IEA Wind Task 36
Forecasting for Wind Power

RECOMMENDED PRACTICES FOR SELECTING RENEWABLE POWER FORECASTING SOLUTIONS

Challenge

The effectiveness of forecasts in reducing the variability management costs of power generation from wind and solar plants is dependent upon both the accuracy of the forecasts and the ability to effectively use the forecast information in the user's decision-making process. Therefore, there is considerable motivation for stakeholders to try to obtain the most effective forecast information as input to their respective decision tools.

One of the main challenges today is that the industry does not have any standards regarding the design, develoment and implementation of forecast solutions and forecast evaluation . This lack of standardised procedures and requirments is an unhealthy development, considering the importance and neccesity of integrating higher amounts of renewable energies on a global basis.

Solution

To overcome some of the obstacles and barriers in the integration of forecasting solutions, the IEA Wind Task 36 has estabished a guidance to stakeholders on the three main parts of this decision process. The first part "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" deals with how to set up and run benchmarks and trials in order to test or evaluate different forecasting solutions against each other and the fit-for-purpose. The third part "Forecast Evaluation", provides information and guidelines regarding effective evaluation of forecasts, forecast solutions as well as benchmarks and trials.

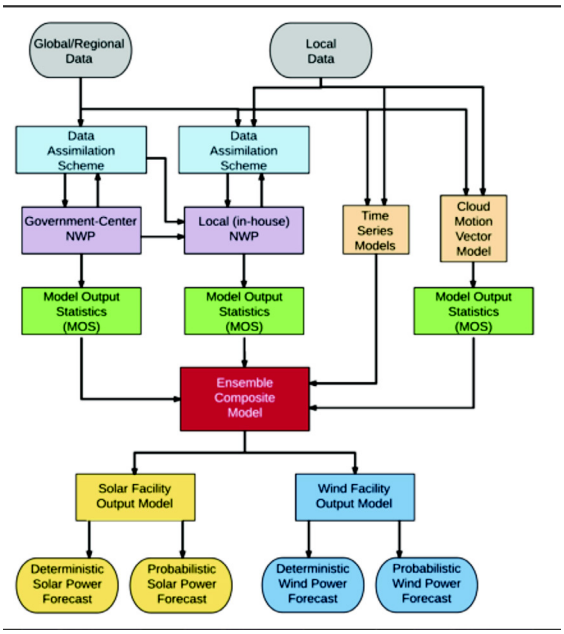
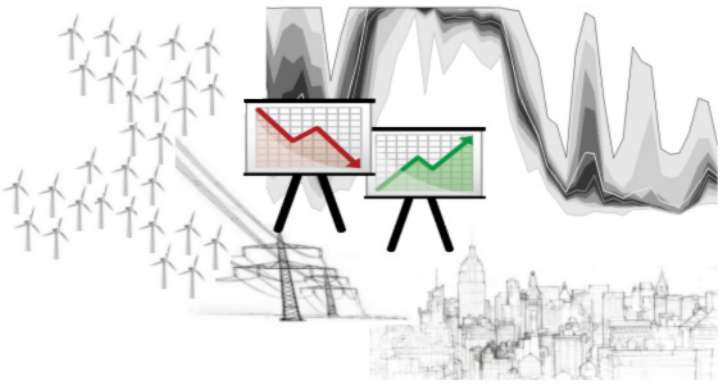


Figure: High-level overview of the components and data flow of a typical state-of-the-art forecasting solution.



Forecast Solution Selection

While every forecasting solution contains very individual processes and practices, there are a number of areas that all forecasting solutions have in common. Figure 1 shows a typical high-level forecast solution framwork. For any industry it is important to establish standards and standardized practices in order to streamline processes, but also to ensure security of supply with a healthy competition structure. The Recommended Practice guideline is providing state-of-the-art practices that have been carefully collected by experts in the area and are being reviewed by professionals and experts in an appropriate number of countries with significant experience in wind energy forecasting.

The key element of the recommended practice guideline is to provide basic elements of decision support and thereby encourage forecast users to analyze their own situation and use this analysis to design and request forecasting solutions that fits their own purpose rather than applying a doing what-everybody-else-is-doing-strategy. It is highly recommended to "engage with the forecast vendors" in order to discuss the vendors recommendations. It is often most beneficial for all parties to issue a request for information, conduct vendor meetings and explain the goal and objective of a solution and let the forecasters give their recommendations.

The guideline provides therefore not only aspects for the selection process to forecast users, but also for vendors new to the market or those wanting to evolve to a new level of service and support as a guideline to state of the art practices that are recommended to be incorporated into business practices. Figure 2 is the decision support tool that has been developed as an aid to develop procedures and processes inside the organisation with with stakeholder engagement. It is explained in detail in the guideline.

