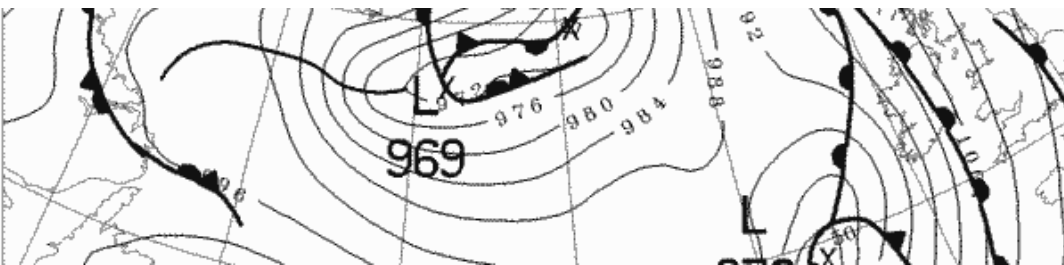


Trading with the Virtual Power Plant

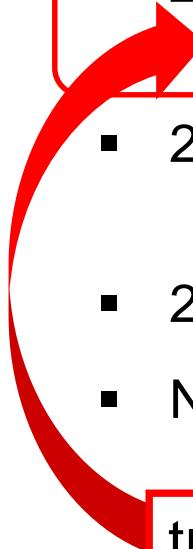
Anne Lenz

UVIG Forecasting Workshop - Session 8
Atlanta, June 22th 2017



Change of Market Rules in Germany

- 1998: market liberalization: unbundling of transmission, production, distribution
- 2000: energy law with tariff system, TSO sell renewable energy at the day-ahead auction
- 2012: introduction of direct marketing of renewables, increased volume of intraday-trading
- 2013: remote control of wind and solar plants becomes legal requirement
- 2015: ancillary service by wind farms
- Now: remote control activations based on price signals and grid bottlenecks



trading companies made contracts with asset owners and build pools of wind and solar plants to sell production on energy markets

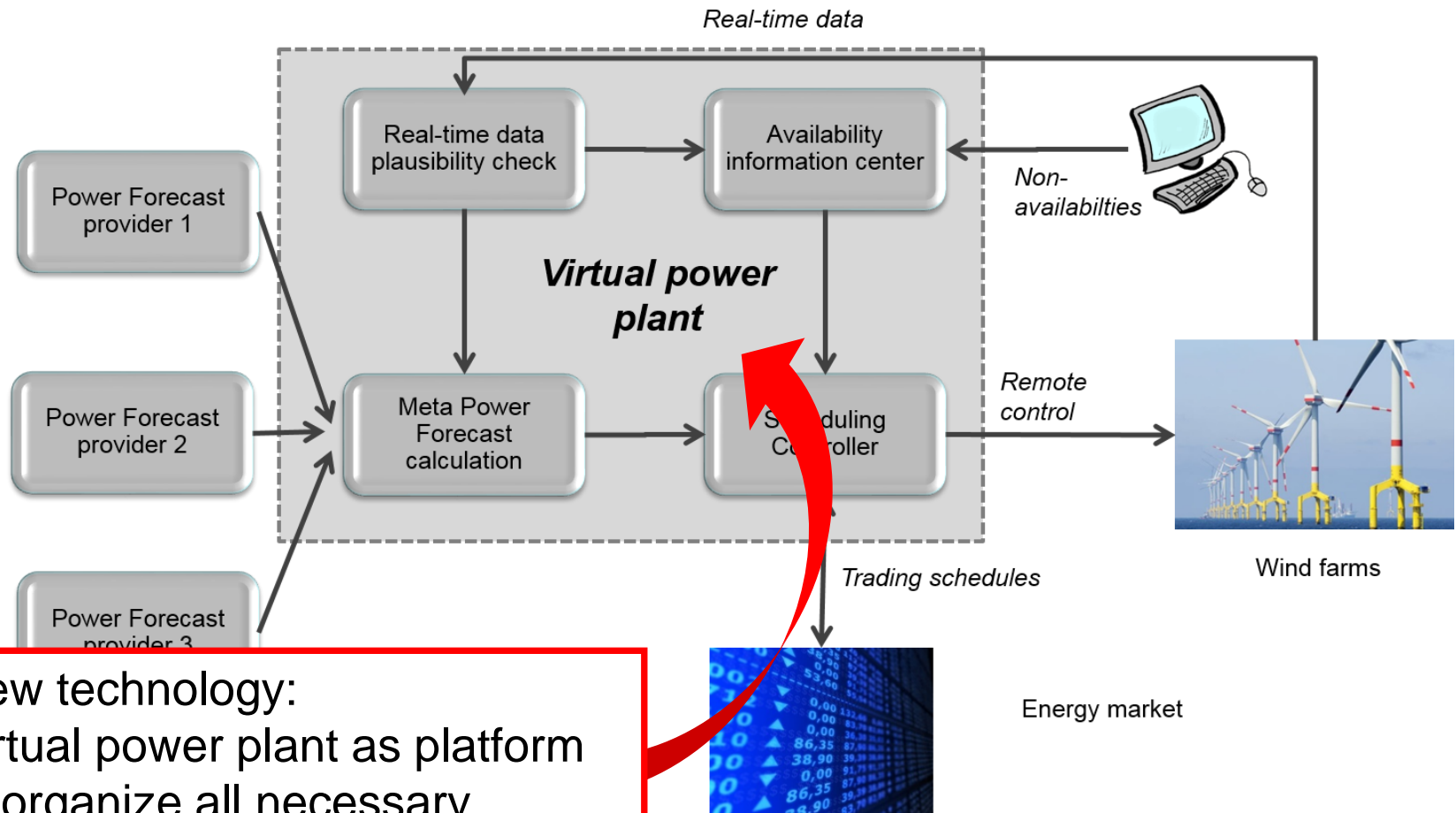
Difficulties in the Beginning of Direct Marketing in 2012

