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Behavioural decision-making Experiments in weather-driven Energy Systems

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The number one target since the Ukraine war has been shaking our world in February 2022 and shown how much impact energy dependencies have on our life, is to increase the amount of renewable energy in an unseen effort and pace. Without the tools to predict and act upon the enormous amounts of variable generation to come, the electric grid will be difficult to keep stable. On top of the energy crisis, we start seeing impacts of the climate crisis with increasing temperatures that change weather systems, causing more extreme weather events that again have impact on the generation pattern from wind and solar driven generation units. The associated uncertainty of (1) strongly increasing penetration of renewable energy generation and (2) increasing amount of extreme weather events call for forecasting tools that take these uncertainties into account and help system operators, traders and balance responsible parties to be able to act upon uncertainties rather than being surprised by them. Mitigating balancing costs and increasing security of supply will have to be at the forefront of everybody's top priorities.

The IEA Wind initiative "Probabilistic Forecasting Games and Experiments" is a collaboration with the Max-Planck Institute for Human Development's WEXICOM project. The objectives of this initiative are (1) to empirically investigate the psychology behind adoption or refusal when dealing with uncertainty forecasts and (2) to use the empirical results to understand how weather and generation forecast providers have to present and communicate uncertainty forecasts to end-users for them to be able to exploit the benefits of the enhanced information in their decision process. Although we simplify our experiments, they are designed as realistic scenarios for many decision-makers in the industry. We are encouraged from the participant's feedback that this type of gamification of a problem is received well as exemplary applications for the use and adoption of probabilistic forecasts into decision processes. The learning-by-doing strategy in a safe environment may not reproduce the entire context of a decision-making problem in a specific operational environment, but on the other hand it provides a platform to test different ways of introducing people with a complex topic, train and teach awareness for the challenges and benefits that come with the advanced technologies.

There are still many open questions that we need to answer, such as how decisions depend on the structure of the decision context, the communication and graphical or textual presentation, and many more. In this context, we will present the results of our second experiment, which is also dealing with the decision-making in extreme wind cases that can lead to power shutdown of wind turbines, and hope with this to inspire a vivid discussion on the topic in the session.

