RETROBUOYS INSTALLED ON GERMAN OFFSHORE WINDFARM TO REPLACE FAILING ANODES

THE PROBLEM

An offshore wind farm in Germany, comprising 80 tripod structures in water depths of 30-40m, was protected by an impressed current cathodic protection system (ICCP) using close mounted anodes. On 33 tripod structures, the existing anodes were beginning to deteriorate and the levels of cathodic protection current was falling and failing to adequately protect the structures submerged steel surfaces.

THE SOLUTION

MENCK Evaluation

Deepwater, an Acteon company, carried out an initial estimate of the cathodic protection (CP) current that would be required to provide adequate levels of CP to the tripod for an extended period and this was found to be approximately 280 A, as a mean current requirement. A system providing approximately 400 A would be required to aid final current (i.e. loss of calcareous deposits after a storm event) and extra contingency. Deepwater recommended a modified version of the RetroBuoy ICCP anode sled.

ICCP System Design

A CP modelling study was initially carried out in order to prove that CP could be provided by one or more remote ICCP anode sleds. The model also confirmed the optimum remote location for the anode sled. An ICCP system with remote anodes, was considered the safest economical solution, i.e. involving the fewest divers. Close mounted impressed anodes would require significant installation time, in addition to the risks associated with cable routing and cable protection. Therefore, an ICCP system utilising remote anode sleds was considered the only practicable solution to meet the current demand.

The proposed system was based on the successfully tried and tested remote ICCP RetroBuoy system. and consisted of the following key components:

- RetroBuoy Junior (seabed mounted impressed current anode sled)
- Subsea anode power cable (DC) (including, subsea armour termination and bend restrictor)
- Cable hang-off assembly
- Subsea Cable Protection Assembly (SCPA)
- Subsea Cable Protection Clamp (SCPC)
- Topside anode junction box
- Power Supply Unit (PSU), switch mode type
- Positive and negative topside power feed cables (DC)
- Structural negative connection
- Concrete mattresses for subsea anode power cable seabed stability

Additionally, a monitoring system was fitted to each ICCP system to ensure proper control and monitoring.

One of the key design criteria was that the system had to be installed in a short period of time with all components deployed from the installation vessel with no special heavy lift equipment. As a solution, the design incorporated the following:

- The power supply unit was modular so it could be easily handled onto the turbine and taken to the location and assembled.
- The concrete stabilisation mattresses were assembled quayside with local labour and concrete.
- The subsea cable for the RetroBuoy Juniors was spooled onto a single deployment reel in finished lengths and the cable protection system was supplied in kit form for assembly on the deck of the vessel.

Installation

Up to four complete retrofit ICCP retrofit systems were taken to the field on the installation vessel at a time. Specially designed installation and deployment equipment was used to speed up the installation process including a mattress deployment frame. All subsea equipment was designed to be installed by ROV without the need for diver involvement. The power supply unit, junction boxes and topside cabling was installed by teams on the tower whilst teams on the vessel simultaneously prepared the subsea equipment. The subsea cable protection clamp was located on the turbine and secured by ROV.

Cable stabilisation mattresses were deployed around the RetroBuoy and along the full cable route. The buoyant anode floats on the RetroBuoy were deployed. The power supply was energised, and the system commissioned. Cathodic protection was restored to the turbine structure. The whole process took less than 24 hours from deployment to commissioning.

THE RESULT

The complete system was custom designed for the application and had to be installed without diver intervention. In addition, there was a very narrow installation window due to weather conditions. Deepwater met these challenges and, with cooperation from the operator and other subcontractors, achieved the target of reinstating specified levels of cathodic protection to the wind turbine subsea structures.