The introduction of direct marketing of renewables increased the volume of intraday-trading.

Problems:

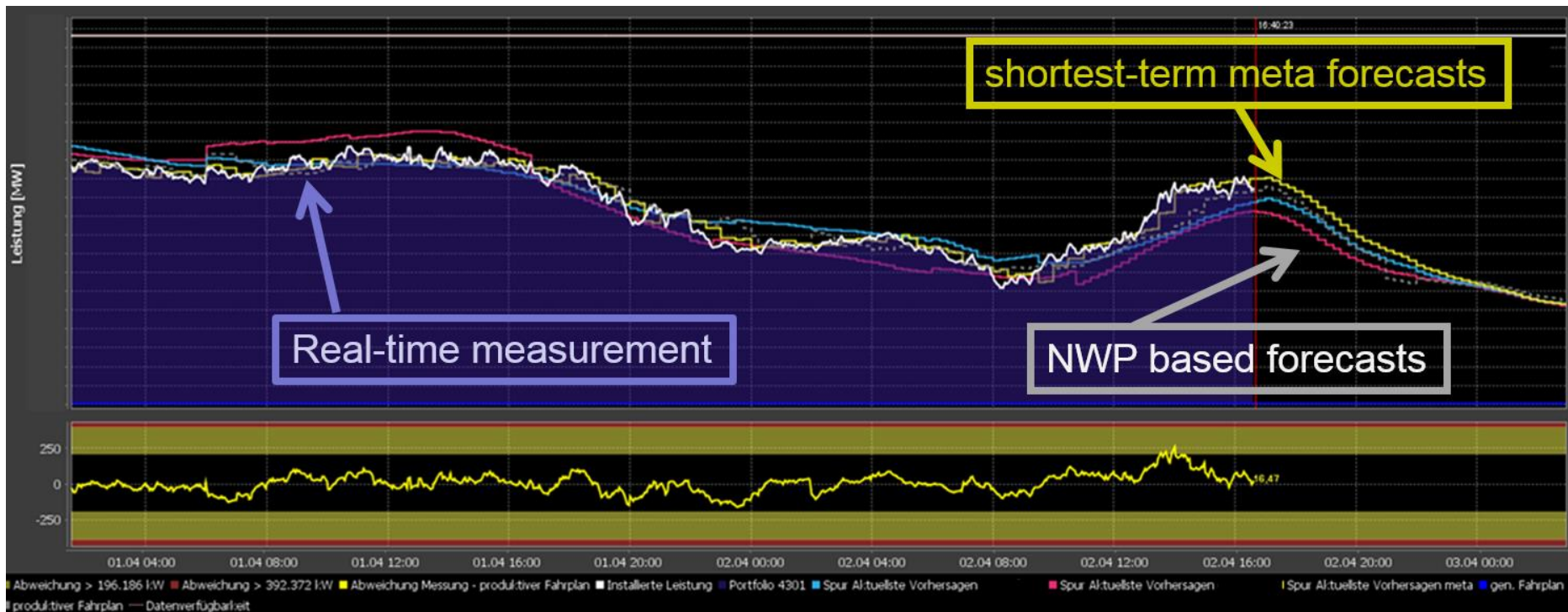
- No real-time data
 - = no idea of current power production
 - = no chance to take action on intraday market
- No remote control
 - = no way of curtailing power production
 - = no chance to avoid negative prices on spot market
- No sufficient IT infrastructure / no 24/7-trading floor
 - = lack of technical and organizational means to react quickly on changing conditions
- ...

