# IEA Wind Task 51 “Forecasting for the Weather Driven Energy System”

## Wind & Solar Integration Workshop

Session 4D - IEA WIND AND PVPS TASK 51 AND 16

Helsinki, Finland – 8th October 2024 -

C. Möhrlen (WEPROG) and John Zack (MESO)

Gregor Giebel, H. Frank, C. Draxl, J. Zack, J. Browell, , G. Kariniotakis, R. Bessa, D. Lenaghan

# International Energy Agency History

**The IEA was founded in 1974 to help countries co-ordinate a collective response to major disruptions in the supply of oil.**

Image source: dpa

## *Specific Technology Collaboration Programs (in renewable energy):*

- Bioenergy TCP
- Concentrated Solar Power (SolarPACES TCP)
- Geothermal TCP
- Hydrogen TCP
- Hydropower TCP
- Ocean Energy Systems (OES TCP)
- Photovoltaic Power Systems (PVPS TCP)
- Solar Heating and Cooling (SHC TCP)
- **Wind Energy Systems (Wind TCP)**

iea Energy Technology Network

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# IEA Wind TCP Research Tasks

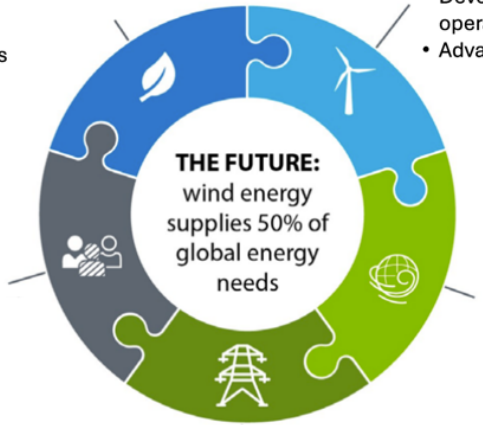
Technology Collaboration Programmes

**Environmental Co-Design**
- Avoiding, minimising, compensating for environmental impacts
- Incorporating environmental costs, benefits into decisions
- Addressing both immediate concerns, future impacts

**Tasks 42, 45, 59 & 60**

**Social Science**
- Acknowledging the transformational nature of development
- Creating just processes
- Valuating benefits, effects, burdens

**Tasks 39, 53 & 62**




**The Turbine**
- Incorporating holistic design
- Developing intelligent controls, operation, maintenance
- Advancing industrialisation

**Tasks 44, 49, 52, 54 & 57**

**The Atmosphere**
- Increasing atmospheric observations
- Expanding, validating universal predictive capability
- Integration, adopting improved models

**Tasks 43, 46, 47, 48, 49, 51, 56**

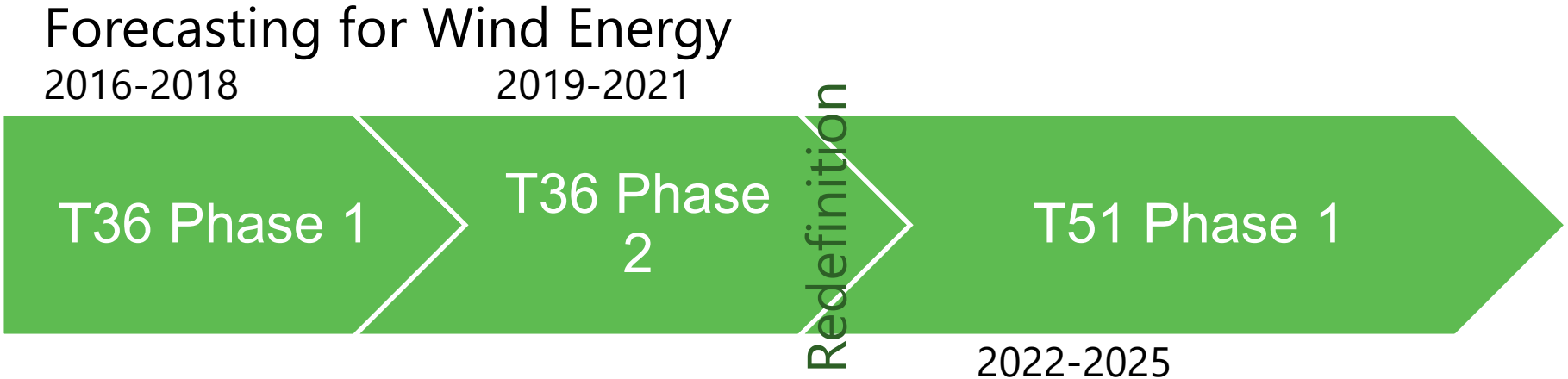
**The Plant and Grid**
- Improving modelling
- Optimising plant design for multiple objectives
- Readying wind plants for grid support

**Tasks 25, 41, 50, 55, 58 & 61**

**Capacity**

As of 2020, about 85% of the world's wind generating capacity–and nearly all offshore capacity–resides within the participating countries. To learn more about the work of each participating member, please click on any of the countries or sponsors below.

