director at Baker Consultants said: “GeoSea invited us to tender for the work package for a benchmark against their usual suppliers; the project managers who reviewed our proposal said that our offer was “the best, both technically and commercially”. We pride ourselves on our innovative approach. It’s great to get this endorsement.

“Baker Consultants brought new ideas on the monitoring protocol to the client, thus offering a truly consultative service. Our proposal included utilising the best available technology coupled with the combined skills of noise monitoring and experience in bioacoustics. This enabled us to analyse vast amounts of data over a relatively short period of time to a high quality standard.”

FUTURE

Baker Consultants and DONG are collaborating to use the data from the Borkum Riffgrund 1 project to conduct a validation study on harbour porpoise activity. This will investigate the difference between number of animals detected using full spectrum recorders versus click detectors with the aim of highlighting the implications of the findings on the mitigation efficiency assessment.

“Gaining timely approval for not only some, but all, of the offshore foundations was a breakthrough for the Borkum Riffgrund 1 project as a whole. One of the factors that contributed to this was Baker Consultants’ fast and efficient reporting and we look forward to working with them on other projects.”

Pablo Rodriguez-Oitaben, works manager at GeoSea

Søren Sørensen, DONG Energy