Complex Processes Need to be Handled



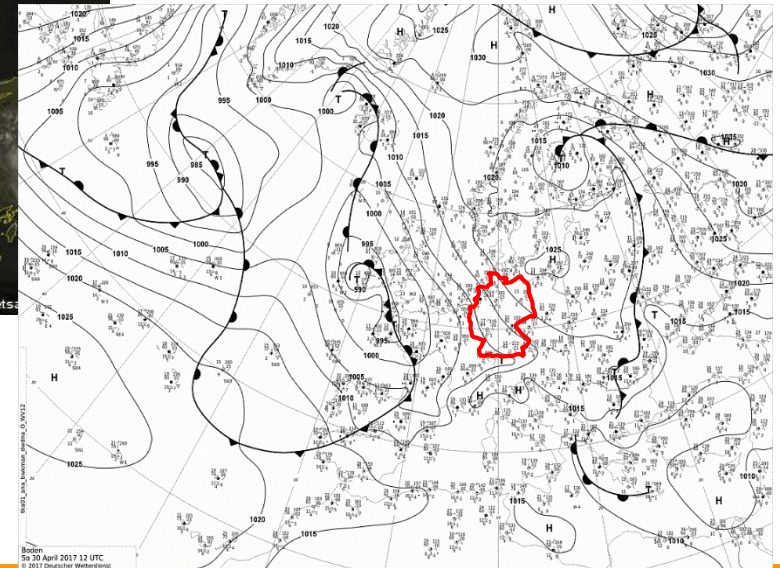
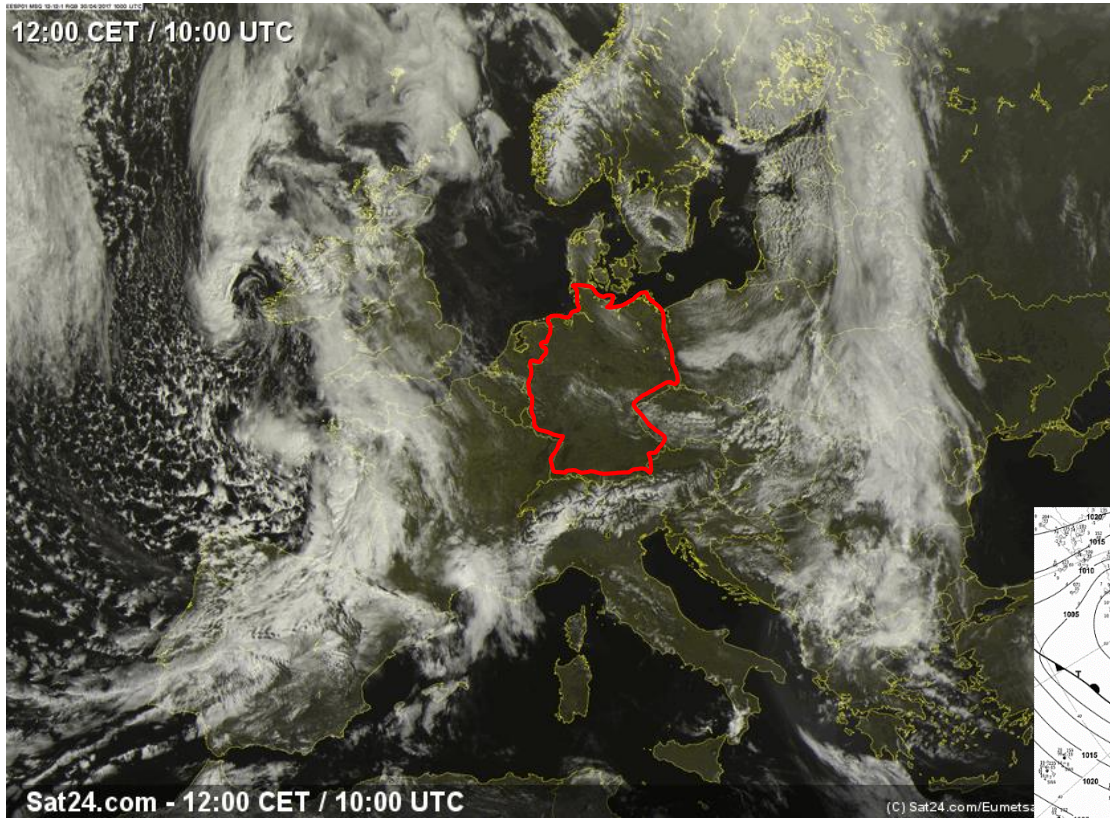
New technology:
Virtual power plant as platform
to organize all necessary
processes

