

Seminar of the Thematic Working Group on “Technology and Grid design”: Baltic Sea Offshore Wind Energy Grid Development 2035

Proceedings from the Workshop

Nicolaos A Cutululis, Senior Researcher in Technical University of Denmark (DTU) welcomed all the guests to the thematic working group seminar of the European project - Baltic InteGrid, also a part of official event of Nordic Clean Energy Week. There were many interested participants from various fields including academia, industry, consultancies, embassy etc. The seminar was a platform to discuss the future offshore wind power development in Baltic Sea region. The seminar was structured in such a way that in the first half of the seminar, experiences from industry and other similar projects were discussed invoking many interesting discussions. In the second half of the seminar, project partners from Baltic InteGrid presented their results from the project inviting the participants for providing feedbacks to be incorporated in the further stage of project.

Pierre Ståhl from Energy Agency for Southeast Sweden, Energikontor Sydost presented the overview of this flagship project detailing the potential and challenges in the Baltic Sea towards offshore wind power installation until 2050. He demonstrated that up to 35 GW of offshore wind farm installations in the Baltic Sea might be possible by 2050. There are multiple possible ways to connect the wind farms to the power network such as radial connection, meshed network etc. Pierre discussed the advantages of having meshed offshore network since it can allow higher flexibility, market integration and wind power integration.

Vladislav Akhmatov from Energinet presented the control and design challenges for upcoming Kriegers Flak combined grid solution between Denmark and Germany. Participants were intrigued to understand how the technical challenges can be overcome through advanced controllers designed specifically for Kriegers Flak. He presented two complex control strategies – automatic voltage regulator and reactive power control to be used in Kriegers Flak connection. These controllers are developed for different control regimes such as in normal operation and fault studies with all the fault possibilities either in Denmark or Germany or in the converters.

Tusitha Abeyasekera from MHI Vestas talked about electrical design of offshore wind turbines emphasizing on how the electrical design of offshore wind turbines has evolved over the years, current research and development going on and future development possibilities. Although he had optimistic view for future development of even larger wind turbines and their further reduction on levelized cost of energy per offshore platform, nevertheless, he mentioned future research and development requirements for wind turbine capabilities to provide ancillary services like sub-synchronous resonance, power oscillation damping etc.

Matti Juhani Koivisto from **DTU** discussed the future wind farm installation scenarios in North Sea from another Danish project, NSON-DK. He explained the challenges and complexities in predicting future scenarios particularly for meshed offshore network. He showed comparison between radial and meshed offshore networks developed in conjunction with market model developed using Balmorel.

Richard Johannes Weinhold from **IKEM**, a project partner drew parallel to previous presentation by Matti, when he presented the prospective offshore scenario in Baltic Sea based on feasibility studies and cost-benefit analysis. It seems that there is no general trend could be identified in the chosen case studies in relation to evaluation of degree of integration of offshore wind. This implies that cost-benefit analysis is case specific and needs to be performed for each individual case study. It was also concluded that cost could significantly vary for different degrees of integration although the benefits might be almost equal.

Andreas Möser presented his research performed in **Lund University** on prefeasibility study for a specific case study in Baltic InteGrid project. The case study involved interconnector between Sweden, Poland and Lithuania to which multiple offshore wind farms could be connected. In this prefeasibility studies, three degrees of integration were considered – zero integration, partial integration and maximum integration, where each integration can have 2 wind power level, i.e. low and high wind power level. Through detailed analysis, it was observed that partial integration is the most feasible option out of three in terms of cost-benefit and component requirements.

Daniel Hermosilla Minguijon from **DTU** presented a novel methodology developed for optimization of wind farm collection system. He compared different state of the art methods with his developed method, which showed the possibility of up to 20% additional cost saving in electrical infrastructure for the considered wind farms in Baltic Sea region. This methodology is developed using genetic algorithm, which is more flexible in adding case specific constraints and is applicable for very complex wind farm layouts.

Juan-Andrés Pérez-Rúa from **DTU** presented his ongoing PhD research work in the Baltic InteGrid project about dynamic cable rating of AC export cables for offshore wind farm applications. By the means of the methodology he developed, it was shown that the maximization of cables power transmission capability could be achieved while respecting the maximum degradation limit allowable to the cable insulation. He also demonstrated substantial potential in economic savings could be achieved by means of optimum sizing of AC submarine cables.

In nutshell, the seminar was well represented with enthusiastic participants and the seminar paints an encouraging positive future for offshore wind power development in Baltic Sea region. Nicolaos Cutululis thanked all the participants for the valuable inputs while closing the seminar.