Forecasting for Wind Energy



# From groups of single wind turbines to large-scale Wind Energy Systems

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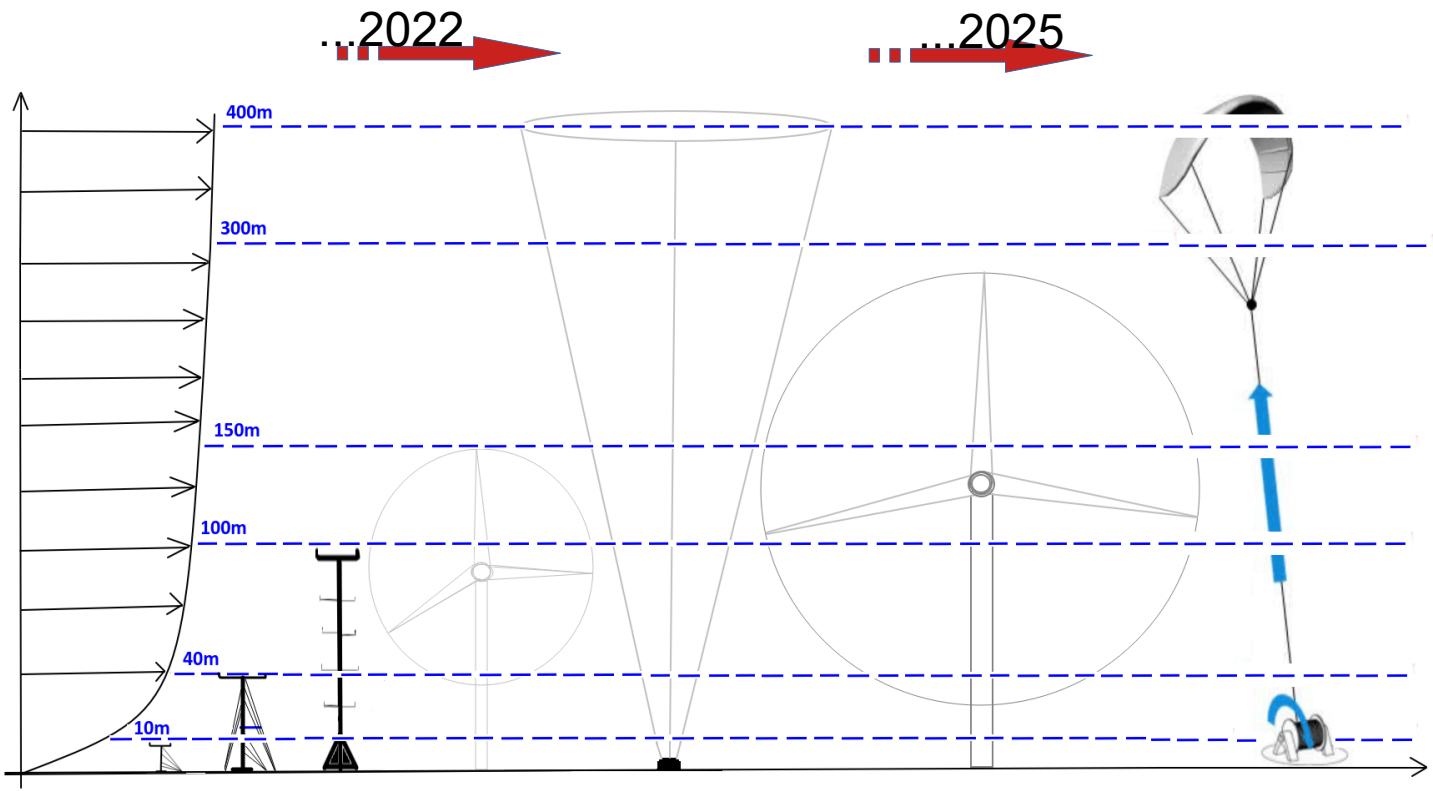
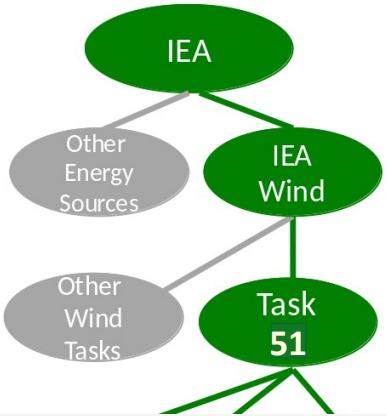
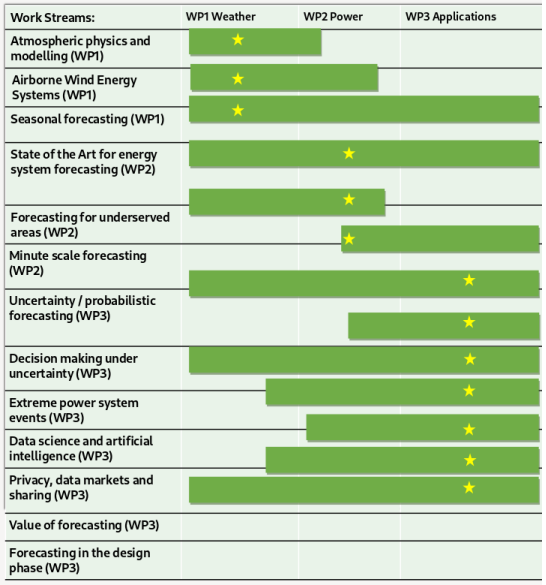



Slide design: Corinna Möhrlen

# IEA Wind Task 51: Forecasting for the weather-driven Energy System




**What is the IEA (International Energy Agency)? (www.iea.org)**

- International organization within OECD with 30 members countries and 8 associates
- Promotes global dialogue on energy, providing authoritative analysis through a wide range of publications
- **One activity: convenes panels of experts to address specific topics**

**Task 51: Forecasting for the weather-driven Energy System:**

- One of 17 Tasks of IEA Wind: https://iea-wind.org/
- Task 36: Phase 1: 2016-2018; Phase 2: 2019-2021 **Task 51: Phase 3: 2022-2025**
- Operating Agent: Gregor Giebel of DTU Wind Energy
- Objective: facilitate int. collaboration to **improve wind energy forecasts**
- Participants: (1) research organization and projects, (2) forecast providers, (3) policy-makers and (4) end-users & stakeholders

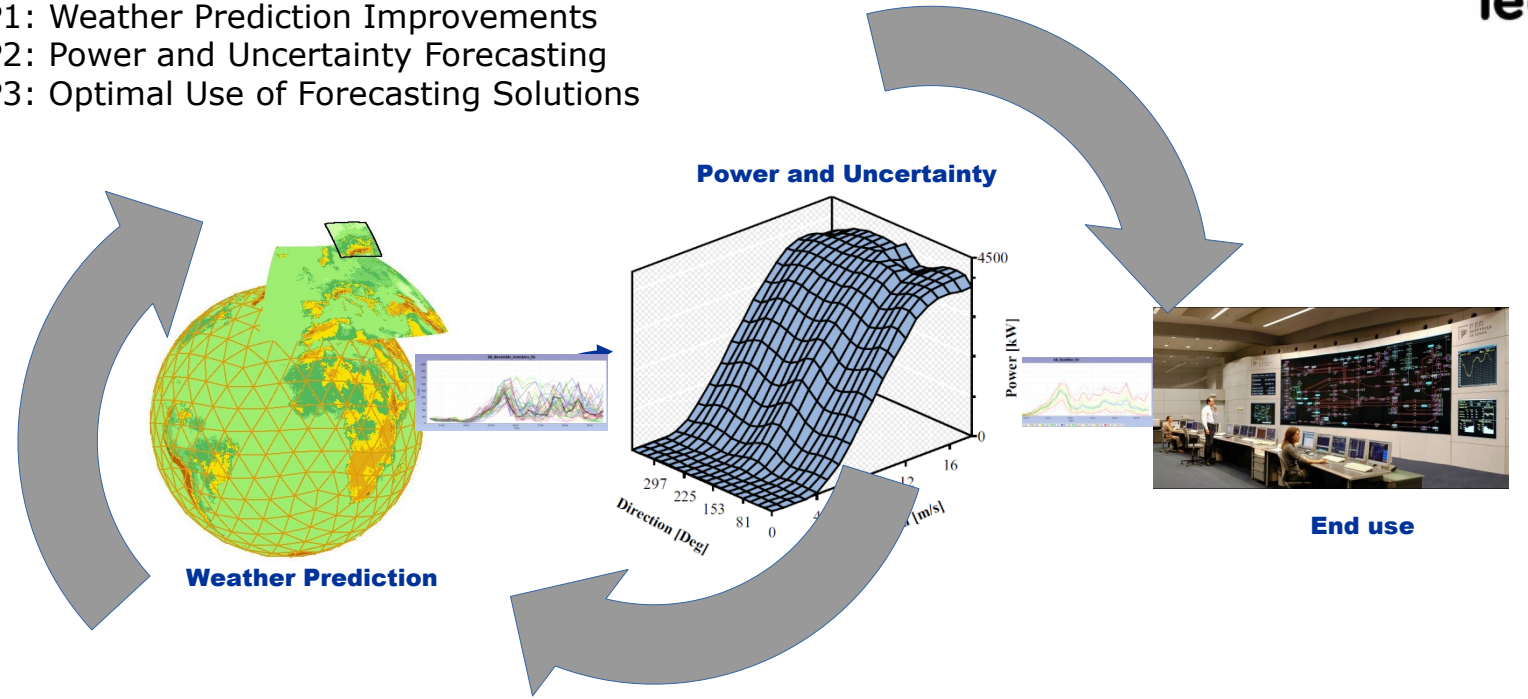
**Task 51 Scope: 3 "Work Packages" distributed over 13 "Workstreams"**

