InnoGrid2020+

The European Research & Development Dissemination Seminar

23 - 24 February 2012

SafeWind

Towards Improved Wind Power Forecasting Technology with Focus on Extremes

"Multi-scale data assimilation, advanced wind modelling and **forecasting** with emphasis to **extreme weather situations** for a safe large-scale wind power integration"

Collaborative research project funded in part by the European Commission under the 7th Framework Program.

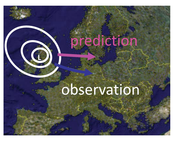
Objectives

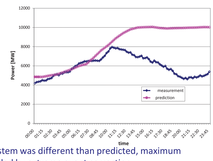
The integration of wind generation into power systems is affected by uncertainties in the forecasting of the expected power output.

Existing wind power forecasting approaches focus on the "**usual" operating conditions** rather than on **"extreme" events**.

The main objectives of SafeWind are :

- to substantially **improve wind power predictability in challenging or "extreme" situations.**
- To study the role of wind predictability as a **system design parameter** linked to the resource assessment phase, where the aim is to take optimal decisions for the installation of a new wind farm.





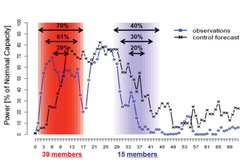
Predictions for Germany : Path of low-pressure system was different than predicted, maximum error: 5500 MW could have been avoided by extreme event correction.

The Project

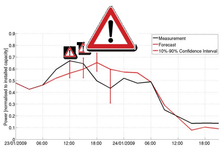
- **22 partners** including TSOs, DSOs, Utilities, Meteorologists, Forecasting companies, Research Centers, Universities
- **Duration : 9/2008-8/2012**

Improved forecasting at different temporal & spatial scales

- The aim is to improve wind predictability with focus on extremes :
  - **at various temporal scales:**
    - ✓ **very short-term** (order of 5 min)
    - ✓ **short-term** (hours to days)
    - ✓ **medium-term** (beyond few days ahead)
  - **at various spatial scales:**
    - ✓ **local** scale: Extreme gusts or shears.
    - ✓ **regional** scale: Extreme events (like thunderstorms) can cause the loss of significant amounts of wind energy with potential impact on the grid management.
    - ✓ **continental** (European) scale: Extreme weather situations (like fronts) can propagate causing impacts in different member states.



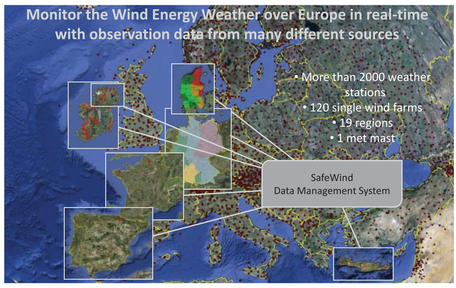
Forecasting ramp occurrence and timing



Warning for large errors

Prediction approaches for Alarming/Warning

- Models for "**alarming**": very short-term (0-6 h).
  - Develop methods to adequately monitor and assess the **wind energy weather situation over Europe** in order to detect severe deviations in the wind power forecast due to extreme events.
    - ✓ React on such deviations by issuing suitable alerts to users that a forecast error is occurring.
    - ✓ Produce improved updates of the prediction in the short-term
- Models for "**warning**": providing info for the level of predictability in the medium-term (next day(s)).
  - ✓ Such tools, based on ensembles and weather pattern identification, can be used to moderate risks in decision making processes (i.e. market participation, reserves estimation etc).



Research in Meteorology oriented to wind industry

- The project develops for first time strong synergy with research in Meteorology (ECMWF, MeteoFrance) targeting to wind power forecasting.
  - Improvement of ensemble forecasts (i.e. ECMWF's Ensemble Prediction System (EPS))
  - Evaluate various EPS configurations
  - Produce optimally combined forecast products

Contribution of Remote Sensing technologies

- Analyze how new measurement technologies like **Lidars** can be beneficial for better evaluation of external conditions, resource assessment and forecasting purposes.

Høvsøre Large Wind Turbine Test Facility

Link resource assessment to wind predictability

- Investigate how the **predictability of a site** can be considered as an additional **design parameter** in the resource assessment phase to decide where to install a wind farm (when revenue is defined by market participation).
- The use of information produced by meteorological models in the determination of Vref parameter will be analysed and a new dynamic risk analysis technique will be developed

A follow-up of the ANEMOS (FP5) and the ANEMOS.plus (FP6) projects

SafeWind Final Public Workshop **: 31 August 2012, Paris, France.**