IEA Wind Task 36 Forecasting – Phase II

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Summary

This poster gives an overview of IEA Wind Task 36 for Wind Power Forecasting. The Operating Agent is Gregor Giebel of DTU, Co-Operating Agent is Will Shaw of PNNL. Collaboration in the task is solicited from everyone interested in the forecasting business. The second phase of Task 36 runs for three years, 2019-2021.

The main deliverables from phase 1 (2016-2018) were (1) an IEA Wind Recommended Practice on the forecast solution selection and evaluation process, (2) an up-to-date list of current wind forecasting projects and their main project results, including datasets which can be used by researchers around the world to improve their own models, and (3) two review journal papers regarding the use of probabilistic forecasts and minute-scale forecasting and one Power & Energy magazine publication. Through workshops, webinars and meetings, dissemination of relevant information in both forecaster and end-user communities has been a focus area. Participation is open for all organisations in member states of the IEA Annex on Wind Power, see ieawind.org for the up-to-date list.

Activities

News: **Recommended Practice finalised and published!**

NWP Improvements

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 in typical rotor heights.

Two lists of data have been kept up-to-date: tall met masts and wind power forecasting experiments. Additionally, this WP verifies and validates the improvements through a common data set to test model results upon and discuss at IEA Task meetings.

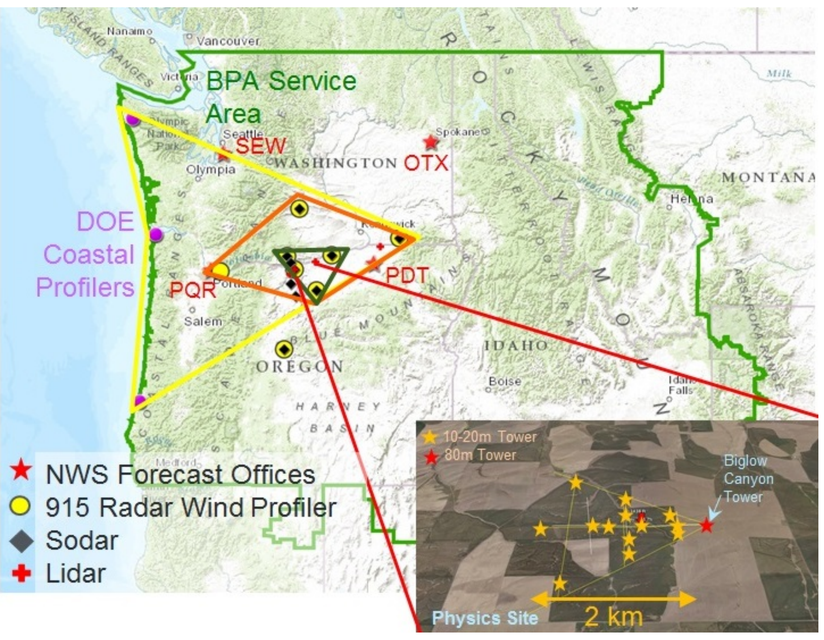


Figure 1: The instrumentation of WFIP2, in the Northwest of the USA. Source: Joel Cline.

RP Forecast Selection Process

In the second WP, a **Recommended Practice** (RP) guiding 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 "**Benchmarks and Trials**", of the series offers recommendation on how to best conduct benchmarks and trials.
The third part "**Forecast Evaluation**", provides information and guidelines regarding effective evaluation of forecasts within or outside of benchmarks and trials.

Get your copy here:
http://www.ieawindforecasting.dk/Publications/RecommendedPractice

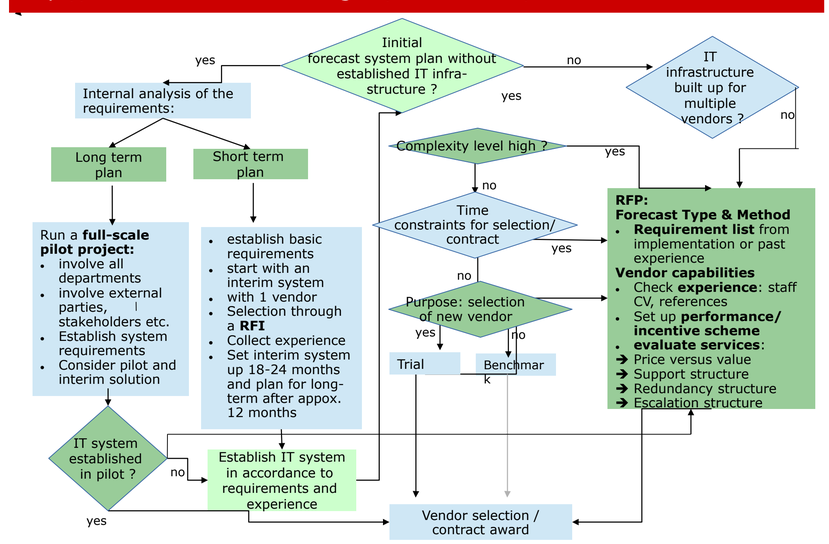
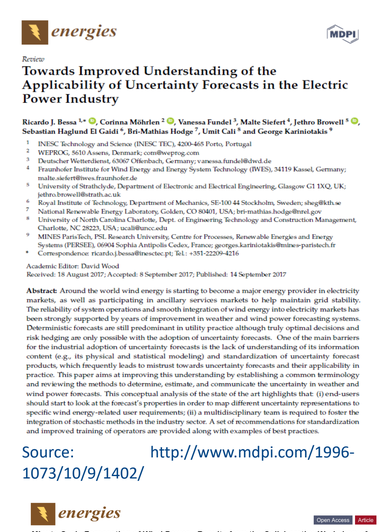


Figure 2:
Overview of a simple decision support scheme illustrating common difficulties when deciding for or against trials or common procurements. Cost, validity and output of trials are often over estimated In their usefulness, because fair evaluation requires a lot of resources, and complex problem solving can often not be verified by simple tests. A guideline for decision making is therefore under preparation by the task.