- WP1: Global Coordination in Forecast Model Improvement
- WP2: Benchmarking, Predictability and Model Uncertainty
- WP3: Optimal Use of Forecasting Solutions

**Task homepage: https://iea-wind.org/task51**

# IEA Wind Task 51 Work distribution

**Task Work is divided into 3 work packages:**
WP1: Weather Prediction Improvements
WP2: Power and Uncertainty Forecasting
WP3: Optimal Use of Forecasting Solutions




Australian Government
Bureau of Meteorology

# IEA Wind Task 51 Work distribution

| Work Streams: | WP1 Weather | WP2 Power | WP3 Applications |
|---|---|---|---|
| Atmospheric physics and modelling (WP1) | ★ | | |
| Airborne Wind Energy Systems (WP1) | ★ | | |
| Seasonal forecasting (WP1) | ★ | | |
| State of the Art for energy system forecasting (WP2) | | ★ | |
| Minute scale forecasting (WP2) | | ★ | |
| Data science and artificial intelligence (WP3) | | | ★ |
| Extreme power system events (WP3) | | | ★ |
| Uncertainty / probabilistic forecasting (WP3) & for underserved areas | | | ★ |
| Decision making under uncertainty (WP3) | | | ★ |
| Privacy, data markets and sharing (WP3) | | | ★ |
| Value of forecasting (WP3) | | | ★ |

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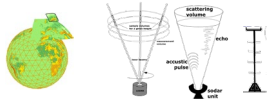
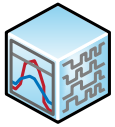


Modelling & data assimilation

Workshops



Verification Platform

Publications

The Task 51 Information Portal aims to be a useful resource for people in forecasting, especially providing links to publically available data for model development.

https://iea-wind.org/task-51/t51-information-portal/

# Information Portal

The Task members identified several issues which might be useful in an information portal for wind power forecasting. Those are:

- A list of meteorology masts with online data over 100m height, useful for verification of wind speed predictions
- A list of meteorological experiments going on currently or recently, either to participate or to verify a flow model against
- A list of publicly available wind power forecasting benchmarks, to test your model against
- A list of current or finished research projects in the field of wind power forecasting
- A list of future research issues
- A list of open weather data

For all of those, we would be happy to accept input, so head over to the site and see where you can help, or what you can use!

Please find the full text of the task description here.

The task is led by Gregor Giebel from DTU Wind Energy.

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# Research projects

https://iea-wind.org/task-51/project-list/

Here are some ongoing and finished projects towards short-term prediction of wind power throughout the last two decades. In total, the public (and partly private) spending on this list exceeds 150 million euro.

| Country | Project acronym | Full title | Sponsor | Total / Funded budget | Start – end date | Participants incl. those from IEA Task 36/51 |
|---|---|---|---|---|---|---|
| DE | WindStore | Optimized system integration of offshore wind energy through intelligent linking of various forecast concepts and forward-looking management of distributed cascade storage systems. | BMWK (German Federal Ministery for Economics and Climate Protection) | 1.76 M€ / 1.47 M€ | Jan 2024 – Dec 2026 | Fraunhofer IEE, DLR, 4Cast, SETrade, WEPROG, EnBW, Stadtwerke Hassfurt und Wunsiedel |
| BE | BeFORECAST | Wake-effect included offshore wind power forecasting for smooth operation of the Belgian electricity grid based on advanced data handling and sensor technology, including airborne systems. | Energy Transition Funds of the Federal Public Service Economy of the Belgian Federal Government | 3.25 M€ / 2.74 M€ | Nov 23 – Oct 25 | von Karman Institute for Fluid Dynamics, Vrije Universiteit Brussel, KU Leuven, 3E, SABCA, Royal Meteorological Institute of Belgium |
| UK | | Multi-variate forecasting for wind power integration in electricity markets | Shell/ETP Scotland | 90k€/120k€ | Oct 22 – Mar26 | University of Glasgow, Jethro Browell |

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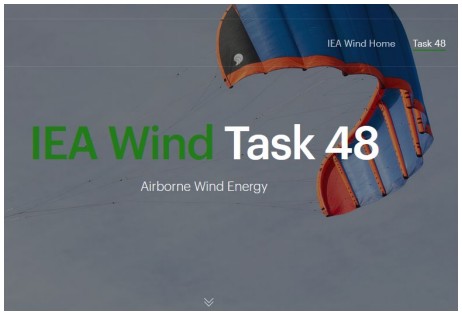
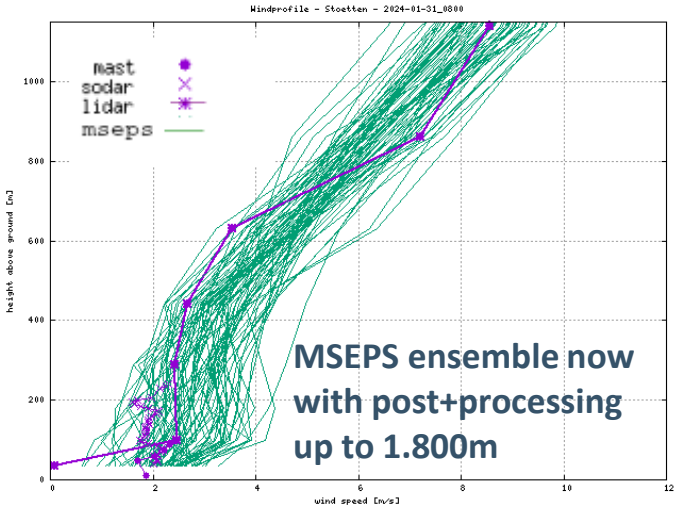
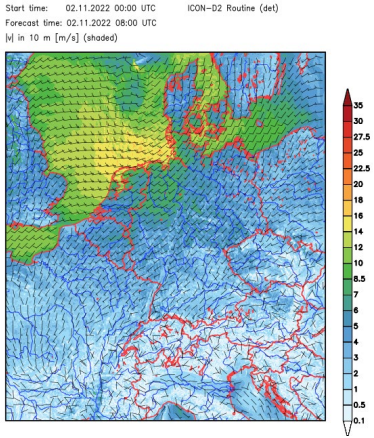
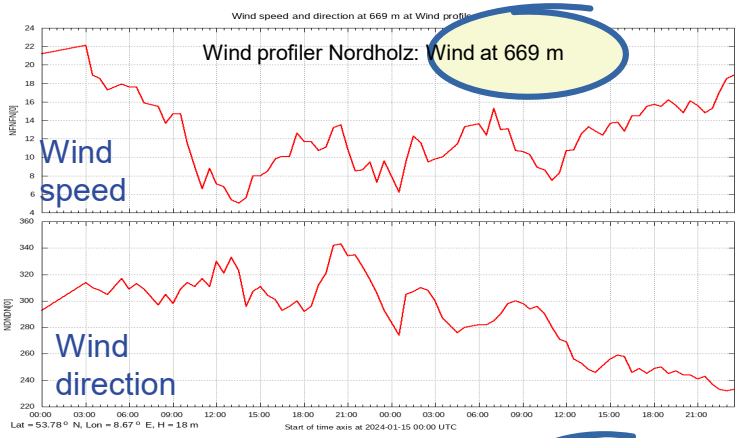
# Workstream Atmospheric Modelling and Physics & first simulations for airborne wind

