

Report on Lecture on VSC by Dr Oriol Gomis

The lecture was focused on the topologies for offshore grids that can be used in wind power systems and the operation and control of HVDC grids for offshore wind.

In the first part of the lecture the integration of wind turbines in the utility grid was presented considering the evolution of this technology. A brief explanation of the different steps followed until now was explained, from the setting up of the first fix speed onshore wind farms to the increase of installation of wind power, which has made necessary the use of variable speed wind turbines and has transformed the concept of the simple wind farms evolving to the idea of wind power plants. Therefore, these wind power plants should be able to have a similar behaviour to conventional power plants (Fault ride-through capability, voltage support, frequency support, etc.). On the other hand, the future options for wind power were analysed, specifically the trend to go offshore, explaining the different reasons and advantages that justify this option and the challenges to overcome. In this sense, different topologies of the offshore wind power plants and their connection to the utility grid and each other are presented considering HVAC and HVDC solutions. Finally, the possibility of a supergrid is commented showing different international projects that follow this idea.

In the second part of the lecture, the control of multi-terminal HVDC systems for offshore wind was presented considering the different control levels and the necessary operational procedures to connect the wind power plants properly to the utility grid. In this sense, the voltage and power control schemes were analysed taking into account issues as the voltage control in case of faults or the optimal power flow of the multi-terminal grid. Then, the specific control schemes for VSCs are presented distinguishing between the grid side VSC control and the wind power plant VSC control. These controls include mainly the voltage modulation for each VSC and the different control loops depending on the VSC operation modes. At the end, the functions required by the wind power plants were analysed and discussed considering the operational actions to carry out in each case.

The topic of this lecture was more related to the work package 1 (connection of offshore wind power to DC grids) and provided a complete state of art necessary before coping with more specific points. However, in general it could help all the fellows to understand the issues presented in the offshore wind power generation and consider some of them in their individual project. Concretely, the control schemes presented in the second part of the lecture will be implemented and will take an important part of the work for many of the fellows. Therefore, this part can be considered a good review for everybody to discuss possible questions.

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