Overview of Prediction and real-time Production

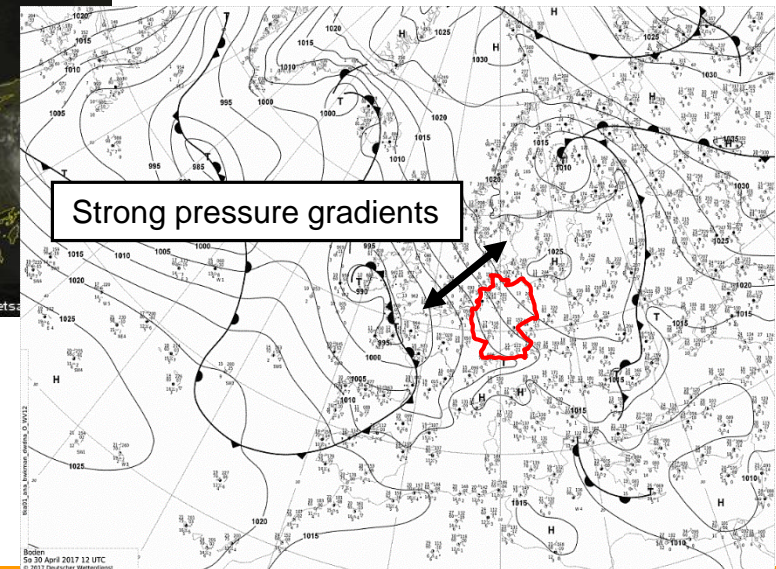
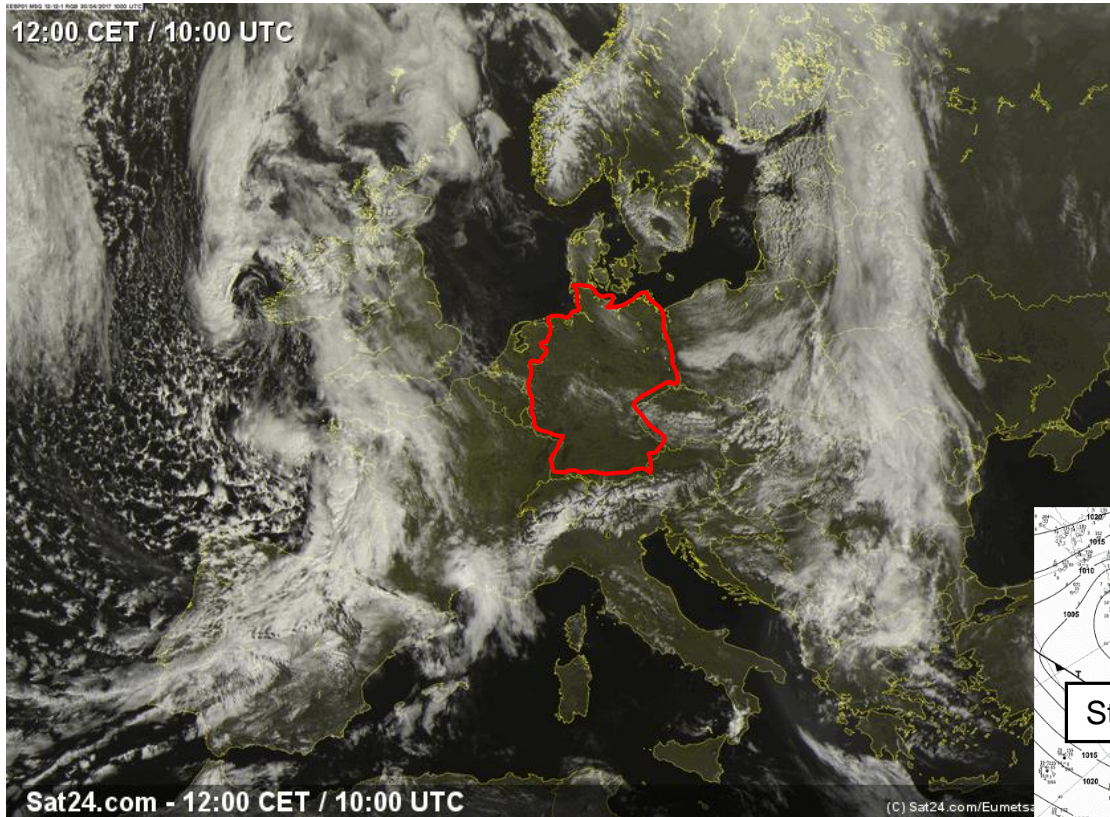