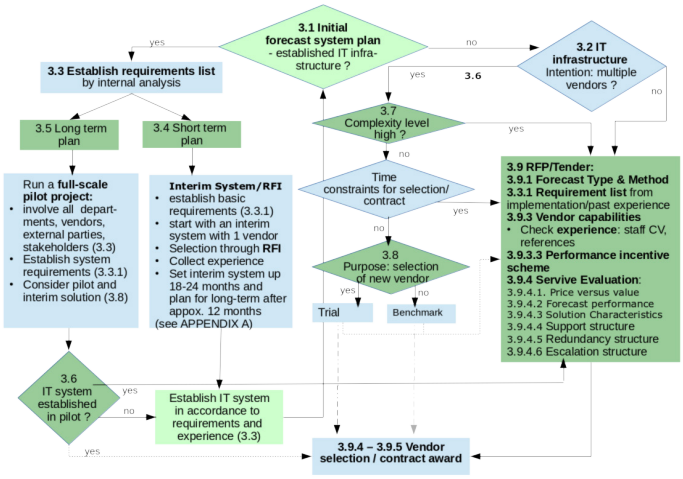


Figure 2: The decision support flow chart for the initial deliberations of the forecast solution selection.

Benchmarks and Trials

In the process of selecting a forecast solution, benchmark and trial exercises can consume a lot of time both for the entity conducting it (hereafter referred to as "Forecast User") and the participating Forecast Service Providers (FSPs). These guidelines and best practices are based on years of industry experience and intended to achieve maximum benefit and efficiency for all parties involved in such benchmark or trial exercises.

Forecast User's benefits when following the guidelines can be summarized to:

- Performance of a representative trial which will select a FSP that fits their need, specific situation and operational setup
- Short term internal cost savings by running an efficient trial
- Long term cost savings of FSPs, by following the trial standards and thereby help reduce the costs for all involved parties

The guideline provides an overview of the factors that should be addressed when con-ducting a benchmark or trial and present the key issues that should be considered in the design as well as describe the character-istics of a success-ful trial or bench-mark. We also discuss how to execute an effective benchmark or trial and specify common pitfalls that a forecast user should try to avoid.

Forecast Trial Checklist

--Preparation--
- ☐ Determine outcomes / objectives
- ☐ Consult expert with trial experience
- ☐ Establish timeline and winning criteria
- ☐ Decide on live or retrospective trial
- ☐ Gather metadata (use IEA checklist spreadsheet)
- ☐ Determine if adequately resourced to carry out
- ☐ Obtain historical data
- ☐ Invite Forecast Service Providers
- ☐ Distribute historical and meta-data
- ☐ Allow two weeks Q&A prior to trail start
- ☐ Begin Trial

--During Trial--
- ☐ Develop validation report
- ☐ Check interim results
- ☐ Provide interim results (if no live data being provided)
- ☐ End Trial

--Post Trial--
- ☐ Provide final results
- ☐ Notify winner(s)
- ☐ Contract with winner(s)
- ☐ Start Service

Figure 3 : The checklist for performing forecasting trials.

Forecast Evaluation

The evaluation of forecasts and forecast solutions is an obligation for any forecast provider as well as end-user of forecasts. It is important, because economically significant and business relevant decisions are often based on evaluation results. Therefore, it is crucial to design and outline forecast evaluations with this importance in mind, give this part the required attention and thereby ensure that results are:

significant
representative
relevant

How to setup an evaluation process and achieve these principles has been the core of the developed recommended practices guideline. These three main principles are outlined in the guideline and brought into perspective with the general concept of evaluation uncertainty and uncertainty of measurement data collection and reporting, which is one of the base principles of evaluation and verification tasks. Here, the impact and consequences of errors in measurement data collection and reporting is explained.

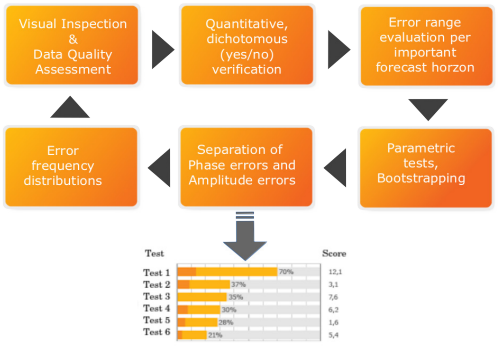


Figure 4 : Conceptualized framework for forecast evaluation.

Furthermore, metrics for evaluation and verification have been conceptualized and categorized in order to provide an issue oriented guideline for the selection of metrics in a evaluation framework (see Fig. 4).
The concept of developing an evaluation framework is described and practical information on how to maximize value of operational forecasts, how to evaluate benchmarks and trials and new forecasting techniques or developments is provided.

Lastly, recommendations are made for a number of practical use cases for power industry specific applications.

Where to get the guideline

The recommended practice guidelines are available as open access on www.ieawindforecasting.dk → Publications

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The **International Energy Agency** is an autonomous organisation which works to ensure reliable, affordable and clean energy for its 30 member countries and beyond.
The **IEA Wind Technology Collaboration Programme** supports the work of 38 independent, international groups of experts that enable governments and industries from around the world to lead programmes and projects on a wide range of energy technologies and related issues.
IEA Wind Task 36 connects 250 experts from academia, forecast vendors and end users to improve the accuracy and value of wind power forecasts.