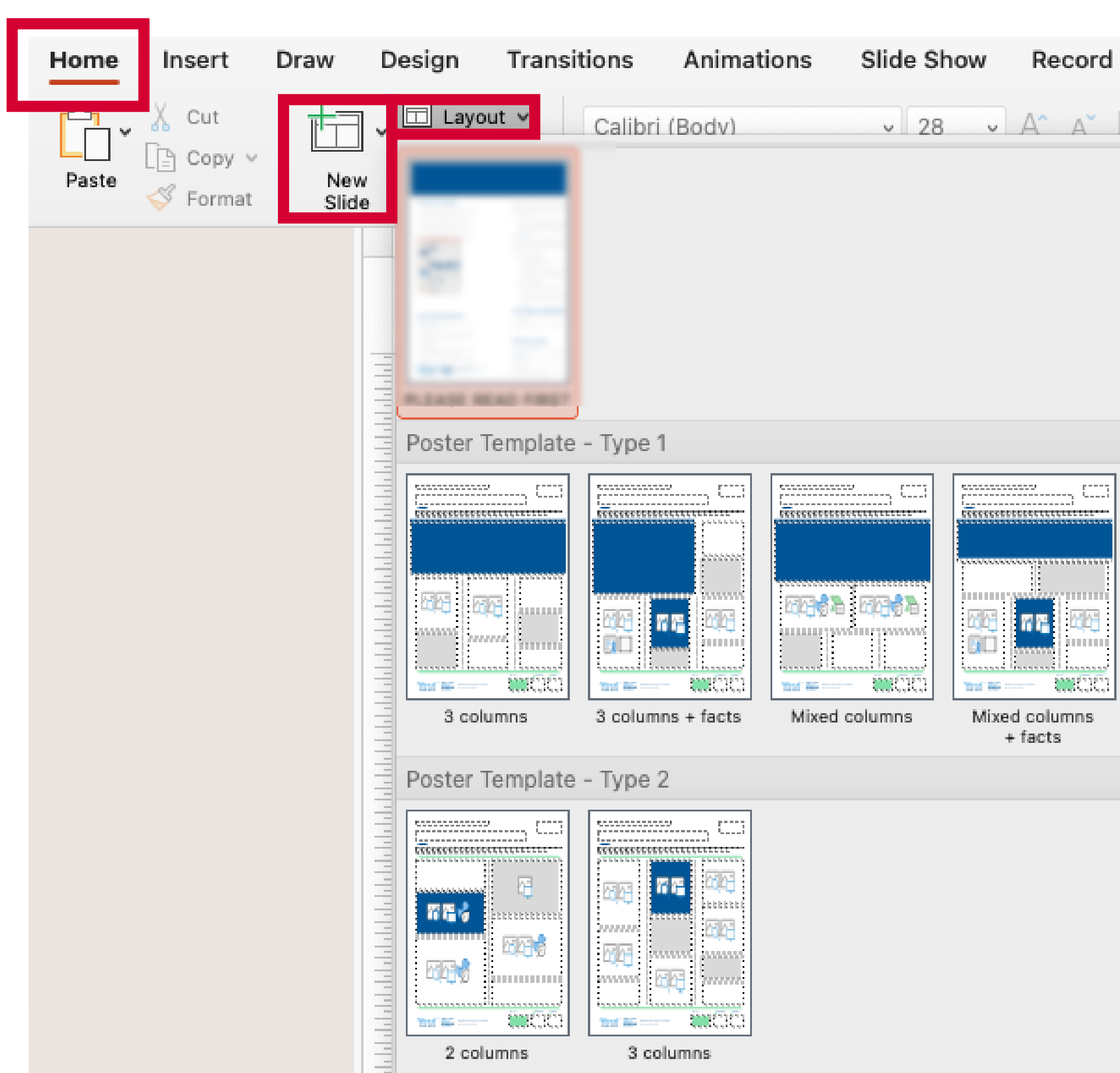


PLEASE READ FIRST!

How to use and customise this template?

