

PROJECT CERTIFICATION FOR OFFSHORE WIND FARM TRIANEL WINDKRAFTWERK BORKUM IN GERMANY

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In May 2008, SGS was assigned a contract to conduct Project Certification services for Trianel Windkraftwerk Borkum (TWB; formerly: Borkum West II) offshore wind farm. Project Certification provided by SGS enables wind farm owners to obtain necessary approvals and meet international and local standards.

PROJECT CASE TRIANEL WINDKRAFTWERK BORKUM

A large number of wind farms are currently under development in German waters in the North and Baltic Seas. For those wind projects located within the so-called Exclusive Economic Zone which begins 12 nautical miles from the coast, official approval by the German Authority "Bundesamt für Seeschifffahrt und Hydrographie" (BSH) is required. The BSH also requires that the development process be accompanied by a project certification to be carried out by a recognised certification body. SGS is currently involved in the project certification of 18 German offshore wind

farms in different development phases with the objective of obtaining approval by the BSH.

The offshore wind farm project TWB is located in the North Sea, approximately 40 km north-northwest off of Lower Saxony. Water depths are in the range of 26,5 to 33 m rel. LAT. The installed capacity of the first project phase will be 200 MW using 40 wind turbines each with a rated capacity of 5 MW. In the second project phase, the project will install the next 40 wind turbines, means 400 MW with 80 installed turbines totally. The annual energy yield is estimated to be total in the order of 1,200 GWh, enough to power some 250,000 households, which will result in an annual reduction of CO₂ emissions of 700,000 tons.

An offshore substation was installed at the same location and connected these wind turbines with the grid on the mainland.

The preliminary geotechnical investigation on site has been completed. On-site construction work for the substation has been finished in April 2013. SGS has been involved with project certification since May 2008 and has been leading the entire certification process according to the needs of this particular customer.

PROJECT CERTIFICATION PHASE I

Phase I of the project certification can be thought of as a feasibility study within the project's development phase. For the certification activities, independent expertise, opinions and advice were provided by several SGS experts who have been involved with the project. Specifically, the SGS team consisted of a project manager, geotechnical experts, an offshore engineering expert and structural design experts. Documents to be verified during this phase are

- Design Basis Documentation
- Preliminary Ground Investigation Reports
- Geotechnical Reports
- Cyclic and Dynamic Analysis of the Geotechnical Loads
- Preliminary Design Document on the sub-structure

The first step was the verification of the Design Basis. This document describes firstly the general assumptions and data sources to be used in the design calculations and development of the project and secondly summarises the environmental, wind, and maritime conditions; relevant technical data; hierarchy of standards to be applied and general recommendations for further calculations.

The Preliminary Ground Investigation Reports and the Geotechnical Report include the results of the geophysical and geotechnical investigations. For the preliminary ground investigation, at least 10 % of the planned turbine locations must be investigated via penetration testing and borehole sampling to provide





a representative portrait of in-situ ground conditions. SGS reviewed documents and independently checked to verify the selected data bases for structural analysis.

The preliminary design document for the sub-structure indicates the selected design of the sub-structure, including its dimensions and the boundary conditions used for dimensioning. SGS experts performed a verification of all relevant documents, including independent comparative calculations and plausibility checks of the data provided. Findings, doubts and deviations were summarised in our status reports, which document the ongoing verification process at SGS. The resulting issues were then discussed with the relevant experts from our client or their subcontractors who prepared the documentation. Upon submission and final check of the revised documentation, SGS prepared the corresponding Certification Report for Phase I, to be submitted to the BSH by the client. Lastly, the BSH reviewed the documentation and invited SGS and the applicant for final discussions prior to issuing its first release.

PROJECT CERTIFICATION PHASE II

Upon completion of Phase I, the design phase of the project commences, known as Phase II of Project Certification. In this phase, detailed calculations of the loads on the turbine and its support structure must be carried out based on local environmental conditions. In this case the turbine and foundation

manufacturer supplied the respective load calculations; these are used to design the final turbine support structure and to verify whether the resulting loads incurred by the turbine and complete structure are within the design limits.

The offshore substation, including the electrical installations, is also part of the Phase II design verification. In order to verify structural integrity, SGS performs parallel independent calculations for both the loads and structural design.

Upon confirmation of the design, the production of offshore components begins. Here, SGS reviews and implements the approved documentation and verifies component specifications in the context of independent audits and manufacturing inspections supplemental to the quality assurance of the operator part of the certification assessment. All structural and contributing load components are directly controlled at manufacturing. Quality standards implemented here require that 25 % of parts used in construction be randomly inspected. Any deviation in specifications is monitored and evaluated in advance and recorded by SGS production test documentation. SGS certifies the production of standardised components preparing the way for deployment and installation. In addition, SGS proves the stability of the foundations and verifies engineering implementation. Moreover, submarine cables, logistics and decommissioning concept are also covered under this verification.

Phase II execution culminates with the third release by the BSH, which is essentially the starting signal for the applicant to commence installation of the offshore turbines, foundations, piles and whole substation.

OUTLOOK

The subsequent phases of Project Certification pertain to the commissioning and operation of the wind farm. The primary focus in these phases will be on the monitoring of production, transport, installation and commissioning. During wind farm operations, SGS will verify the recurrent tests as well as prepare the inspection reports on periodic monitoring.

At this time, all necessary permits for the Project "Trianel Windkraftwerk Borkum" have been obtained. The sub-station, as well as the foundational structures for the offshore wind turbines, have been erected. The installation of the inter-array cabling and the actual offshore wind turbines began in June 2013.

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