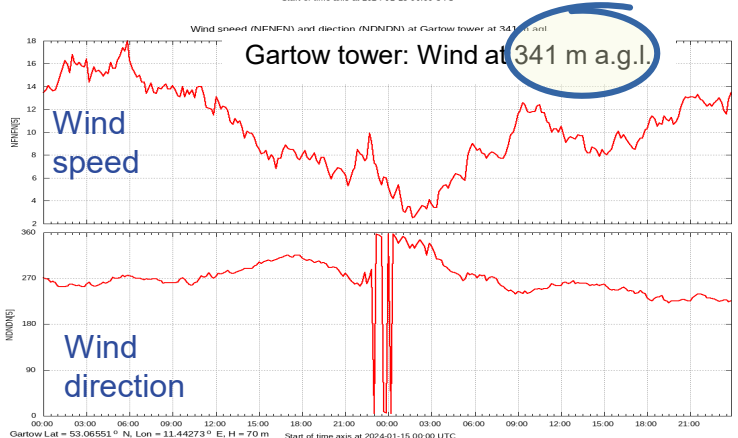



**ICON-DE model now in 15min resolution every hour**



# Elsevier OpenAccess Book

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ISBN: 978-0-443-18681-3
PUB DATE: November 2022
DISCOUNT: Non-serials
FORMAT: Paperback

Editors: Corinna Möhrlen, John W. Zack, and Gregor Giebel

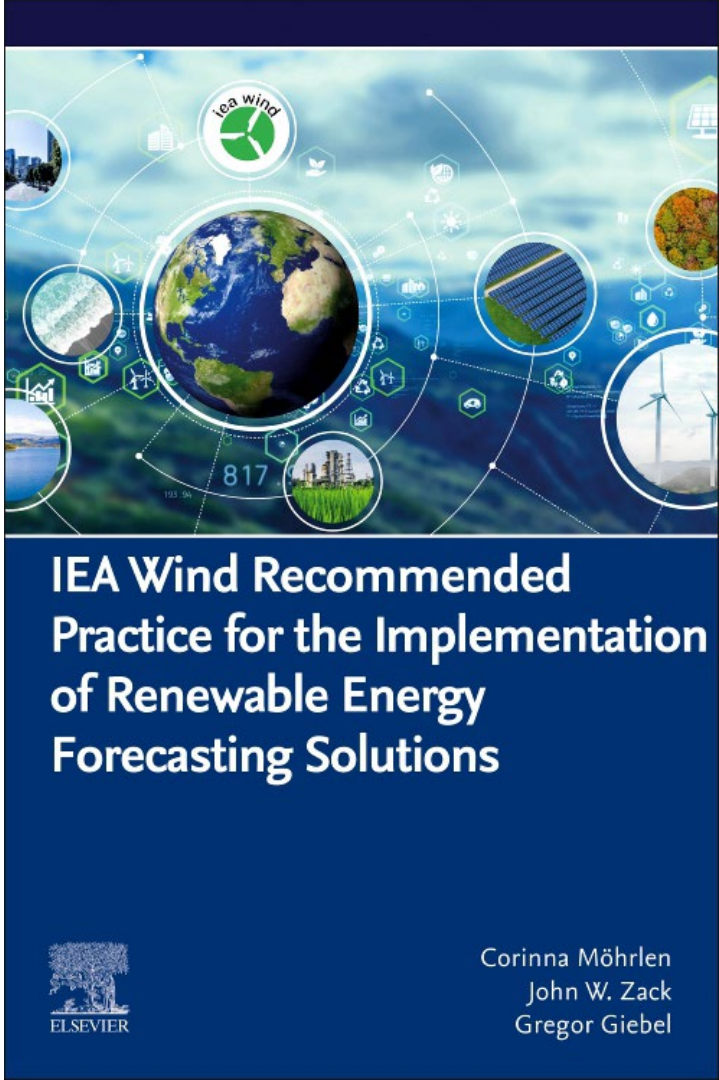
https://www.elsevier.com/books/iea-wind-recommended-practice-for-the-implementation-of-renewable-energy-forecasting-solutions/mohrlen/978-0-443-18681-3

Online OpenAccess:

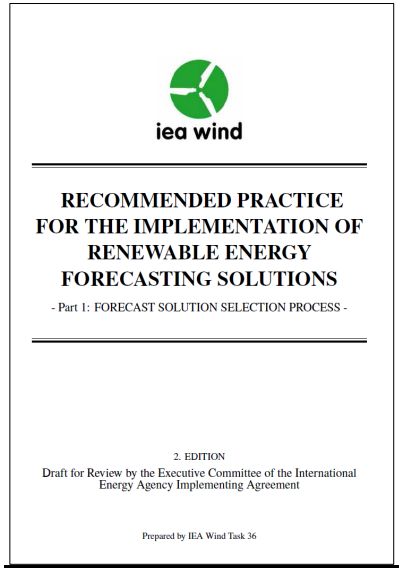
https://www.sciencedirect.com/book/9780443186813/iea-wind-recommended-practice-for-the-implementation-of-renewable-energy-forecasting-solutions

