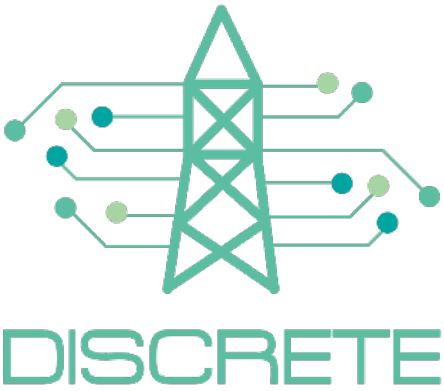

D3.1. Document on uncertainty representation methods in data driven optimisation models

Authors: Toubeau, J.-F. (2024). Forecasting Techniques for Ancillary Services Provision, Chapter 7 of the Book 'Grid services from wind turbines', to be published in 2025.

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The chapter focuses on both deterministic and probabilistic forecasting techniques that can be used for predicting short-term uncertainties and ancillary service requirements. It discusses various forecasting methods, such as statistical models, machine learning algorithms, and ensemble techniques. Advantages and drawbacks regarding forecasting performance, model complexity and the engineering efforts required for optimal model tuning are fully detailed. Overall, the chapter highlights the need for continual development in forecasting models to better handle the variability and unpredictability of uncertainties arising in power systems.

Each method brings its strengths and weaknesses in handling the complexities of wind power forecasting, such as its interpretability, its ability to capture intricate spatiotemporal dependencies or to adapt dynamically to new data for recalibration. In particular, the integration of forecasting with decision-making processes emerges as a critical theme, advocating for a seamless blend where the output of forecasting directly informs and optimizes operational strategies. This alignment is crucial for navigating the uncertainties inherent in wind power and for optimizing the use of ancillary services.

The chapter also emphasizes the growing relevance of collaborative and privacy-preserving techniques in model training, which could revolutionize how data is leveraged across different stakeholders without compromising proprietary information.

In essence, the advancements in forecasting techniques not only promise enhanced accuracy and efficiency in uncertainty management but also signify a step forward towards more sustainable and reliable energy systems. As the field continues to evolve, the ongoing development of more robust, adaptable, and integrated forecasting models will be vital in meeting the challenges of tomorrow’s energy demands.