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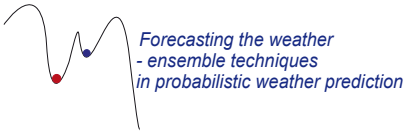

Dynamic thermal rating of power transmission lines related to renewable resources

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Under certain unfavorable conditions, overhead power transmission lines are operated close to the thermal limits. Such conditions occur more likely with increasing demand and generation of electricity. The further factor is represented by modern renewable energy sources, such as wind turbines and solar plants. Those have been booming for the last two decades and have caused a significant decentralization of electricity production. In particular, new wind and solar farms have been built in remote areas that often lack suitable power grid connections, and can lead to system congestion. A possible solution is to construct a new power transmission line, or to reconductor an old line. However, such upgrades require a significant investment, and take a long time to deploy. An alternative to expensive upgrades is to uprate the power lines. The static rating of existing lines can be upgraded using more accurate assessment of the climatic conditions along the transmission corridor, or the lines can be rated in real time using a dynamic thermal rating (DTR) system.

Dynamic thermal rating of power transmission lines can provide a significant increase of transmission capacity compared to the more traditional static rating. The most important inputs to weather-based DTR systems are measured or forecast meteorological data. This information can be obtained in form of instantaneous or averaged values, and with various sampling/update intervals. Due to the random character of the updates with instantaneous weather data, the averaged inputs appear to be a better choice, providing more accurate estimates of conductor ampacity and temperature. The analysis of update intervals of the weather data shows that 10-minute interval is sufficient to provide accurate ampacity estimates, while longer intervals cause significant errors in ampacity determination.

The relation of DTR to the renewable resources is obvious when we consider input parameters of the calculation scheme – wind speed, ambient temperature and shortwave radiation. Those are exactly same variables determining production of wind and solar energy. A case study of virtual wind or solar farm and corresponding power transmission line shows limits of renewable energy production at given site.