IEA Wind Task 51 Information

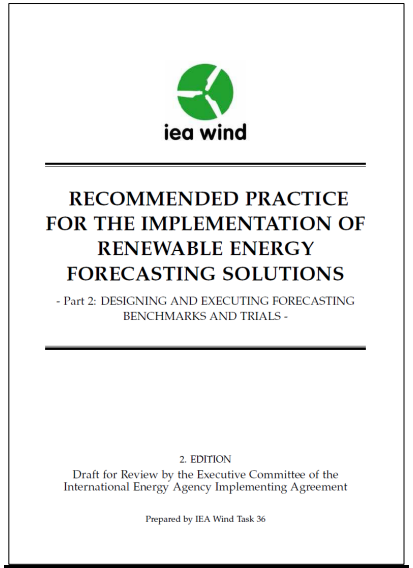
iea-wind.org → Task 51 → Publications → Recommended Practice



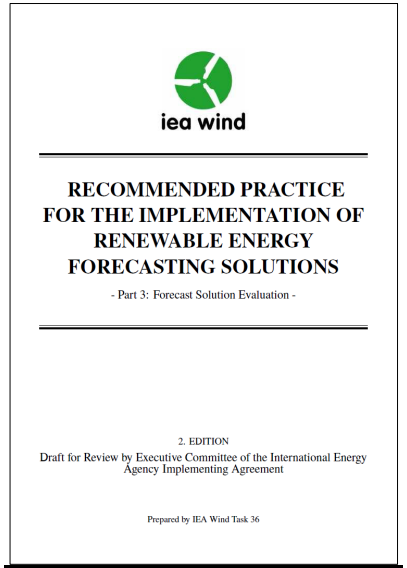
# IEA Best Practice Recommendations for the Selection of a Wind Forecasting Solution v2: Set of 4 Documents



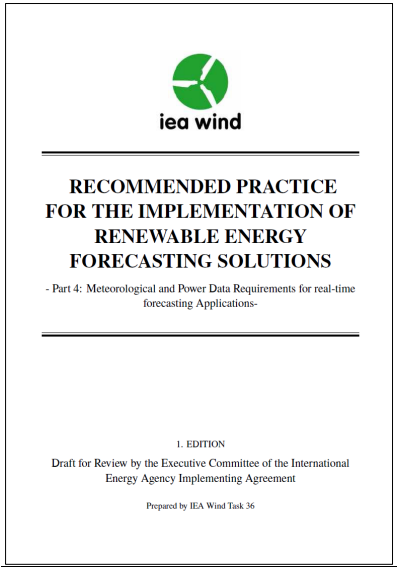

Part 1: Selection of an Optimal Forecast Solution




Part 2: Design and Execution of Benchmarks and Trials




Part 3: Evaluation of Forecasts and Forecast Solutions




Part 4: Data Requirements for Real-time Applications

Now as OpenAccess book!

Introduction: https://www.youtube.com/watch?v=XVO37hLE03M

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# Validation & Verification code examples

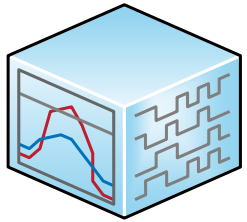

Examples developed within the IEA Wind Task 36 and Task 51:

## WE-validate

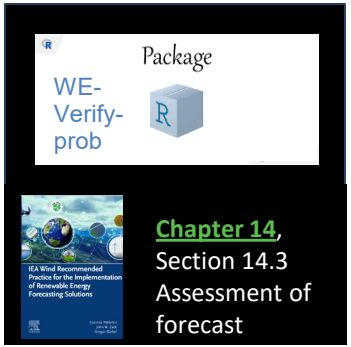
Available on GitHub: https://github.com/joejoeyjoseph/i-validate/

Use Case: Demo Jupyter Notebook (U.S. Mountain Wave case):
https://nbviewer.jupyter.org/github/joejoeyjoseph/i-validate/blob/main/notebooks/demo_notebook.ipynb

Existing metrics: RMSE, cRMSE, mean bias, mean absolute error
Existing plots: time series, histogram, scatter plot



**WE-validate-prob –** R-package for probabilistic verification
Existing metrics: CRPS, Brier Score, ROC curve, Histograms, Reliability Diagram, Contingency table
Existing plots: time series, histograms, ROC curve, CRPS




See also our workshops & conference page:
https://iea-wind.org/task51/task51-publications/task51-workshops-and-special-sessions/

# Workstream Uncertainty :

**Uncertainty Propagation throughout the model chain with real data**

## PHASE I
2022-2023

tool 1

tool 2

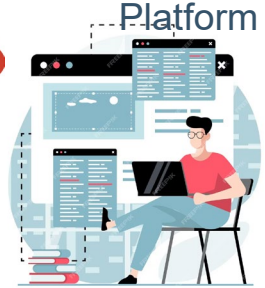
WE-prob tool

tool 3

Uncertainty Quantification with test data sets according to 2022 UQ publication*

## PHASE II
2024

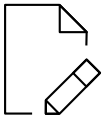
Online Verification Platform



Discussion & testing of verification platform

## PHASE III
2025

Publication



Discussion & writing of publication with most suitable test cases

* Uncovering wind power forecasting uncertainty sources and their propagation through the whole modelling chain
https://www.sciencedirect.com/science/article/pii/S1364032122004221

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# Review of uncertainty propagation

## Work program Part I

- **Qualitative description** of the origins and propagation of uncertainty through the forecasting chain (D2.2)

→ Published in *Renewable and Sustainable Energy Reviews* in 2022

## Work program Part II (2023-2025)

- **Quantification** of the origins and propagation of uncertainty through the forecasting chain

Uncovering wind power forecasting uncertainty origins and development through the whole modelling chain[★,★★]

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[a]North China Electric Power University, State Key Lab of Alternate Electrical Power System with Renewable Energy Sources, Beijing, P.R. China
[b]WEPROG, Dreijervaenget 8, 5610 Assens, Denmark
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ARTICLE INFO

*Keywords:*
wind power
forecast uncertainty
modelling chain

ABSTRACT

Wind power forecasting has been supporting operational decision-making for power system and electricity markets since 30 years. Efforts of improving the accuracy and/or certainty of wind power forecasts, either deterministic or probabilistic, are continuously exerted by academics and industries. Forecast errors and associated uncertainties, which propagate through the whole forecasting chain, from weather provider to the end user, cannot be eliminated completely due to many reasons; for instance, endogenetic randomness of weather systems and varying wind turbine performance. Therefore, understanding the sources of uncertainty and how these uncertainties propagate throughout the modelling chain is significant to implement more rational and targeted uncertainty mitigation strategies and standardise the uncertainty validation. This paper presents a thorough review of the uncertainty propagation through the modelling chain, from the planning phase of the wind farm and the forecasting system through the operational phase and market phase. Moreover, the definition of the uncertainty sources throughout these phases build the guiding line of uncertainty mitigation throughout this review. In the end, a discussion on uncertainty validation is provided along with some examples. Highlights of this paper include: 1) forecasting uncertainty exists and propagates everywhere throughout the entire modelling chain and from planning phase to market phase; 2) the mitigation efforts should be exerted in every modelling step; 3) standardised uncertainty validation practice and global data samples are required for forecasters to improve model performance and for forecast users to select and evaluate the model's output.