Deviations of forecast can be settled on intraday market to reduce balancing costs.

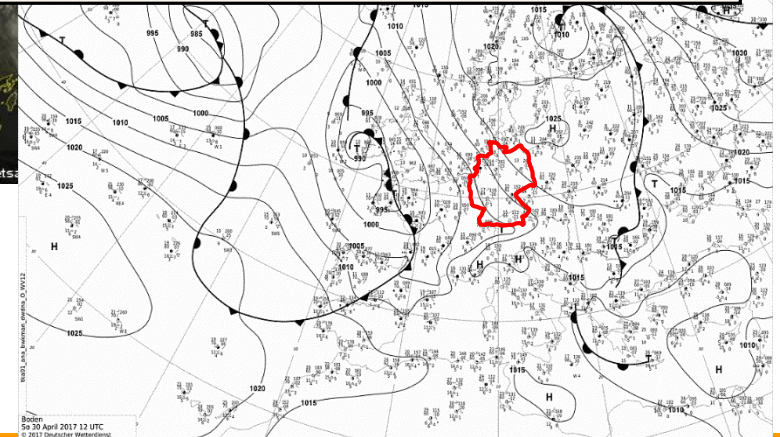
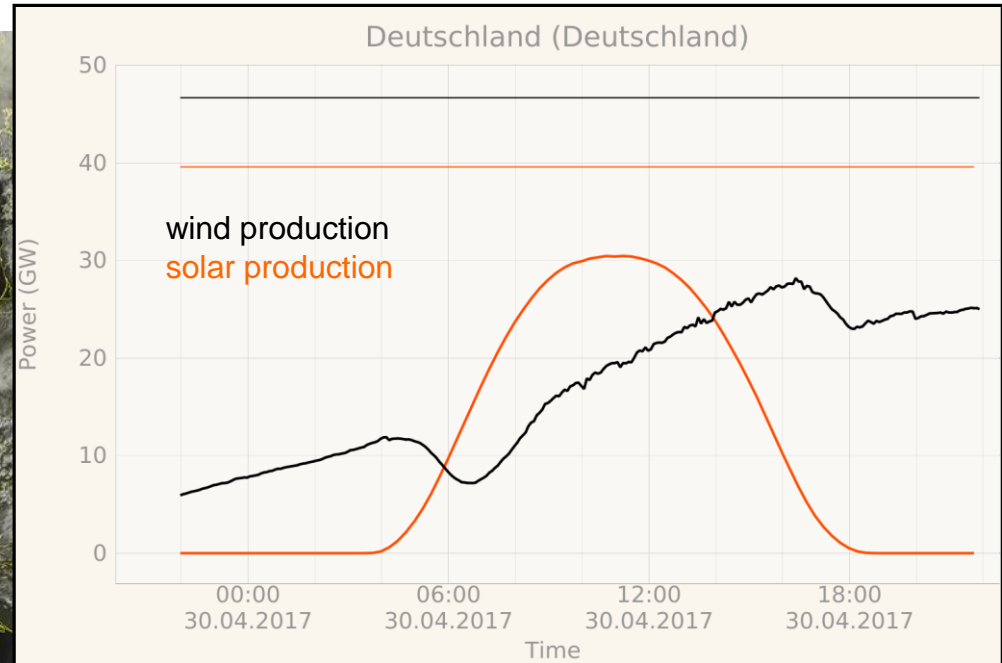
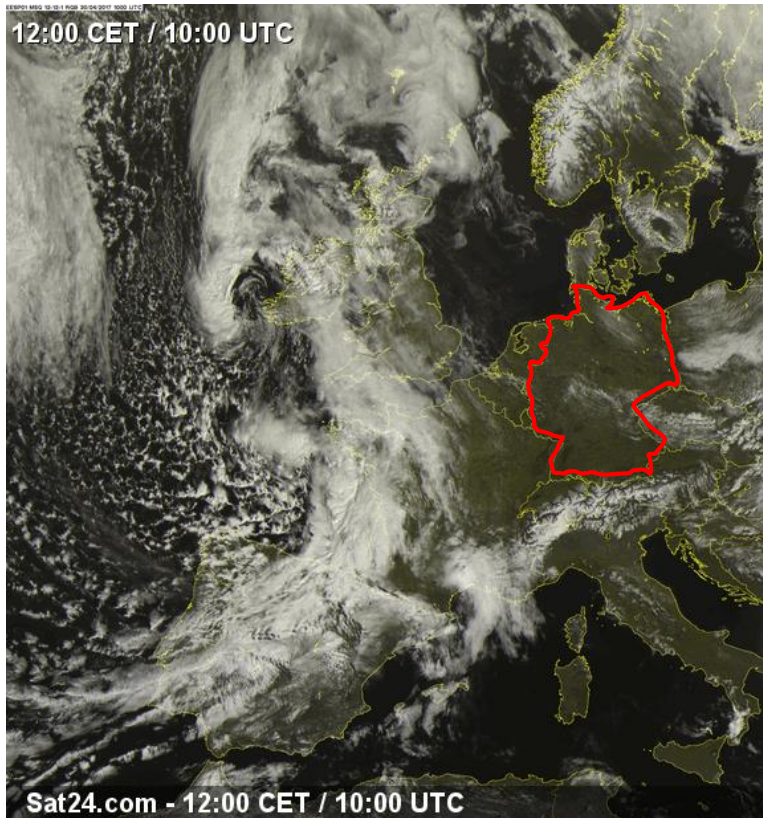
Negative Energy Prices on April 30th 2017



