

This poster gives an overview of the IEA Wind Task 36 for Wind Power Forecasting. Collaboration in the task is amongst forecasting experts and those interested in the forecasting business. The second phase of the Task runs for three years, 2019-2021.

In the first phase an IEA Recommended Practice on the forecast solution selection and evaluation process, an information portal for many forecasting related issues and a review article and position paper regarding the use of probabilistic forecasts were developed. Additionally, dissemination of relevant information in both the forecasters and the end-users community has been paramount with special sessions, workshops and webinars.

The Operating Agent is Gregor Giebel of DTU, Co-Operating Agent is Will Shaw of PNNL. Participation is open for all organisations in

Work Package (WP) Activities

NWP Improvements (WP1)

Forecast Selection Process (WP2)

This WP brings together global leaders in NWP models as applied to the wind industry to exchange information about future research areas. The emphasis is on improvements of the wind-related forecast performance of these models especially at typical rotor heights.

Two lists for tall met masts and experiments of up-todate data are maintained. Additionally, this WP verifies and validates the improvements through a common data set to test model results upon and discuss at IEA Task meetings.



In the second WP a three-part series of recommended practices guides (RP) for the selection process of forecasting solutions was developed:

The first part, the "Forecast Solution Selection Process" deals with the selection and background information necessary to collect and evaluate when developing or renewing a forecasting solution for the power market. The second part of the series "Benchmarks and Trials" offers recommendation on how to best conduct benchmarks and trials.

The third part, the "Forecast Evaluation" provides information and guidelines regarding effective evaluation of forecasts, forecast solutions and benchmarks and trials.

> Initial forecast system plan withou established IT infra-

The third WP surveyed the current state of use of forecast uncertainties by the power systems sector documents and and publishes results in a report and publications. WP This also provides outreach users of to forecasts via webinars or other means to enhance knowledge their and ability to use all available information for

Note: Note:

Use of Uncertainty Forecasting (WP3)



Towards Improved Understanding of the Applicability of Uncertainty Forecasts in the Electric **Power Industry**

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Abstract: Around the world wind energy is starting to become a major energy provider in electrici markets, as well as participating in ancillary services markets to help maintain grid stability The reliability of system operations and smooth integration of wind energy into electricity markets ha een strongly supported by years of improvement in weather and wind power forecasting system Deterministic forecasts are still predominant in utility practice although truly optimal decisions and risk hedging are only possible with the adoption of uncertainty forecasts. One of the main barrier or the industrial adoption of uncertainty forecasts is the lack of understanding of its informatic ontent (e.g., its physical and statistical modeling) and standardization of uncertainty foreca products, which frequently leads to mistrust towards uncertainty forecasts and their applicability in practice. This paper aims at improving this understanding by establishing a common terminolog nd reviewing the methods to determine, estimate, and communicate the uncertainty in weather and wind power forecasts. This conceptual analysis of the state of the art highlights that: (i) end-users hould start to look at the forecast's properties in order to map different uncertainty representations to specific wind energy-related user requirements; (ii) a multidisciplinary team is required to foster the ntegration of stochastic methods in the industry sector. A set of recommendations for standardization ind improved training of operators are provided along with examples of best practices.

Source: http://www.mdpi.com/199 6-1073/10/9/1402/

Figure 1: The instrumentation of the Second Wind Forecast Improvement Project (WFIP2), in the Northwest of the USA. Source: Joel Cline.



nfrastructure

Figure 2:

Overview of a simple decision support scheme illustrating common difficulties when deciding for or against trials or common procurements. Cost, validity and output of trials are often over estimated in their usefulness, because fair evaluation requires a lot of resources, and complex problem solving can often not be verified by simple tests. A guideline for decision making is therefore under preparation by the task.

Prediction Models Designed to **Prevent Significant**

By Jan Dobschinski Ricardo Bessa, Pengwei Du, Kenneth Geisler Sue Ellen Haupt, Matthias Lange, Corinna Möhrlen, Dora Nakafuji, and Miguel de la Torre Rodriguez

operations.