### 1. Introduction

High penetration of wind power has been recognised globally as one of the most important features of current and future sustainable power systems. The natural randomness and variability of the wind itself can aggravate negative impacts of wind power on power system operation and market trading, which strengthens the significance of forecasting technology. Wind power forecasting (WPF) started more than three decades ago [16], with the first operational forecasting tools arriving at system operation level some 10 years later at the Danish transmission system operator ELSAM [10]. Since then, researchers have been making continuous efforts to improve the forecasting accuracy and reliability.

It is impossible to achieve perfect predictions of wind power at any given time or location, due to chaotic atmospheric motions having temporal and spatial scales that typically span more than six orders of magnitude [17, 18, 19]. Along with the complex wind field, wind turbine performance creates nonlinear and time-varying uncertainties in wind power forecasting. To improve the value of forecasts and their usage, we practically consider three questions: why, when and to what extent the forecasting uncertainty will happen [20]. Accordingly, this further guides the mitigation of forecasting uncertainty. There is plenty of literature in this area, and can be clarified into following three categories.

★ This paper was coordinated under the auspices of IEA Wind Task 36 'Forecasting for Wind Energy'. Corinna Mörlen, Tuhfe Göçmen, Mark Kelly and Gregor Giebel were funded by the Danish EUDP project "IEA Wind Task 36 Phase II Danish Consortium", Grant Number 64018-0515.
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# Workstream *Decision-making under Uncertainty*

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## Decision making under uncertainty

**Forecasting Games**

| Forecast Game | Short Description | Link |
|---|---|---|
| **Wind Power Trading decisions for a Wind Park in complex Terrain** | IEA Wind Task 36/51 and MPI for Human Development have released a forecast game at the European Meteorological Society Annual Conference 2021.<br>The game investigates how ensemble forecasts showing forecast uncertainty can improve our ability to make informed decisions, also when the weather conditions are complex or extreme.<br>In the experimental game, the player is asked to make trading decisions for a wind farm in complex terrain in a number of situations based on deterministic and probabilistic power and wind forecasts. | Forecast Game (choose "Play the Game" at top menu)<br>Forecast Game Results<br>Links to additional material:<br>WIW2022: Key Note Presentation<br>EMS 2022: Presentation<br>AMS 2022: Presentation<br>Electric-City 2021: Paper & award winning Poster<br>EMS 2021: Presentation<br>IEA Task 36 Webinar Youtube & Presentation |
| **Wind Power Trading decisions for an Offshore Wind Park** | IEA Wind Task 36 and MPI for Human Development have released a forecast game at the IEA Wind Task 36 Glasgow workshop in Jan 2020.<br>The game investigates how useful different forecasts are for wind power trading decisions in a simplified way.In the game, the player is asked to make trading decisions for an offshore wind farm in the Northsea in a number of situations based on deterministic and probabilistic power and wind forecasts. | Forecast Game (offline version to come soon)<br>Forecast Game Results<br>Forecast game introduction presentation:<br>IEA Wind Task 36 YouTube channel at time: 3:03:00.<br>Presentation Download<br>Publications:<br>MetApplications, 2022<br>Jof Phys. Conf Series 2021 |
| **Call for Water Game** | In the game the player is managing a water supply reservoir!<br>Purpose of the Game is to train with forecast information and improve decision-making.<br>The player is newly appointed water manager for a | Forecast Game<br>License conditions Creative Commons CC- |
| **Call for Water Game** | In the game the player is managing a water supply reservoir!<br>Purpose of the Game is to train with forecast information and improve decision-making.<br>The player is newly appointed water manager for a reservoir that serves water uses for a town and is responsible to secure sufficient water for the town at a specific time.<br>The game is played in two rounds of 5 years each. | Forecast Game<br>License conditions Creative Commons CC-BY-NC-ND 4.0 |
| **HEPEX Forecast Game "Pathways to running a flood forecasting centre: an adventure game"** | The game simulates the responsibilities of a water management centre in charge of protecting a city against floods.<br>The game is investigating what kind of information is needed and how many days in advance the forecast information is good enough to make a decision that could save lives and money. | Forecast Game<br>A blog post on the game was published in the Imprex project website<br>Reference: Arnal et al. (EGU 2017 abstract) |
| **Feuerwache (only available in German)** | The game's aim is to well users understand and are able to make use of the uncertainty of weather forecasts<br>The task of the game is to decide on 16 days, whether or not to request more firefighters for the next 21 hours to handle additional missions in predicted storm events. | Forecast Game |

**Offline Games**

| HEPEX Forecast Games | | |
|---|---|---|
| **Water Management Game** | The game experiment focuses on risk-based decision-making in water management using probabilistic forecasts of inflows to a reservoir | Download: English (original version), German<br>Reference: Crochemore et al., 2015 HEPEX blog post |
| **Peak Box Game** | The "Peak Box" game supports interpretation and verification of operational ensemble peak-flow forecasts, proposed by Zappa and colleagues, and encourages discussions of the use of ensemble predictions in operational hydrology.<br>**The Peak-Box defines the "best estimate" of a flood event's timing and magnitude by framing the discharge peaks of all members of an ensemble forecast and taking their median in timing and magnitude.** | **Download: Peak Box Game**<br>**Reference: Zappa et al., 2013**<br>**HEPEX blog post** |

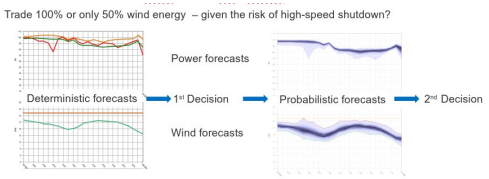
**Table and collection of forecasting Games:**
iea-wind.org/taks 51
→ Workstreams → Decision Making under Uncertainty

https://iea-wind.org/task51/task51-work-streams/ws-decision-making-under-uncertainty/

# Decision-making under Uncertainty

## "Probabilistic Forecasting Games & Experiments" initiative

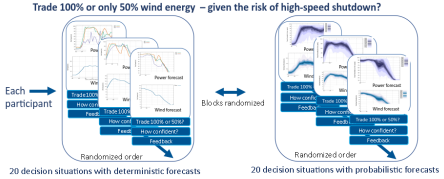
### 1. Experiment (2020)




**Game:** 12 cases
**Decision structure**: 12 deterministic Forecasts followed by a probabilistic forecast
After each decision, possible change of decision based on new information

### 2. Experiment (2021-2024*)

**Game:** 40 cases





**Decision structure:** 20 deterministic cases + decision confidence request
20 probabilistic cases + decision confidence request

* still open...: https://meteorology.mpib.dev/wind-power-decisions/about.html

# Workstream Data Science and AI


Webinar now available in our YouTube channel IEAWindForecasting

https://youtu.be/t6H7diavQdg

As the world's fastest-growing technology, **Artificial Intelligence** (AI) is rapidly shaping industries such as Energy and Meteorology.