Step 1: Choose the layout

- The template comes with six predefined slide layouts (type 1 and type 2).
- Click on the "Home" tab > "New slide" > and choose the layout from the dropdown arrow next to it.
- You can change the anytime by clicking on the dropdown arrow next to "Layout" button.
- Once you've chosen a template, click on "File" and select "Save as" or "save a copy" to save your presentation. Choose a location and provide a file name.



Step 2: Customise the template

Fonts and colours:

- Take care of the fonts. Please use the default font of the template "Calibri".
- Do not change fonts and colours in the header and footer sections.

Text and content:

- Replace the placeholder text with your own content. Click on the text boxes and start typing.
- Text should not be smaller than 28pt for readability.

Content boxes/columns:

Please note that **you can change the position of the type of content and height of the boxes in any way you prefer.** Please make sure they are properly aligned and centred when doing so.

- Tip: click on the "View" tab and make sure the "Gridlines" and "Guides" boxes are ticked. You can leave the size of one square in the gridlines as space between each of your content boxes.

Graphs or images

If the template includes image placeholders, you can click on them to insert your own images. To do this, go to the "Insert" tab and choose "Pictures," and select the image file from your computer.

- Tips for inserting images:

- Use the corner handles to maintain the aspect ratio and avoid distortion.
- Crop Images: Use the "Crop" tool to eliminate unnecessary parts of an image. Right-click on the image, select "Crop," and adjust the handles.

- Tips for inserting graphs:

- Double-click on elements of the chart to customize colours, labels, and titles.
- Use the "Chart Tools" tab in PowerPoint to make adjustments to the appearance and formatting.

Step 3: Add your logo and booth number

- Don't forget to add your logo on the top right corner of the page.
- If your company is exhibiting at the event, write the booth number on the bottom right corner (Meet us at). Otherwise keep this blank and WindEurope will delete the box.
- QR codes will be added by WindEurope on the bottom right corner of the page.

Step 4: Save your work

Regularly save your progress:

Save your work periodically to avoid losing any changes.

Review and edit:

Go through your presentation to check for any errors or improvements.

Save or export:

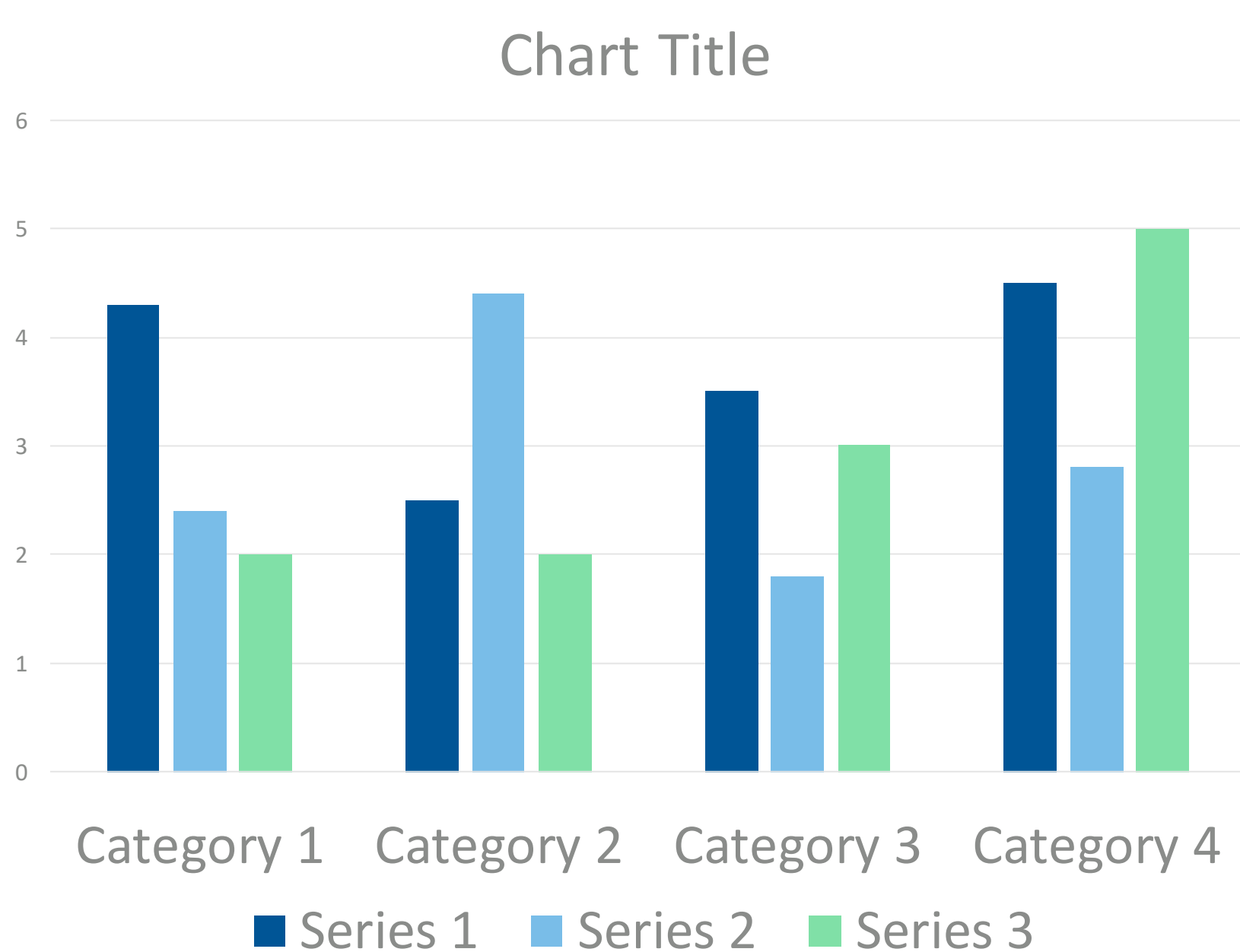
Save your final presentation in **PowerPoint**.