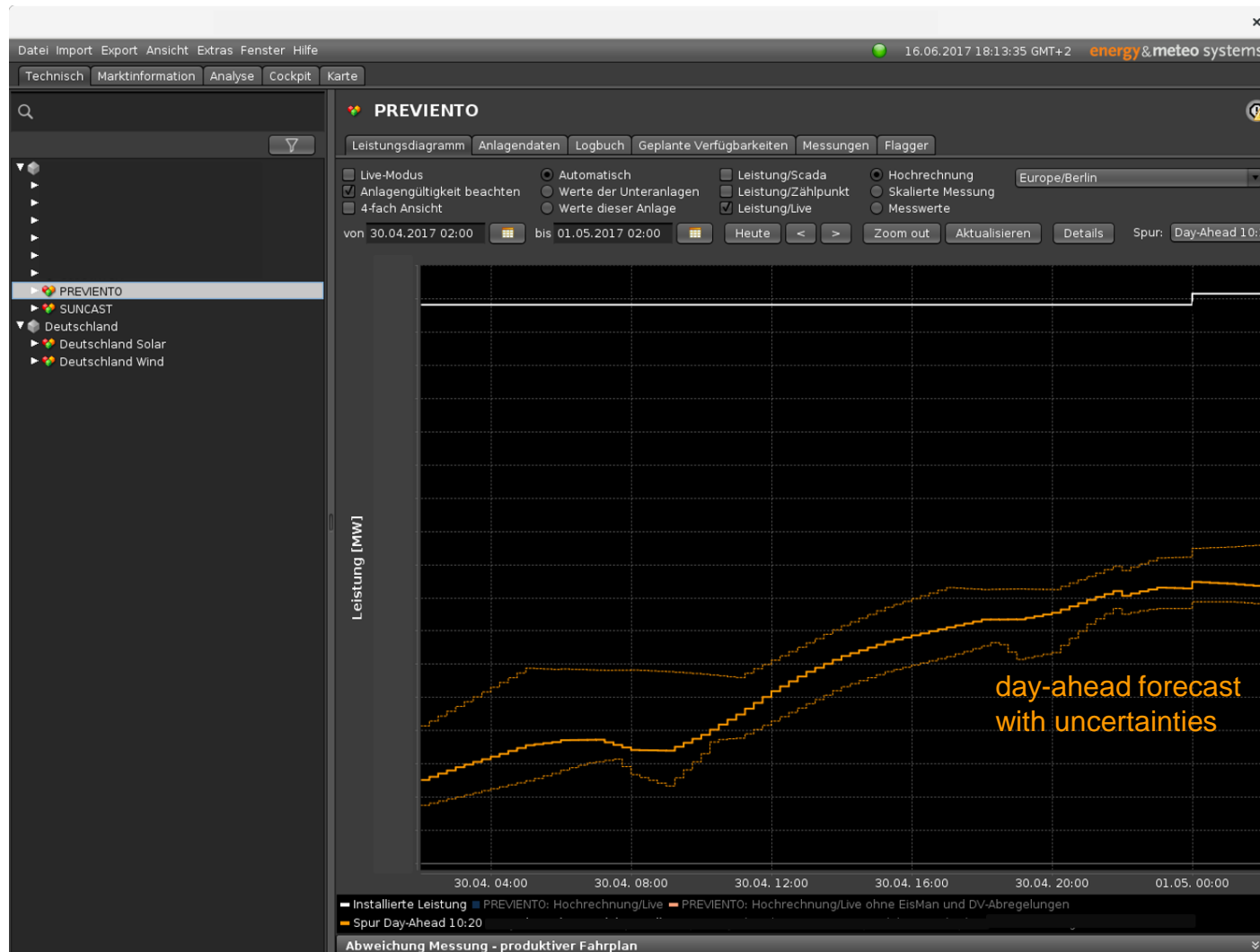
Negative Energy Prices on April 30th 2017