To help address stakeholders' concerns about the impacts of increasingly incorporating AI and Machine Learning into weather and power prediction models, a webinar in Deep Learning for Weather-Based Power Prediction was held in January 2024

In this Webinar we brought to-gether the **Energy Meteorology and Machine Learning/ Deep Learning (ML/DL) communities** to showcase the latest advancements in ML/DL for weather prediction.

## Some Lessons Learned from the webinar:

### Positive developments:

- ⇧ The models start to show skill
- ⇧ The models suggest a new approach to meteorological questions
- ⇧ Fast hypothesis testing and scope narrowing forsimulations with physics models
- ⇧ The models develop fast due to large resources put into new features
- ⇧ Huge ensembles (>1000 members) are on the horizon
- ⇧ There is work underway to start the AI models from measurements alone

### Challenges to be solved:

- ⇩ Quality control of input data is not yet handled - outliers, missing or corrupt data
- ⇩ High complexity and variety of data to train models is a challenge
- ⇩ Feature engineering needs features – without physics this will be difficult
- ⇩ Data-driven models require new look upon data sharing which has been a challenge until now

# Workstream Data Sharing

## Workplan

A recently policy paper for the European Commission about the transformation of the energy system covering digitilisation and data sharing was generally for the energy sector – covering RES only on the surface.

Status: Development of a position paper about data sharing for the renewable energy sector has been started

A group of contributors are covering different aspects of RES: resource assessment/site location, forecasting, trading, O&M, etc.


* https://op.europa.eu/en/publication-detail/-/publication/21b0260e-a2d5-11ee-b164-01aa75ed71a1/language-en/format-PDF/source-300344208

# WS Extreme Power System Events


IEA Wind TCPTask 51
“Forecasting for the weather-driven energy system”

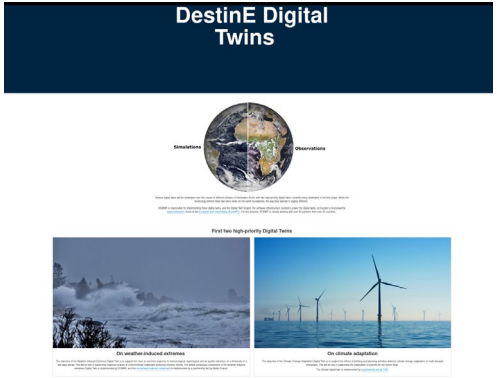
**Workshop** on
Extreme Power System Events
Boulder, April 2025


**IEA Wind Task 51 Austria Workshop at the NH Danube City Hotel in Vienna on November 6, 2024**

GeoSphere Austria, Austro Control Digital Services GmbH and WEB Windenergie AG are organizing the IEA Task 51 Austria Workshop on...

https://iea-wind.org/2024/07/31/iea-wind-task-51-austria-workshop-in-

# Collaboration




<u>Collaboration with Subtask</u>: *On-demand digital twin extremes forecasting system for renewables - The Destination Earth Extremes digital twin*

https://www.ecmwf.int/en/about/media-centre/news/2024/governance-led-international-partnership-wins-bid-to-develop-destination-earths-on-demand-extremes-digital-

# WS Extreme Power System Events

## What is an extreme event ?

Ireland and UK experienced two storms in a row:
Isha on Jan, 21st 2024 and
Jocelyn on Jan, 22nd 2024

THE IRISH TIMES

Storm Isha Live

### Storm Isha: Second storm, Jocelyn, to hit on Tuesday as thousands remain without power and water

Some 93,000 properties still without electricity as Met Éireann issues further Orange warnings for Donegal, Mayo and Galway

Ireland

### Storm Isha: Thousands without power and ov wind causes damage across Ireland

Flights cancelled and diverted in Dublin Airport due to 'severe and des reporting fallen trees

Expand

Waves crash over the pier at Fenit, Co Kerry on Sunday as Storm Isha lashes the southwest. Photograph: Domnick Walsh/Eye Focus

THE IRISH TIMES

14:31

### Main points:

- **Follow live coverage of the clean-up after Storm Isha in Monday with our live coverage.**
- Over 170,000 homes and businesses are without power on Sunday evening
- A status red weather warning for wind is in effect in Co Donegal
- An orange weather warning is in effect for all of Ireland
- Earlier red wind warnings issued for counties Mayo and Galway have since expired
- Dublin Airport says Storm Isha is having an impact on flights
- Local authorities and fire and rescue services across the country are responding to reports of fallen trees

iea wind

# WS Value of Forecasting

**Status is monitored by looking and discussing the use of wind power forecasts**

+++ now in collaboration with Task 50 Hybrid Power Plants +++

**User Cases presented at Meetings + Reports**

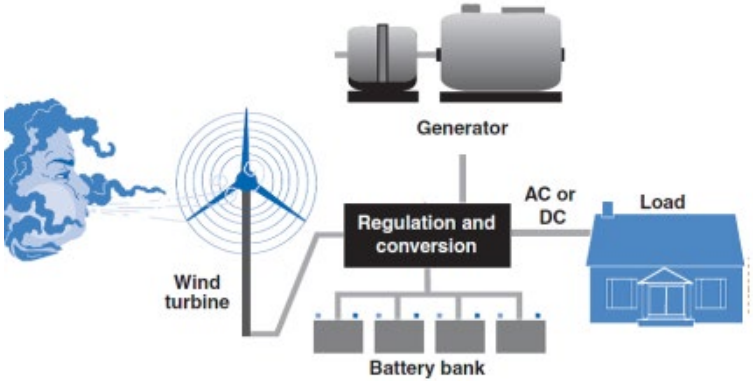
See iea-wind.org/task51 → Publications → Workshops & Special Sessions

Dimitrios Eleftheriou, Ea Energianalyse: *use of wind power forecasts in scheduling a hybrid energy asset consisting of wind turbines, electrolyser and hydrogen storage*

Honglin Wen, Shanghai Jiao Tong University: *Value-oriented Renewable Energy Forecasting for Coordinated Energy Dispatch Problems at Two Stages*

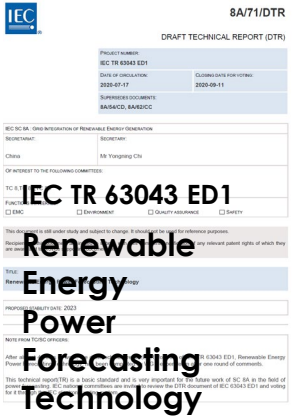
Antonio Couto, LNEG, Portugal: *Addressing the challenges of wind power plants hybridised with solar power: A generation forecast perspective. (see also publication)*