EXAMPLE

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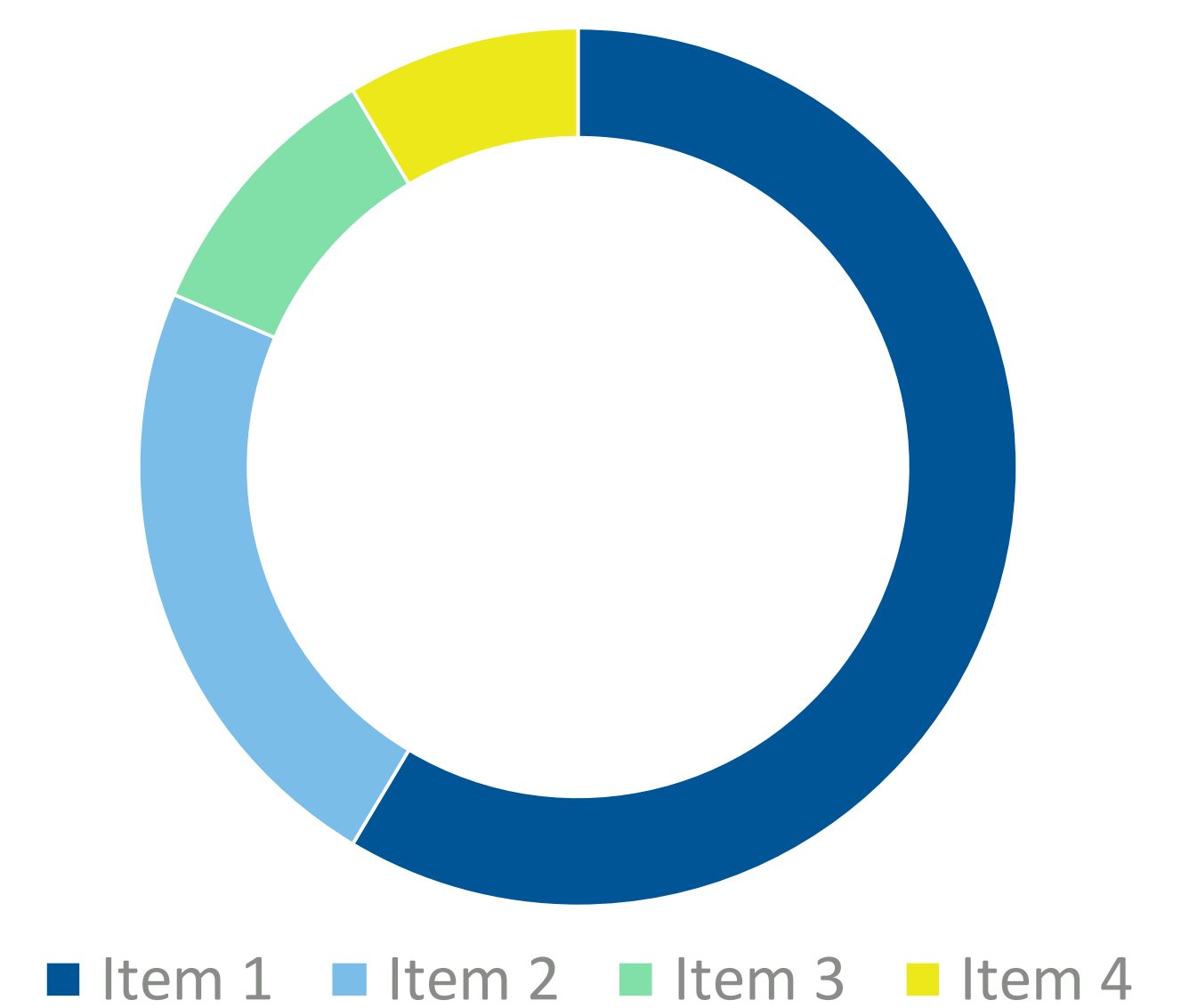
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