EMS Annual Meeting Abstracts
Vol. 16, EMS2019-561, 2019

Wind generating power and cooling the power lines

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Transition to renewables redistributes geographically the electric power generation, which is a challenge for the existing network of power lines. In Estonia an increasing amount of electric energy is produced in wind farms at the coastal zone. The amount of transmitted electric power is limited by heating of power lines. Stronger winds at the coastal area increase the power output of the wind farms and at the same time improve the heat dissipation of power lines, thus enabling more power to be transmitted. The aim of this study is to clarify, how well the wind speed along a 330 kV power line from coast to inland is correlated with wind generating power in coastal wind farms. 2D sonic anemometers were used to measure the wind speed at 5 power poles at height of 10 m, spread at distances 20 – 100 km from coast through 11 consecutive months (December 2017 – October 2018). Output wind components were averaged at time step of 5 minutes and compared with winds measured simultaneously in four coastal windfarms, keeping in mind both wind speed and direction, as the wind across the line cools more efficiently as wind along it. In general, the correlation between wind speeds at inland and coastal sites was found to be rather poor, Pearson correlation coefficients 0.34 – 0.61. Distribution of wind directions in line masts varies highly, depending on local obstacles, such as forest edges and hills nearby. Most critical heat-up situation, when strong coastal wind coincides with much weaker inland wind and hot summer weather, occur at a rather specific weather pattern, which includes a cyclone slowly approaching from west, thus conditioning warm air flow from south. 15 out of 46 most critical hours occurred within two days of August 2018. These results are to be used to optimize the power transmission network. This study is funded by AS Elering.