



Umbrella Project

“Development of a dedicated innovative toolbox to support the grid security approach of transmission system operators (TSOs)”

When thinking about future electricity generation often Renewable Energy Sources (RES) come to mind, like wind and solar power. One of the goals is to move production away from fossil fuels towards more renewable ones. For electrical grid operation this change is not trivial and has quite some challenges before a high penetration of RES can be safely integrated into the transmission grid.

TSOs ensure a safe and reliable operation of the extra-high voltage grid, mitigating risks of accidents or, in the worst case, a European wide black out. Therefore TSOs must predict the amount of power that is required in a certain region and where this power will be generated. TSOs forecast where congestions may occur by taking into account the capacity of power lines, transformers and so on. This is done one day ahead, hence the name Day Ahead Congestion Forecast (DACF).

Currently this forecast is done deterministically, neglecting uncertainties entirely or considering them only implicitly via security margins. But with growing uncertainties due to the increase of volatile RES infeed and the intraday electricity market this deterministic approach is not sufficient anymore. Furthermore, the European integration of electricity markets will lead to an increase of cross-border flows, which requires even better coordination between different TSOs. These uncertainties present themselves on different time scales, for example a day ahead or real-time. Most of the involved uncertain processes are more or less easy to predict individually, but TSOs can only observe an aggregation of them which makes it hard to collect and use the data of their transmission grid.

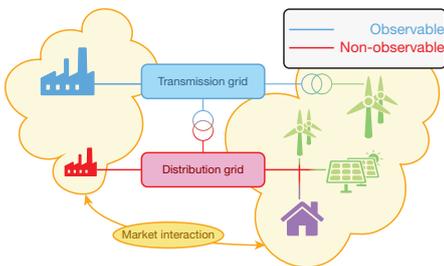
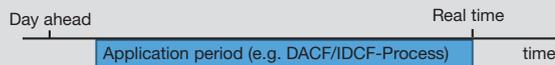


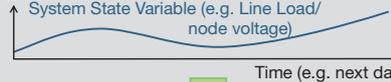
Fig1: Representation of the data aggregation

UMBRELLA is an EC FP7 research project and is developing software methods for these increasing uncertainties to support the decentralised grid security assessment of TSOs. This gives the opportunity to strengthen the cooperation between the TSOs when facing the growing complexity in system operation. A network

Operational Planning and Power System Operation



State of the Art



- Deterministic system state forecasts
- Deterministic assessment usually manual remedial optimisation

UMBRELLA-Toolbox

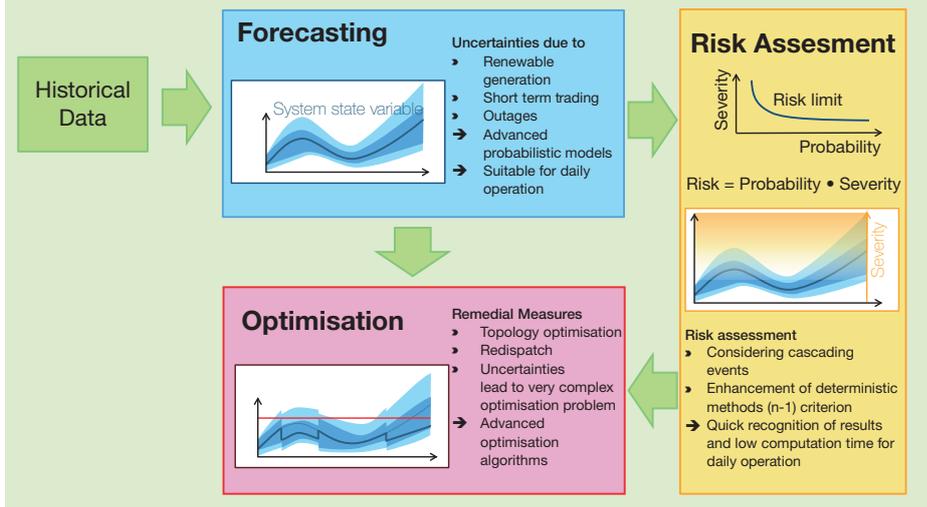


Fig 2: Overview of the UMBRELLA toolbox prototype structure

security analysis with all relevant TSOs “on board” looking at the same results and evaluating solutions in a coordinated and optimised way boosts the efficiency of system operation. Furthermore, UMBRELLA methodologies provide a step forward in the evaluation of the various uncertainties and of their impact in the different operational timeframes, as well as an introduction of risk-based assessment and optimisation of remedial actions, all of which include state-of-the-art transmission technologies like High-Voltage Direct-Current (HVDC) lines and Phase Shifting Transformers (PST).

Since the beginning of 2012, UMBRELLA has been active and is currently near completion: the

scientifically sound bases to support common TSO decisions have been researched and applied in a further advanced deterministic and in an innovative probabilistic way. The several components are just now linked together into a toolbox prototype and tested by usage of historic data. By the end of 2015 the enhancement of these components and the related TSO procedures will have been demonstrated utilising this developed toolbox prototype.

Visit <http://e-umbrella.eu> for further information.