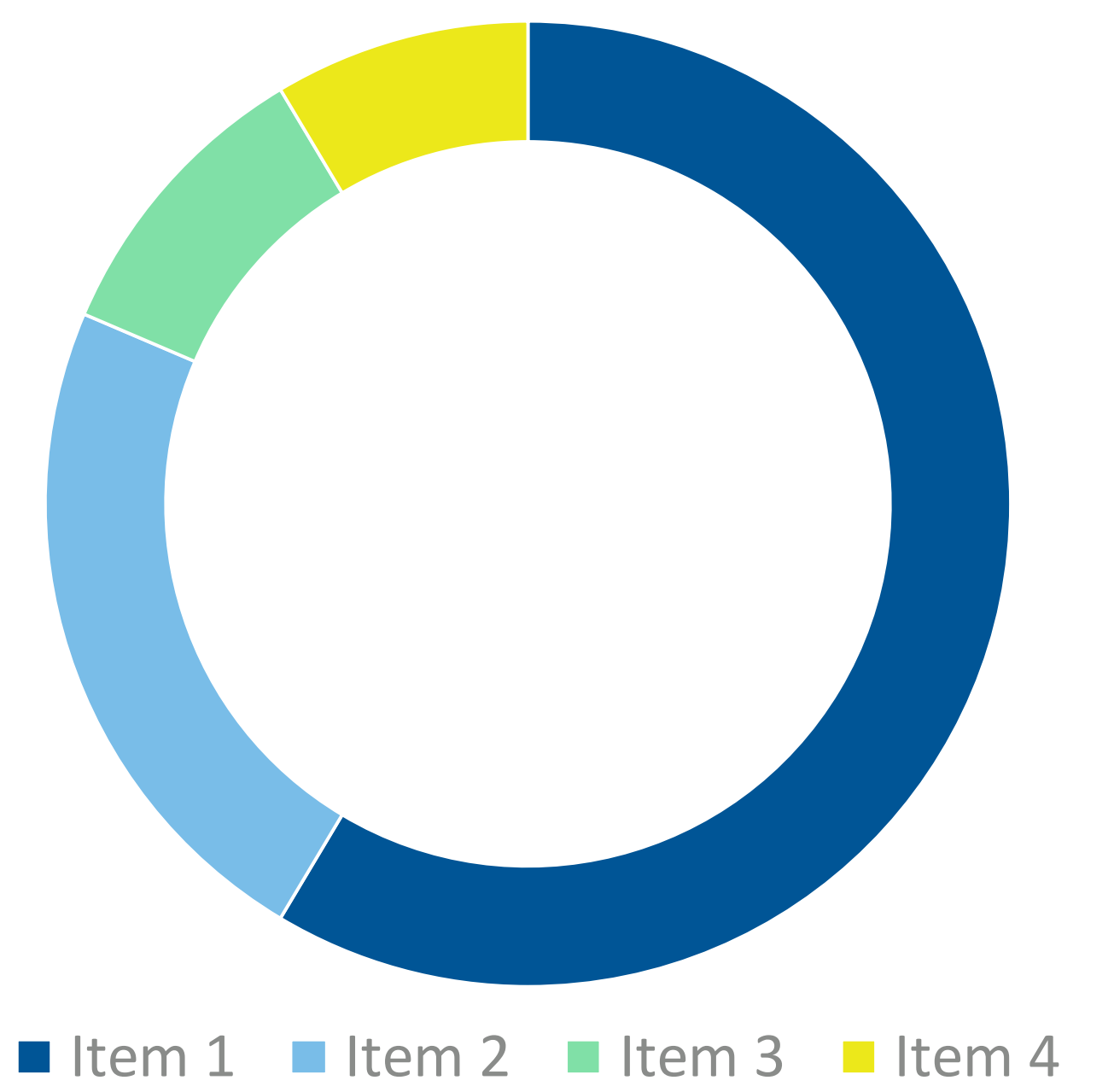
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QUICK FACTS

