Bachelor Thesis: Evaluation of wind vector propagation methodologies for the purpose of minute-scale power forecasting

Scope:
With the increasing share of renewables in today's energy system, minute-scale wind speed and power forecasts are gaining importance. Not only do they support a smoother grid integration of strongly fluctuating renewable energy, but also hold significant value for electricity trading purposes. Commonly, statistical models are used for minute-scale forecast, however, they lack accuracy during extreme and rare events (i.e. wind/power ramps). Recently, remote sensing-based power forecast have been increasingly researched and proven to be valuable for minute-scale forecasting. Here, long-range lidar or radar measurements are used to derive horizontal wind field information upstream of the target wind farm or wind turbine. Using an advection technique, wind vectors are propagated in space and time to deduce wind speed and power forecasts.
Aim of this work is to implement and test different wind vector propagation techniques and to further integrate them into an already existing forecasting algorithm. Basis of the forecast are horizontal long-range lidar measurements performed at an offshore wind farm in the German North Sea. The forecast accuracy will be evaluated using high frequency SCADA data.

Work steps:
- Literature review
- Preparation of thesis outline
- Familiarization with lidar and SCADA data
- Implementation of several wind field propagation methodologies into an existing forecasting algorithm
- Evaluation of forecast accuracy
- Analysis, interpretation and documentation of the results

Requirements:
- Programming Skills in Matlab
- Basic knowledge in meteorology and lidar concept
- High interest in wind energy

Place	ForWind – University of Oldenburg
Begin	As soon as possible
Duration	4-6 months
Supervision	Frauke Theuer frauke.theuer@uni-oldenburg.de