MEMO

TKI WIND OP ZEE

Subject	R&D innovation theme 4.3. from the Innovation Contract (page 27).
Date	19 March 2013

4.3 Internal electrical network and connection to the high-voltage network

4.3.1 The importance

Offshore substations are large and heavy, and are therefore expensive and difficult to transport and install. In terms of technology, there are many challenges in the areas of HVDC, advanced reactive current compensation equipment, DC switching devices & power electronics, and electrotechnical security and control. Substation and cable controllers cannot rely on sufficient statistical data for developing a maintenance policy and strategy. The creation of an offshore network with e-hubs ensures the connection to offshore wind farms and to the European markets. The fluctuating wind patterns are increasingly determining the energy flows in the European net. The smart transmission grid (or smart super grid) is a solution to this; it is a net with built-in smart control and regulation possibilities for energy flows at the transmission level.
There will probably be a single offshore substation for the demonstration wind farm (Leeghwater). That substation may be light, modular and innovative, but must first be reliable and safe. Internal cables are placed between the turbines in the testing area. Monitoring technologies for determining the location and status of the cable can be tested there. Smart control and regulation possibilities at the wind turbine, substation and wind farm level can be tested in the testing area. Whether or not a HVDC connection will be applied to the testing area depends on, among other things, the distance from the shore. The supplier of the electrical infrastructure of the testing area will be asked to achieve a maximum integration of all components in the electrical systems (from the turbine to the grid). The testing area cannot be expected to connect to an interconnector.

4.3.2 The R&D activities

1. Designing a lighter and modular offshore substation.
2. Developing monitoring technologies for determining the status of the cable (partial discharge, vibration measurements, temperature protection, etc.) and also for prevention.
3. Smart transmission grid. Designing and demonstrating smart control and regulation possibilities at the wind turbine, substation and wind farm levels. Ensuring that HVDC connections/innovative preparations of Net op Zee can be regulated. Integrating all components in the electrical systems (from the turbine to the grid).
4. Designing and demonstrating the combination of an international transmission and an offshore wind farm, with the emphasis on technical aspects, structuring of electricity markets and adjustment of regulations. Next, initiating and managing standardisation activities which will eventually result in a transnational grid and e-hubs on the North Sea.

4.3.3 The parties involved

Companies	Knowledge institutes
2-B Energy, Atos, CPNL Engineering, CWC, DC Offshore, De Vries & Van de Wiel, DHV, Ecofys, Essent, GL Garrad Hassan, Grontmij, IHC Merwede, Liandon, NNOW, Royal Haskoning, Siemens, Smulders Projects, Van Oord, We@Sea	ECN, KEMA, MCN, NHL University, University of Groningen, TNO, TU Delft