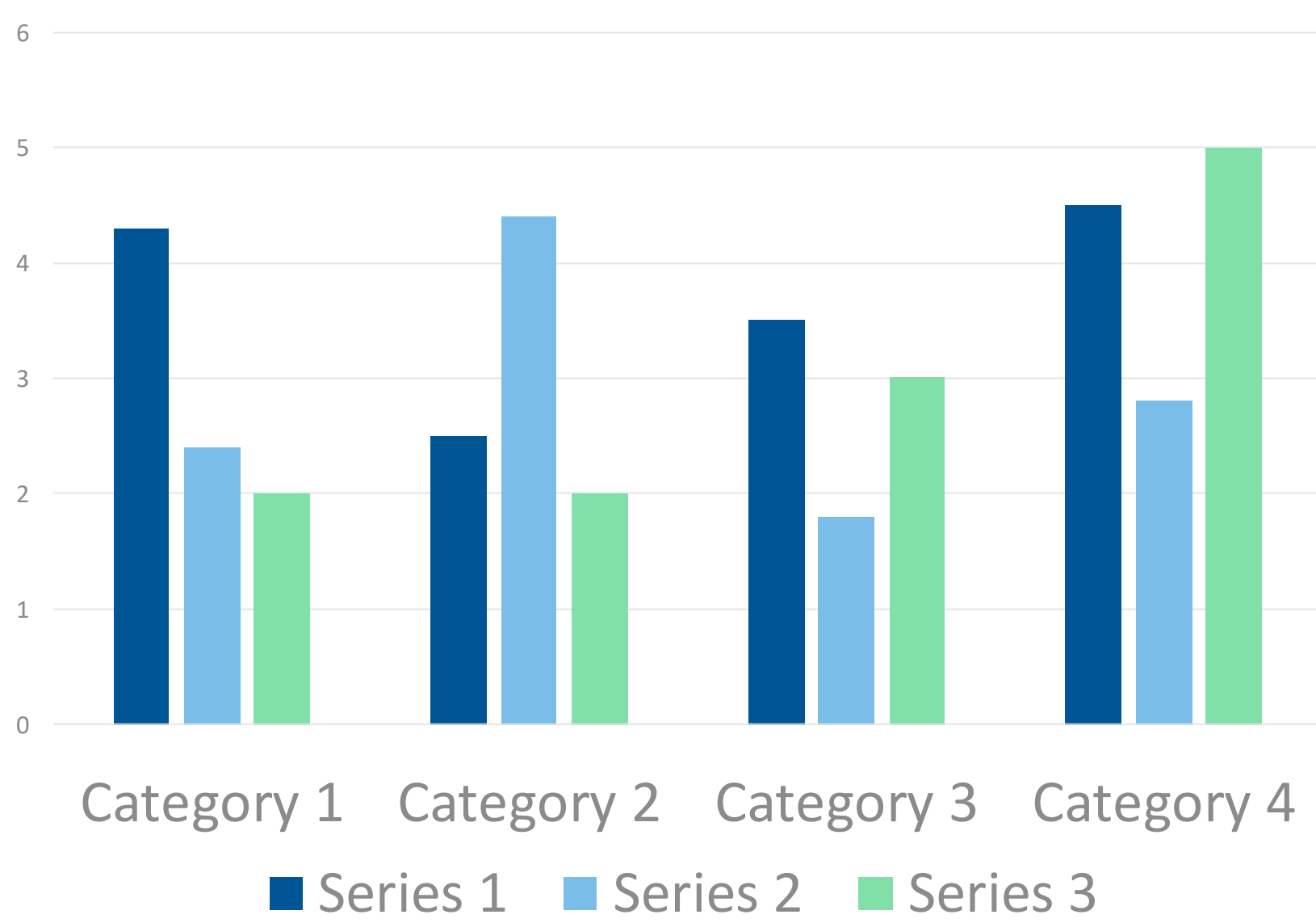
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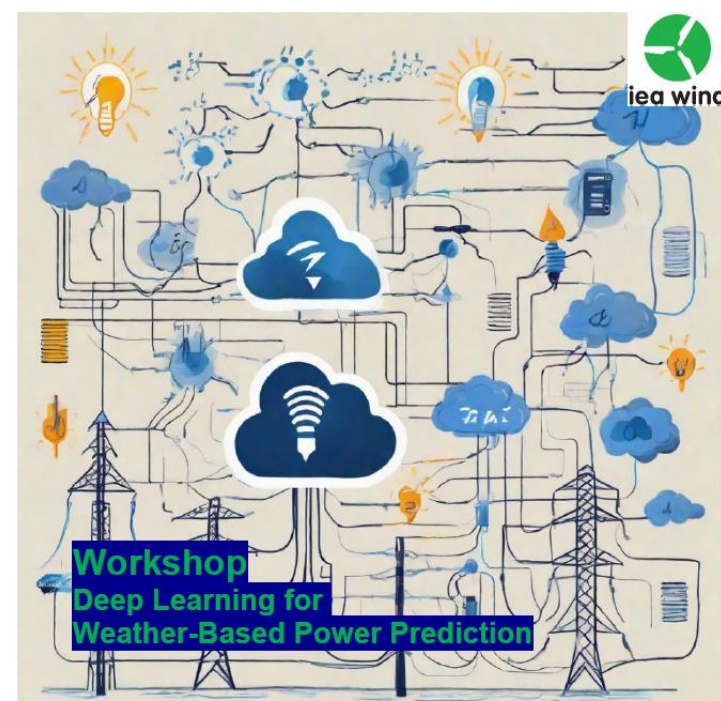
Workshops and webinars from IEA Wind Task 51 Forecasting for the Weather Driven Energy System

