



Study Committee B3 "Substations"

WORKING GROUP FORM

WG: B3.26

Name of Convener: J S Finn

Title of the Group: "Guidelines For The Design And Construction Of AC Offshore Substations For Wind Farms"

Background

More and more large wind farms are being located offshore, particularly in the North Sea region. The capacities of each of these wind farms are of the order of several hundreds of MWs. Most of the turbines in such wind farms are arranged in clusters and electrically connected to an offshore substation typically at 33kV and provided with a step-up transformer with on-load tap changer. The transmission to shore is then achieved with HV AC cables (132 kV and higher) or with a HVDC link. The length of these cables can be significant and reactors may be needed offshore as well as onshore to compensate for the capacitive power produced by the cable and consideration needs to be given to transient voltages affecting long cables.(Ref TB 268).

Furthermore, cable routing and terminations also need to be considered(including cable risers, thermomechanical forces et cetera) at all voltages to avoid installation difficulties with the cables. Filtering to avoid resonances may also be required to be located offshore.

Whereas electrical substations located on offshore platforms have been installed for many years in the oil and gas industry to supply load, the specific difference between these earlier substations and those required for wind farms is their operation as part of a generation connection involving the higher powers and voltages required together with the tighter budget constraints of the wind farm industry. This presents many new challenges in the design of such substations, including optimum single line diagram, electrical design standards, specific plant design issues, layout, maintainability, personnel access, cable connection, centre of gravity issues and foundation design to mention but a few.

These observations raised the question whether CIGRE should address these substations and the specific challenges in some detail and provide some useful guidelines covering all of the aspects which need to be considered in the design, development and construction of these substations.

[Ref: 1. Masoud Bazargan, "Offshore substation", Power Engineer, June/July 2007; 2. J S Finn, M Knight and C Prior "Designing Substations for Offshore Wind Farm Connections" , CIGRE paper B3-201 2008 Session].

Scope and aim

The scope of the Working Group will be limited to AC substations located offshore. At high powers and longer distances the use of HVDC may be required and/or give a more economical solution but this is outside of the scope of this Working Group.

The aim of the activity is to:-

- (i) Identify the key issues which impact on the design and construction of these substations
- (ii) Provide constructive guidelines to designers, developers and constructors to assist them in addressing these issues in order to develop cost effective practical and sustainable solutions to these challenges.

Deliverables / time schedule

Deliverable: A guideline document detailing the key issues and providing constructive advice to enable designers, developers and constructors to make the important decisions necessary for a cost effective and sound technical solution achieving sustainable substations.

Form: A technical brochure with summary in Electra. It is anticipated that an interim report will also be published in Electra when all of the issues have been clearly identified.

Time Schedule: Start of the activity: Spring 2009, interim Electra report summer2010 and final brochure by mid 2011.

Approved by TC Chairman: Klaus Fröhlich Date: 07/02/2009