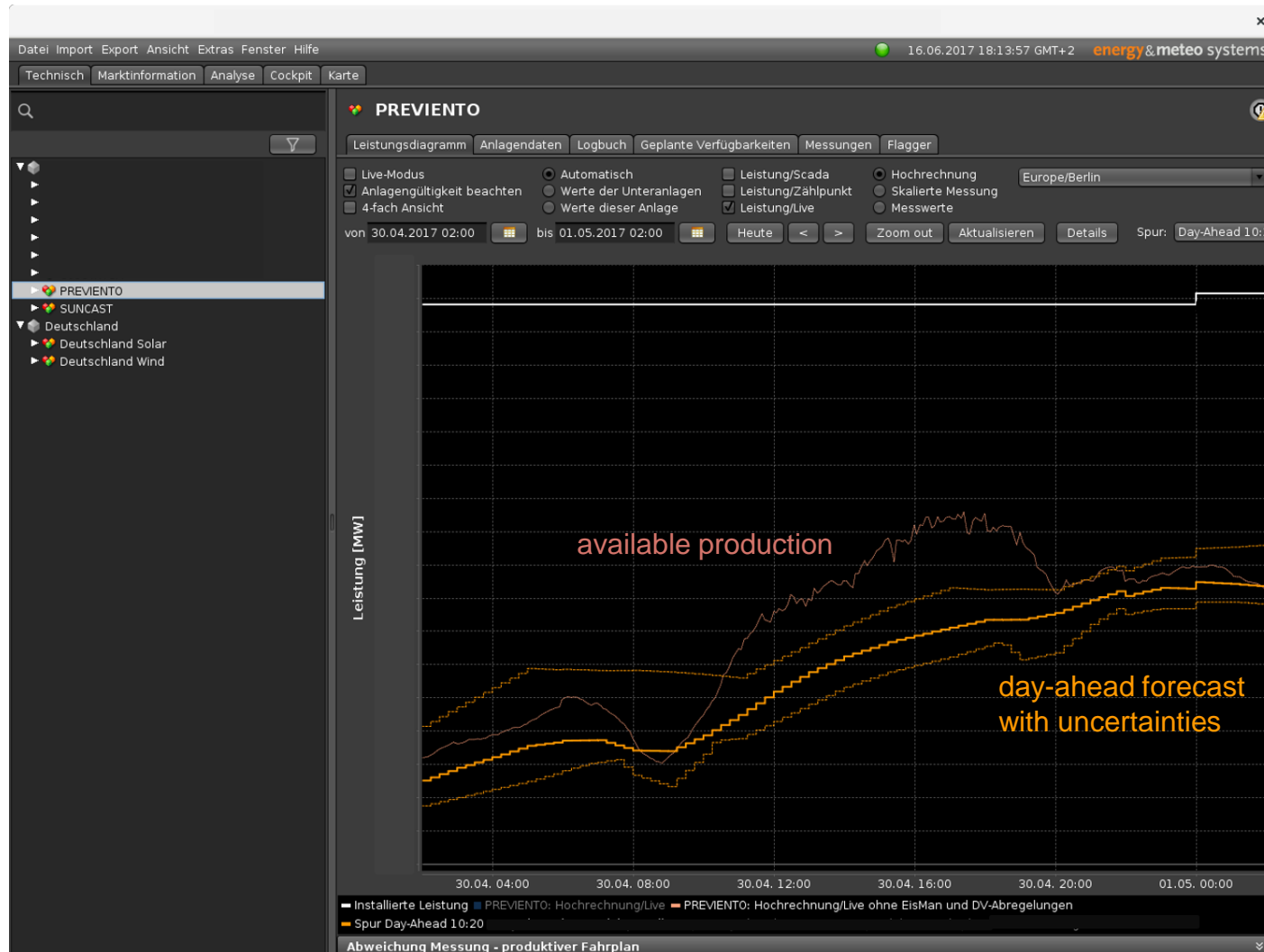
Negative Energy Prices on April 30th 2017