Gregor Giebel Caroline Draxl Helmut Frank John Zack Jethro Browell Corinna Möhrlen Georges Kariniotakis Ricardo Bessa David Lenaghan



EXAMPLES OF PAST WORKSHOPS

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, the International Energy Agency's (IEA) Wind Task 51 "Forecasting for the Weather Driven Energy System" invites you to a webinar in Deep Learning for Weather-Based Power Prediction. In this Webinar we will bring together the Energy Meteorology and Machine Learning / Deep Learning (ML/DL) communities to showcase the latest advancements in ML/DL for weather prediction. This event also provides an opportunity to discuss future directions for the integration of these new generation models in the Energy systems.



Watch it on <https://youtu.be/t6H7diavQdg>.

Learning:

- The models are already quite accurate. ECMWF was one of the first to try, and will add AIFS to its suite of models soon, also as part of the ensemble system. ECMWF packages the models for ease of use: <https://github.com/ecmwf-lab/ai-models>
- The models are easy to work with. E.g., Greg Hakim could download the models, do some experiments and write a paper in a few months.
- Some of the models at least seem to get the physics right. Greg Hakim did some experiments with a number of the models. None have explicit physics, but seem to build a good picture anyway.
- The models develop fast. Where in conventional NWP models, a model cycle can be years, new AI WP models come every few months, and bring significant improvement.
- Huge ensembles (>1000 members) get possible, probabilistic forecasting is coming. Once trained, the running time of e.g. a global 1-km resolution model for 48 hours is 20 seconds, plus 20 minutes for data I/O.
- Currently for global models, though LAMs are coming; not (yet?) for LES or climate
- Start from analysis, or measurements? Currently, all models start from a "proper" NWP analysis, e.g. from ECMWF IFS. But there is significant work underway to start the models from measurements alone.
- How to keep outliers under control?



Forecasts of wind and clouds are important inputs for the control and value of renewable power plants. The forecasts on a time resolution of minutes or seconds are typically data driven, looking at upstream plants, all-sky images of clouds or direct measurements of wind by lidars. The workshop took place as the collaboration of the International Energy Agency's (IEA) [Wind Task 51 Forecasting](#), [IEA Wind Task 52 Lidars](#), [IEA Wind Task 50 Hybrid Power Plants](#), [IEA Wind Task 44 Wind Farm Flow Control](#) and [IEA Photovoltaic Power Systems Programme \(PVPS\) Task 16 Solar Resource](#). Some 70+ people attended in person, another 20 followed online.

Lessons learned from the Minute-scale workshop

Two aspects of Minute-scale:

- Forecasts for the next minutes ahead
 - Forecasting in time-scales of minutes
- The first (1) is done with data-driven or hybrid algorithms such as:
 - Data-driven:** Machine Learning, dynamic graph ML, neural networks such as GNN, feature engineering, generator models, graph convolutional long-short-term memory models etc.
 - Hybrid:** can include heterogeneous data sources from satellite or NWP images improve predictions, use cloud-scale dependent autoregressive advection or deep learning radiative transfer emulators, Kalman filters

Observational data sources are:

- WIND: scanning LIDARs with scanning heads, or sonic anemometers and sodars for wind applications
- SOLAR: ASI (all sky imaging, fish-eye cameras pointed at the sky) and satellite observations

Learnings from recent research:

- Feature engineering methods need "engineering" in the sense of knowing the atmosphere and its development to be useful
- High-resolution NWP with high-time resolution of the order 5-10min are enabling NWP models to be used for minute-scale forecasting
- AI weather forecasting system 3D-CNN is mapping relationship between global analysis and local (wind/solar) measurements and aims to replace the modelling process of traditional NWP scales with local measurements

Evaluation methods:

- Data Scientist and Physicists/Meteorologist evaluate forecast skill and value different
- Data-driven and NWP-driven methods model/predict different space and time scales of features and this needs to be considered in the comparison process

End-users and applications:

- O&M Wind has changed focus away from scanning LIDARS due to costs since last workshop in 2018 to data-driven methods with near-by measurements
- System operators are seeing the need for
 - balancing the grid
 - ramping reserves
- Traders:
 - balancing
 - ancillary services

Largest global discussion forum for renewables forecasting

2025: public Workshop on Extreme Events in the Power System, Autumn, USA or Europe

Recent workshops on State of the Art, Seasonal Forecasting, and AI Weather Prediction on YouTube "IEAWindForecasting"

Expected 2026-2029:
Phase II of Task 51, incl. work stream on AI Weather Prediction. Collaboration on IEC standard for forecast evaluation.