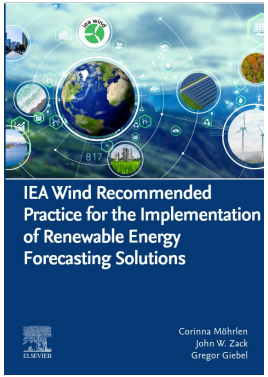
Rujie Zhu, Technical University of Denmark: *Value of forecasting for hybrid Energy Management*



# Collaboration and Liaison with IEC Scientific Committee 8A on *Grid Integration of Renewable Energy Generation*

## Common work: IEC Technical Report TR63043 - Renewable Energy Power Forecasting Technology




- Technical Report was released in 2020 by Sub-Committee 8A Grid Integration of Renewable Energy Generation, Working Group 2 Renewable energy power prediction
  https://webstore.iec.ch/publication/26529 - Link to IEC SC8A WG2

- New Work Item for the development of a IEC Standard in Oct. 2023

**See session 9D...**

# Task 51 Web Presence

## Website

https://iea-wind.org/task51


Forecasting for the Weather Driven Energy System — Improving the value of renewable energy forecasts to the wind industry

The Task 51, under the *IEA Implementing Agreement for Co-operation in the Research, Development, and Deployment of Wind Energy Systems* (IEA Wind) focuses on improving the value of renewable energy forecasts.

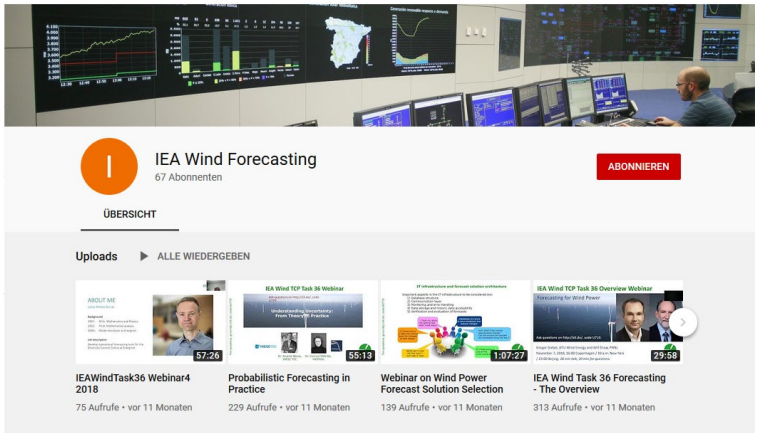
There are three distinct areas of challenge in forecasting wind power. The first area is in the continuing effort to improve the representation of physical processes in weather forecast models through both new high performance initializations and tailored parameterizations. The second area is the heterogeneity of the forecasters and end users, the full understanding of the uncertainties throughout the modelling chain and the incorporation of novel data into power forecasting algorithms. A third area is representation, communication, and use of these uncertainties to industry in forms that readily support decision-making in plant operations and electricity markets.
This Task will focus on facilitating communication and collaborations among international research groups engaged in the improvement of the accuracy and applicability of forecast models and their utility for the stakeholders in the wind industry, in the power sector and in the energy system.

This Task has the following specific objectives:

- To establish an active, open forum for sharing knowledge among the participants, related IEA Wind Tasks and other related TCPs through workshops, dissemination and communication measures
- To establish and communicate standards and frameworks for the operation and evaluation of forecast model performance
- To identify paths to increased application and utility of forecast information to the task stakeholders
- To advance the knowledge in the underlying atmospheric physics, in the mathematical models converting the transforming atmospheric quantities to energy system application variables, in the modelling of the uncertainty and in the applications and decision-making
- To identify most promising areas for new research to improve the quality and utility of forecasts
- To provide guidelines for the implementation of optimal forecasting solutions

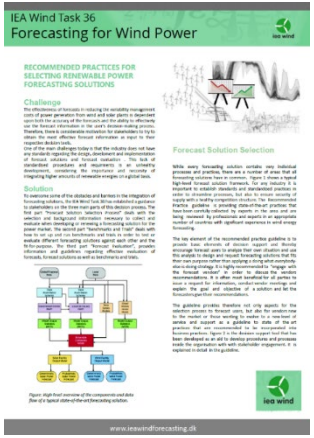
## YouTube Channel

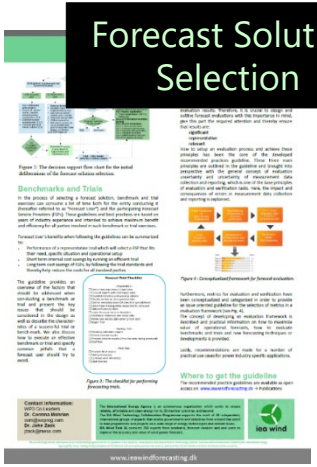
https://www.youtube.com/c/IEAWindForecasting

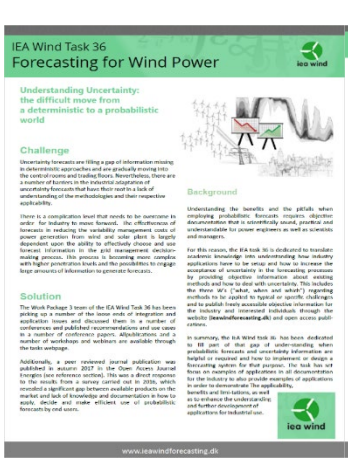


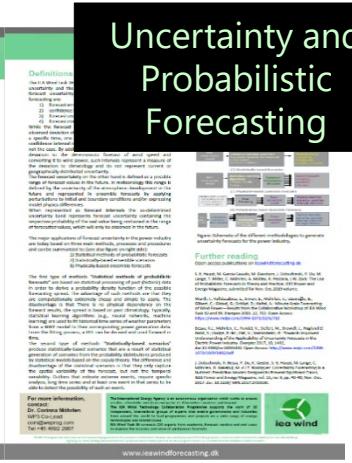
# Handouts

- 2-page handouts: quick overview of major results
- 3 currently available; can be obtained from: https://iea-wind.org/task51/task51-publications/task51-posters-and-handouts/

# Summary

- Framework conditions changed since first phase of Task 36: **RES is no longer addition to system, but IS the system**; sector coupling to transport, heat, X…
- Has new challenges for **new forecast horizons** (seasonal forecasting…)
- Needs strong **collaboration with related TCPs** (**solar**, hydro, hydrogen, …) and related Tasks (Integration, Lidar, Farm Flow Control, Hybrids, …), standardisation (IEC), data markets, data control & quality assessment (WMO)
- **Uncertainty**, probabilistic Forecasting & data-driven **AI** modelling is in focus
- **Workshops&Webinars**: State of the art, Seasonal Forecasting (2023), Minute Scale Forecasting (2024) and Extreme Power System Events (2025) Webinar on AI in meteorology & energy

iea wind

# Task 51 – *"Forecasting for the weather-driven Energy System"*

iea-wind.org/task51

Get in touch with us…

## Task Managers and Workpackage Leads :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