spheric processes that weather forecasts w ever be perfectly accurate. This natural fi s challenges not only for private life, pu safety, and traffic but also for electrical po tems with high shares of weather-dep ind and solar power production To facilitate a secure and economic grid narket integration of renewable energy sou RES), grid operators and electricity traders know how much power RES within their : ms will produce over the next hours and d This is why RES forecast models have grown he past decade to become indispensable tools nany stakeholders in the energy economy. Driv increased grid stability requirements and et forces, forecast systems have become taile to the end user's application and already per reliably over long periods. Apart from a resid oderate forecast error, there are single extra error events that greatly affect grid operator Nevertheless, there are also forecast sys that provide additional information about t pected forecast uncertainty and estimation both moderate and extreme errors in addition the "best" single forecast. Such uncertainty fo casts warn the grid operator to prepare to take s ial actions to ensure grid stability. The State of the Art in Forecast Generation foday, some forecast systems have I ped specifically to predict the power prod ion of single wind and solar units, differ sized portfolios, local transformer stations ogrids, distribution and transmission g nd entire countries. Nearly all forecast sys ave one thing in common; they rely on nu cal weather predictions (NWPs) to calculate 1 pected RES power production. The wa transform weather predictions into power for sts depends crucially on the end user's a cation and the available plant configuration surement data. If historical me vailable, forecast model developers often u atistical and machine-learning techniqu

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atomatically find a relation between histor

ower measurements. If no historical measurements nt data are available, e.g., for new installa

of RES units, the transformation of weathe

ower is often accomplished by physically base nodels that consider the unit's parameters to r

ather forecasts and simultaneously obser

Source: DOI: 10.1109/MPE.2017.2729100

Results

Information Portal

A list of met masts useful for validation of forecasts is publicly available and maintained. The list currently contains more than a dozen masts on- and off-shore.

A list of currently running or recently finalized meteorological experiments to either participate or to verify a flow model against is available, e.g. the Perdigao experiment of the New European Wind Atlas or the Wind Forecast Improvement Project 2.

Minute Scale Forecasts

In June 2018, IEA Wind Task 32 Lidars and 36 Forecasting combined workshop on Very Short Term held a Forecasting of Wind Power. The main tools employed were lidars, radars and SCADA data. Main results were:

Phase II

The second phase of the Task adds some new targets:

• Discussion of possible parts of the forecasting processes to be standardised in the future.

A list of current or finished research projects in the field of wind power forecasting is published and maintained

All publications from the Task group is available with **Open Access**

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• Forecasts on the minute time scale are getting more

important in high-wind-penetration power systems.

- A combination of weather models and instrumentation provide important information when persistence fails, namely in fast changing weather conditions, ramping and high speed wind events. **energies**
- Data quality is a major issue, incl. sensor availability (e.g. for Lidars).

Journal paper is published in Energies "Minute-Scale Forecasting of 2019: Received: 14 December 2018; Accepted: 14 February 2019; Published: 21 February 2019 Abstract: The demand for minute-scale forecasts of wind power is continuously increasing with the growing penetration of renewable energy into the power grid, as grid operators need to ensure grid stability in the presence of variable power generation. For this reason, IEA Wind Tasks 32 Power – Results from the Wind and 36 together organized a workshop on "Very Short-Term Forecasting of Wind Power" in 2018 IEA Wind is an international platform for the research community and industry. Task 32 tries t collaborative workshop of IEA Wind focuses on improving the value of wind energy forecasts to the wind energy industry. The worksho identified three applications that need minute-scale forecasts: (1) wind turbine and wind farm control these applications range from around 1 s for turbine control to 60 min for energy market and gri control applications. The methods that can be applied to generate minute-scale forecasts rely o Task 32 and 36".



• Online verification and benchmarking of current NWP models with met mast data (details --> home page).

 Detailed review of uncertainty propagation through the modeling chain.

 Assessment of the value of probabilistic forecasts, both on a theoretical basis as well as through description of actual use cases and examples.

• Development of an IEA Recommended Practice for the requirements of data and instrumentation for real-time forecasting.

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owards enhancing quality and reliability of the input measurement dat

numerical weather prediction models

Minute-Scale Forecasting of Wind Power-Results from the Collaborative Workshop of IEA Wind Task 32 and 36

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dentify and mitigate barriers to the use of lidars in wind energy applications, while IEA Wind Task 3

power grid balancing, (3) energy trading and ancillary services. The forecasting horizons

neasurements from met masts, turbines or profiling remote sensing devices. Upstream data nee to be propagated with advection models and point measurements can either be used in statistica time series models or assimilated into physical models. All methods have advantages but also

shortcomings. The workshop's main conclusions were that there is a need for further investigatior into the minute-scale forecasting methods for different use cases, and a cross-disciplinary of different method experts should be established. Additionally, more efforts should be direct

Keywords: wind energy; minute-scale forecasting; forecasting horizon; Doppler lidar; Doppler rad

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