Work Streams:	WP1 Weather	WP2 Power	WP3 Applications	Deliverable	#_Due	Collaboration
Atmospheric physics and modelling (WP1)	★			List of experiments and data	D1.1, Ongoing	WMO, PVPS T16
Airborne Wind Energy Systems (WP1)	★			Presentations on workshop	Part of D2.1	Task 48 Airborne Wind Energy
Seasonal Forecasting (WP1)	★			Workshop / Paper	D1.6 / M15- May 2023, Reading	Hydro TCP, Hydrogen TCP, Biomass TCP
State of the Art for energy system forecasting (WP2)		★		Workshop / Paper	D2.3 / M17- May 2023, Reading	PVPS Task 16, Hydrogen TCP, Hydrogen TCP
Minute scale forecasting (WP2)		★		Workshop / Paper	D3.7 / M17- May 2023, Reading	Wind Task 52 Lidar, 44 Farm Flow Control and 50 Hybrid
Uncertainty / probabilistic forecasting (WP3)			★	Uncertainty propagation paper with data	D.3.6 / M22	PVPS T16
Decision making under uncertainty (WP3)			★	RefFact v3	M28	
Extreme power system events (WP3)			★	Training course	M12, M18	
Data science and artificial intelligence (WP3)			★	Workshop	D1.8 / M22- Spring 2024, Reading	Task 52, EDC, EA, SGAN, PVPS T16, G-FCI
Privacy, data markets and sharing (WP3)			★	Workshop / Paper	D1.5 / M15	ESG
Value of forecasting (WP3)			★	Data format standard	D1.4 / M15	IEA Wind Energy Forecasting

- Cross-cutting work streams
- Collaboration with other IEA Wind Tasks (Lidar, Hybrid Power Plants, Wind Farm Flow Control, Large-Scale Integration, Distributed Wind, Airborne Wind, ...) and other IEA TCPs (PVPS, Biomass, Hydrogen, Hydro, ...) as well as WMO
- Also collaborating with IEC SC8A WG2 Forecasting of Renewable Power, developing standards for input data and evaluation protocols for renewable generation forecasts
- Built on IEA Wind Recommended Practice
- Error evaluation frameworks:
 - WE-validate (Juniper package)
 - WE-validate_prob (R package)
 - Forecast Arbiter (formerly Solar Arbiter, now also for wind, load and net load)
 - NCEPU Evaluation and Uncertainty Quantification Framework

For collaboration in the Task or just for the newsletter, please contact the Operating Agent, Gregor Giebel (grgi@dtu.dk).
Current member countries are AT, CN, DE, DK, ES, FR, IE, NL, PT, SE, UK and US.

WORKSHOP FORECASTING EXTREME EVENTS IN THE POWER SYSTEM



[Note: the workshop was originally intended for early April, but with the uncertainties affecting the US federal administration we decided to postpone it until after the summer.]

Extreme weather conditions, such as heatwaves, severe storms, floods, and cold snaps, can significantly impact electricity grids and energy supply by disrupting power generation, transmission, and distribution systems. For example, intense heat can reduce the efficiency of power plants, while cold weather can freeze infrastructure like power lines and transformers, causing outages. Severe storms, including hurricanes or tornadoes, can damage essential grid components, leading to widespread disruptions. Additionally, extreme weather can spike electricity demand, further stressing the grid and potentially leading to power shortages or blackouts.

In this context, forecasting for such extremes and implementing effective mitigation strategies are critical for enabling system operators to prepare for these events well in advance. By improving weather prediction models, utilizing advanced analytics, and reinforcing grid infrastructure, operators can better anticipate extreme events and minimize their impact. Mitigation methods such as the development of more resilient infrastructure, smart grid technologies, and early warning systems can help ensure the grid's reliability and sustainability during extreme weather events, addressing the challenges posed by increasing climate volatility.

The workshop will address these challenges from a weather forecasting perspective, from the power grid perspective and discuss cybersecurity aspects to prevent failures when dealing with artificial intelligence methods.

- Interested in sharing your experience? Send us (Gregor or Corinna) an abstract to any of these topics:
 - Definition and associated differences of extremes in meteorology and the power system
 - Forecasting tools to mitigate Extremes in the power system
 - AI and Cybersecurity in Extreme situations



IEA Wind Recommended Practice for the Implementation of Renewable Energy Forecasting Solutions



Corinna Möhrlen
John W. Zack
Gregor Giebel



Meet us at

