Task 36 Forecasting for Wind Power



Gregor Giebel, DTU Wind Energy

4 Nov 2016

EERA ESI SP2, Lyngby, DK







Short-Term Prediction Overview



Improvements in NWPs

Online data



Numerical Weather Predictio

Coordination Datasets Benchmarks

Prediction model



End user







WP1 Meteorology

Lead:

- Helmut Frank, DWD
- Joel Cline, DoE
- Will Shaw, PNNL













WP1 Meteorology

- Task 1.1: Compile list of **available data sets**, especially from tall towers.
- Task 1.2: Creation of annual reports documenting and announcing **field measurement programs** and availability of data.
- Task 1.3: Verify and Validate the improvements through a **common data set** to test model results upon and discuss at IEA Task meetings







WP1 deliverables

- D 1.1: Annual summary of major field studies supportive of wind forecast improvement; list of available data (*M12, M24, M36*)
- D 1.2: Organization of meetings and special sessions at international conferences on wind energy (*M6-M36*)
- D 1.3: Report on future issues for research in wind power prediction (M30)







Task 1.1

Compile list of available data sets, especially from tall towers. Lead: DWD

- Tall means > 100m (offshore maybe a little less)
- List currently contains 12 masts, more are welcome!





Benchmarks and Error measures

Benchmark Best Practice Standard evaluation protocol

orke

iea wind

Online data

Prediction model





WP2 Benchmarks

Lead:

Pierre Pinson, DTU Elektro Bri-Mathias Hodge, NREL Caroline Draxl, NREL









Task 2.1 – Lead DTU Elektro

Design of benchmark exercises: best practice

D2.1: IEA Recommended Practice on Wind Power Forecast Evaluation, for both deterministic and probabilistic forecasts







Task 2.2 – Lead DTU Compute / Elektro

Standard evaluation protocol for both deterministic and probabilistic forecasts: review of existing, best practice, and critical assessment of new proposals







Task 2.4 – Lead DTU Elektro

Set-up and dissemination of benchmark test cases and data sets

E.g. Global Forecast Competition on Kaggle, ANEMOS comparison







Task 2.4 – Example datasets



AEMO dataset

(Australia, 20 wind farms, 5min res. over several years)

• **RE-Europe** (Europe, 1500 nodes with wind and solar power, hourly res. over 3 years – to be extended)



Advanced Usage

Decision support Scenarios Best Practice in Use Communication



End user





Prediction model





WP3 Advanced Usage

Lead:

George Kariniotakis, Mines ParisTech Industry co-lead









Task 3.1 – Lead: WEPROG

State of the art of use of forecasts uncertainties in the business practices (operation/management, planning of power systems, markets operation/participation) of actors in the power systems sector (TSOs, DSOs, ESCOs, traders etc).

Please fill in the questionnaire at

http://www.ieawindforecasting.dk/topics/workpackage-3/task-3-1 (also linked from main page of the task)







Task 3.4 – Lead: NREL

Review of existing/proposal of best practices on how to measure/quantify the value from the use of probabilistic forecasts







Task 3.5 – Lead: INESC TEC

Communication of wind and wind power forecasts to end-users. Review, recommendations/best practice. Is it necessary to standardise wind power forecasting products?







WP0 Management

Tasks:

- Task 0.1: Task web site.
- Task 0.2: Contractual reporting
- Task 0.3: Final report
- Task 0.4: Special Sessions

Deliverables:

- D 0.1: Website
- D 0.2 0.4: Annual reports
- D 0.5: Organization of biannual meetings





Website: www.ieawindforecasting.dk

			Contact
IEA WIND TASK 36	$-\sum_{i=0} \frac{1}{i!} f^{**}(x)$		
ABOUT PARTNERS TOPICS	MEMBER SITE IEA WIND		ied wind
RELATED PROJECTS		NEWS	All
> IEA Wind		THE DESCRIPTION	03 June 2016 Questionnaire on State of the
> IEA Wind Task 25 - Large-sc		News	art
> IEA Wind Task 31 Wakebench			18 May 2010 10 June 2016: IEA Wind Task
> EWeLiNE			36
> WFIP2			18 May 2016 9 June 2016 Workshop in Barrelona
New European Wind Atlas	7		Darcelona
			18 May 2016 8 June 2016 Potentially sub- task

Source: Red Electrica de España

Wind power forecasts have been used operatively for over 20 years. Despite this fact, there are still several possibilities to improve the forecasts, both from the weather prediction side and from the usage of the forecasts. The new International Energy Agency (IEA) Task on Forecasting for Wind Energy tries to organise international collaboration, among national weather centres with an interest and/or large projects on wind forecast improvements (NOAA, DWD, ...), operational forecaster and forecast users.

