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Towards improved RES predictability

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Introduction

- RES forecasting is a mature technology with operational tools and services used by different actors
- However, there are gaps and bottlenecks in the value/model chain...

 Significant research worldwide



The RES forecasting model and value chain





Forecasting accuracy remains low



Power output of a wind farm on a day



Forecasting accuracy remains low



predicted, Max. error: **5500 MW...**



Forecasting accuracy remains low



- Imbalance costs for traders
- Increased need for costly remedies (reserves, storage, demand response...)
- Reduced capacity to support the grid (AS)
- Lower RES acceptability
- RES curtailment

....

Higher maintenance costs





New needs emerge for applications like provision of ancillary services by VPPs



Gaps and bottlenecks





BOTTLENECKS IN THE CONNECTION:

Lack of open data (privacy issues)



Lack of price-based incentives to share data

Accuracy remains low & lack of standardization

BOTTLENECKS IN THE MODELS:



Need for NWP products adapted to RES use cases



Limitation of models to exploit large and heterogeneous data



Decaying commercial value of forecast products



Need for models adequate in high RES integration scenarios and digitalization of the energy sector



Next Generation Modelling and Forecasting of Variable Renewable Generation for Large-scale Integration in Energy Systems and Markets





Vision



Achieve **outstanding improvement** in RES predictability through **a holistic approach**, that covers the **whole model and value chain** related to RES forecasting (from weather prediction up to end-use applications).



- disruptive research ideas
- multidisciplinary consortium



Overarching goal



Smart4RES aims at developing and validating the next generation tools that jointly enable:

- 1) an increase of at least 15% in RES forecasting performance and,
- 2) enhanced value in applications thanks to a holistic approach that considers the whole model and value chain of RES electricity production forecasting.



Next generation RES forecasting tools

The expectations are:

- Outstanding level of accuracy
- Maximal value in applications
- Seamless approaches able to consider multiple data sources.
- Efficient models for all variable RES (e.g. wind, PV, solar thermal, run-of-the-river hydro, combinations).
- Ability to cover the full spectrum of temporal and spatial scales





Objectives





Objectives







Validation of new models in living labs and assessment of forecasting value vs remedies

Concept & methodology





Concept & methodology



NorthWest meteorological **measurement network** & PV plants (DLR)

- **Network of PV plants** at mid-west of France (HESPUL)
- **RES plants** at different areas in Europe (EDP, EDP Renewables)



Open for collaboration with other industrial actors, just contact us

8 Wind Float Atlantic (EDP, EDP Renewables)

9 Very large PV 150 MWp plant (Solaïs/Third Step)

Aggregated Belgium **offshore** wind farms (Open Data Set)

- Refined cloud radiative impact for solar irradiance forecast
- Advanced tools to take advantage of ensemble simulations for wind and solar forecasts
- Seamless forecast from very short to medium ranges













Very high resolution NWPs



Very high resolution LES (large-eddy simulations) and advanced data assimilation (https://vimeo.com/335806229)



Smart4RES

- Advanced analysis of camera images for cloud characterization
- Eye2Sky network of 35 sky cameras



km

- Camera (10 in operation & 10 planned/negotiation) Camera + irradiance (6 in operation & 6
- planned/negotiation) Camera + reference meteo
- station (2 in operation)
- Camera + PV monitoring station (Solarpark Ammerland)
- Ceilometer (6
 2
 - Eye2Sky & 4 DWD)





Some ideas – RES forecasting



Improve very short-term PV and wind forecasting (cameras, lidar..)





Towards better multi-source forecasting

- Increase quantity/quality of inputs
- Methodologies to tackle challenges of multiple sources (dimensionality, heterogeneous correlations between data sources and production...)

• Towards better seamless forecasting

- Looking for generic models: assess validity for various renewable energy sources
- Best candidates to reproduce temporal correlations / exploit temporal information? (e.g. recurrent models, adversarial networks...)



Multi-source input PV forecasting

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Some ideas – Collaborative forecasting

- The traditional view (forecasting for a single location)
- Many works have shown the benefits from integrating spatially distributed information (wind farms or PV plants as sensors).
- Development of a framework for data sharing preserving privacy and confidentiality constraints







 Modelling Tools for Integrating RES Forecasting in Electrical Grids, Electricity Markets and Storage Operation



Some ideas – Applications



- Trading portfolios (VPP) with RES and eventually storage.
 - Work over the entire model chain of forecasting plus decision-aid in order to propose a value-oriented forecasting approach for trading







Community research



Next generation forecasting for renewable energies