Use of Uncertainty Forecasting (WP3)

The third WP assessed the current use of forecast uncertainties by the power systems sector via a survey and documented the results in a report. This WP also provides outreach to forecast users via webinars and other means to enhance their knowledge and ability to use all available forecast information for operations.


energies
Review
Towards Improved Understanding of the Applicability of Uncertainty Forecasts in the Electric Power Industry
Ricardo J. Bessa, Corinna Möhrlen, Vanessa Fundel, Malte Siefert, Jethro Browell, Sebastian Haglund El Gaidi, Bri-Mathias Hodge, Umit Cali and George Kariniotakis
Academic Editor: David Wood
Received: 18 August 2017; Accepted: 8 September 2017; Published: 14 September 2017
Abstract: Around the world wind energy is starting to become a major energy provider in electricity 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 has been strongly supported by years of improvement in weather and wind power forecasting systems. 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 barriers for the industrial adoption of uncertainty forecasts is the lack of understanding of its information content (e.g., its physical and statistical modeling) and standardization of uncertainty forecast 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 terminology and 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 should 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 integration of stochastic methods in the industry sector. A set of recommendations for standardization and improved training of operators are provided along with examples of best practices.

Source: http://www.mdpi.com/1996-1073/10/9/1402/


energies
Open Access Article
Minute-Scale Forecasting of Wind Power—Results from the Collaborative Workshop of IEA Wind Task 32 and 36
by Ines Würth, Laura Valldecabres, Elliot Simon, Corinna Möhrlen, Bahri Uzunoğlu, Ciaran Gilbert, Gregor Giebel, David Schlipf and Anton Kaifel
Energies 2019, 12(4), 712; https://doi.org/10.3390/en12040712 21 Feb 2019
Cited by 2
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 [...]
(This article belongs to the Special Issue Solar and Wind Energy Forecasting)


Prediction Models Designed to Prevent Significant Errors
By Jan Dobschinski, Ricardo Bessa, Pengwei Du, Kenneth Geisler, Sue Ellen Haupt, Matthias Lange, Corinna Möhrlen, Dora Nakafuji, and Miguel de la Torre Rodriguez
Uncertainty Forecasting in a Nutshell
IT IS IN THE NATURE OF CHAOTIC ATMOSPHERIC processes that weather forecasts will never be perfectly accurate. This natural fact poses challenges not only for private life, public safety, and traffic but also for electrical power systems with high shares of weather-dependent wind and solar power production.
To facilitate a secure and economic grid and market integration of renewable energy sources (RES), grid operators and electricity traders must know how much power RES within their systems will produce over the next hours and days. This is why RES forecast models have grown over the past decade to become indispensable tools for many stakeholders in the energy economy. Driven by increased grid stability requirements and market forces, forecast systems have become tailored to the end user's application and already perform reliably over long periods. Apart from a residually moderate forecast error, there are single extreme-error events that greatly affect grid operators.
Nevertheless, there are also forecast systems that provide additional information about the expected forecast uncertainty and estimations of both moderate and extreme errors in addition to the "best" single forecast. Such uncertainty forecasts warn the grid operator to prepare to take special actions to ensure grid stability.
The State of the Art in Forecast Generation
Today, some forecast systems have been developed specifically to predict the power production of single wind and solar units, differently sized portfolios, local transformer stations and subgrids, distribution and transmission grids, and entire countries. Nearly all forecast systems have one thing in common: they rely on numerical weather predictions (NWPs) to calculate the expected RES power production. The way to transform weather predictions into power forecasts depends crucially on the end user's application and the available plant configuration and measurement data. If historical measurements are available, forecast model developers often use statistical and machine-learning techniques to automatically find a relation between historical weather forecasts and simultaneously observed power measurements. If no historical measurement data are available, e.g., for new installations of RES units, the transformation of weather to power is often accomplished by physically based models that consider the unit's parameters to map the internal physical processes.
1540-7977/17©2017IEEE
IEEE power & energy magazine
november/december 2017

Source:
DOI: 10.1109/MPE.2017.2729100

Results

Information Portal

A list with masts useful for validation of the forecasts is published, measuring at least 100m. The list currently contains more than a dozen masts on- and offshore.

A list of meteorological experiments going on currently or recently, either to participate or to verify a flow model against. For example the Perdigao experiment of the New European Wind Atlas or the Wind Forecast Improvement Program 2.

A list of current or finished research projects in the field of wind power forecasting.

Also, check out our recorded **webinars** on YouTube!

See IEAwindforecasting.dk.

Minute Scale Forecasts

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

- 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 at fast changing weather conditions, ramping and high speed wind events.
- Data quality is a major issue, including sensor availability (e.g. for Lidars).

Journal paper is published in Energies 2019: "Minute-Scale Forecasting of Wind Power – Results from the collaborative workshop of IEA Wind Task 32 and 36" (see above)

Phase II

The second phase of the Task adds new targets:

- Discussion of possible parts of the forecasting processes to be standardised in the future.
- Online verification and benchmarking of current NWP models with met mast data.
- 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.

Download the poster