The Task is divided in three work packages: Firstly, a collaboration on the improvement of the scientific basis for the wind predictions themselves. This includes numerical weather prediction model physics, but also widely distributed information on accessible datasets. Secondly, we will be aiming at an international pre-standard (an IEA Recommended Practice) on benchmarking









Task 0.4

Organization of regular meetings and special sessions at international conferences on wind energy. Lead: DTU Wind Energy

• First event: Special Session at AMS General Meeting, January, Seattle

https://ams.confex.com/ams/97Annual/webprogram/meeting.html#Tuesday1





Collected Issues

Nowcast (especially for difficult situations, thunderstorms, small lows, ...) Sub 1 hour temporal resolution Meteorology below 1km spatial resolution Stability issues, especially with daily pattern / (Nightly) Low level jets Icing Farm-Farm interaction / quality of direction forecast Short-term ensembles Ramps and other extremes Spatio-temporal forecasting Rapid Update Models (hourly, with hourly data assimilation) Use of probabilistic forecasts and quality of the extreme quantiles Do DSOs need different forecasts than TSOs? Penalties for bad performance? Incentives for improved perf.? Seasonal forecasting? What's the business case? Data assimilation (with non-linear Kalman filters, 4D Var, ...)



Paper on future research issues:

The Science of Making Torque from Wind (TORQUE 2016) Journal of Physics: Conference Series **753** (2016) 032042

TORQUE 2016

Munich, Germany, 5-7 October

IOP Publishing doi:10.1088/1742-6596/753/3/032042

http://iopscience.iop.org/article/10.108 8/1742-6596/753/3/032042

Wind power forecasting: IEA Wind Task 36 & future research issues

G Giebel¹, J Cline², H Frank³, W Shaw⁴, P Pinson⁵, B-M Hodge⁶, G Kariniotakis⁷, J Madsen⁸ and C Möhrlen⁹ Published under licence by IOP Publishing Ltd Journal of Physics: Conference Series, Volume 753, B. Wind, wakes, turbulence and wind farms



G Giebel¹, J Cline², H Frank³, W Shaw⁴, P Pinson⁵, B-M Hodge⁶, G Kariniotakis⁷, J Madsen⁸ and C Möhrlen⁹

¹DTU Wind Energy, Risø, Frederiksborgvej 399, 4000 Roskilde, Denmark

² Department of Energy, Wind and Water Power Program, 1000 Independence Ave. SW, Washington DC 20585, USA

³ Deutscher Wetterdienst, Frankfurter Str. 135, D-63067 Offenbach, Germany

⁴ Pacific Northwest National Laboratory, 902 Battelle Boulevard, P.O. Box 999, MSIN K9-30, Richland, WA 99352 USA

⁵DTU Elektro, Ørsteds Plads, 2800 Kgs. Lyngby, Denmark

⁶National Renewable Energy Laboratory, 15013 Denver West Parkway, MS ESIF200, Golden, CO 80401, USA

⁷MINES ParisTech, PSL Research University, Centre PERSEE, CS 10207, 1 Rue

Claude Daunesse, 06904 Sophia Antipolis Cedex, France

⁸ Vattenfall AB, Jupitervej 6, DK-6000 Kolding, Denmark

⁹ WEPROG Aps, Willemoesgade 15B, 5610 Assens

E-mail: grgi@dtu.dk

Abstract. This paper presents the new International Energy Agency Wind Task 36 on Forecasting, and invites to collaborate within the group. Wind power forecasts have been used operatively for over 20 years. Despite this fact, there are still several possibilities to improve the forecasts, both from the weather prediction side and from the usage of the forecasts. The new International Energy Agency (IEA) Task on Forecasting for Wind Energy tries to organise international collaboration, among national meteorological centres with an interest and/or large projects on wind forecast improvements (NOAA, DWD, MetOffice, met.no, DMI, ...), operational forecaster and forecast users.





Thank You!!

Gregor Giebel DTU Wind Energy, Frederiksborgvej 399, DK-4000 Risø grgi@dtu.dk Cell: +45 4056 5095



www.ieawindforecasting.dk

The IEA Wind agreement, also known as the Implementing Agreement for Cooperation in the Research, Development, and Deployment of Wind Energy Systems, functions within a framework created by the International Energy Agency (IEA). Views, findings, and publications of IEA Wind do not necessarily represent the views or policies of the IEA Secretariat or of all its individual member countries.