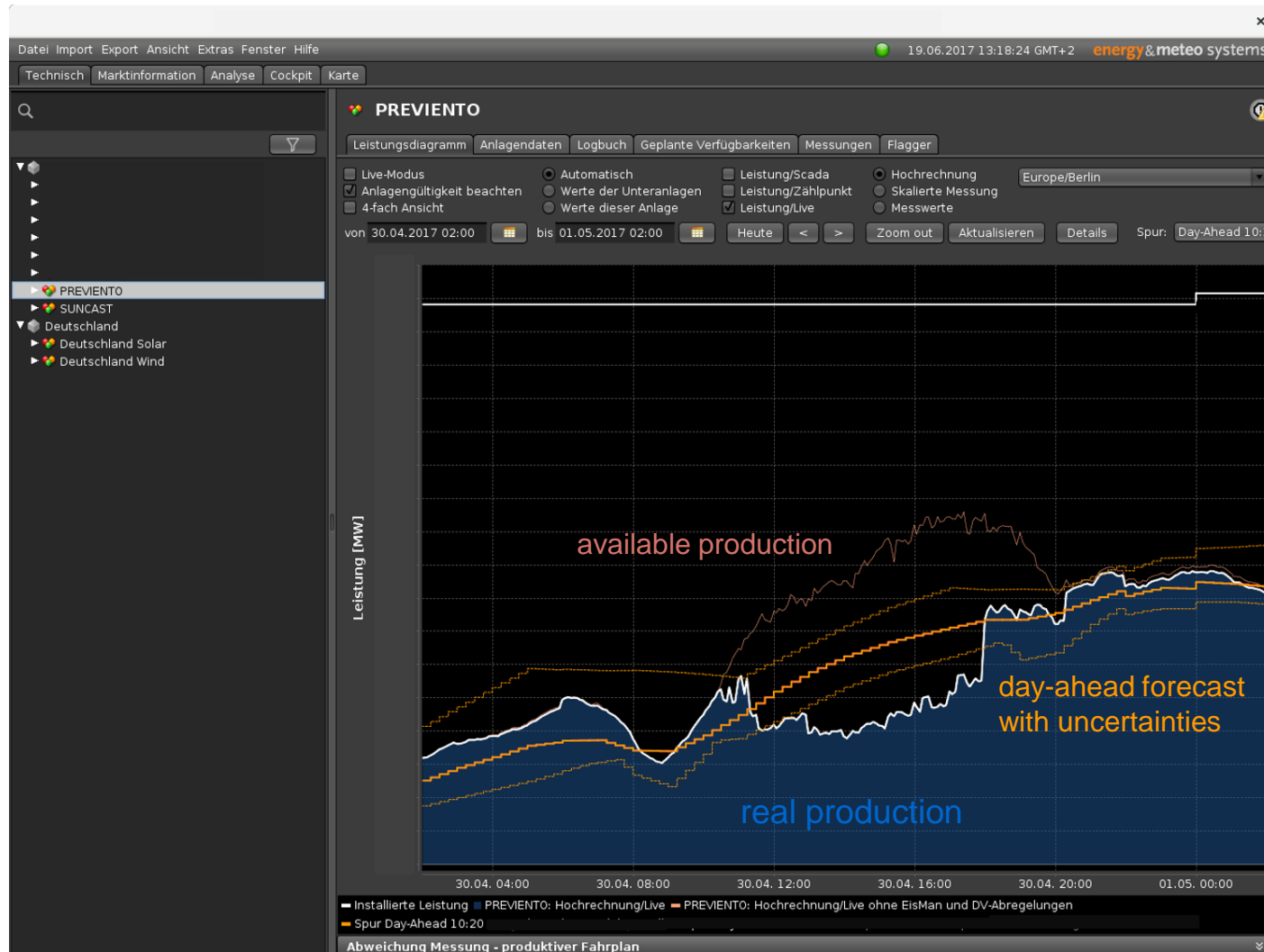
Negative Energy Prices on April 30th 2017



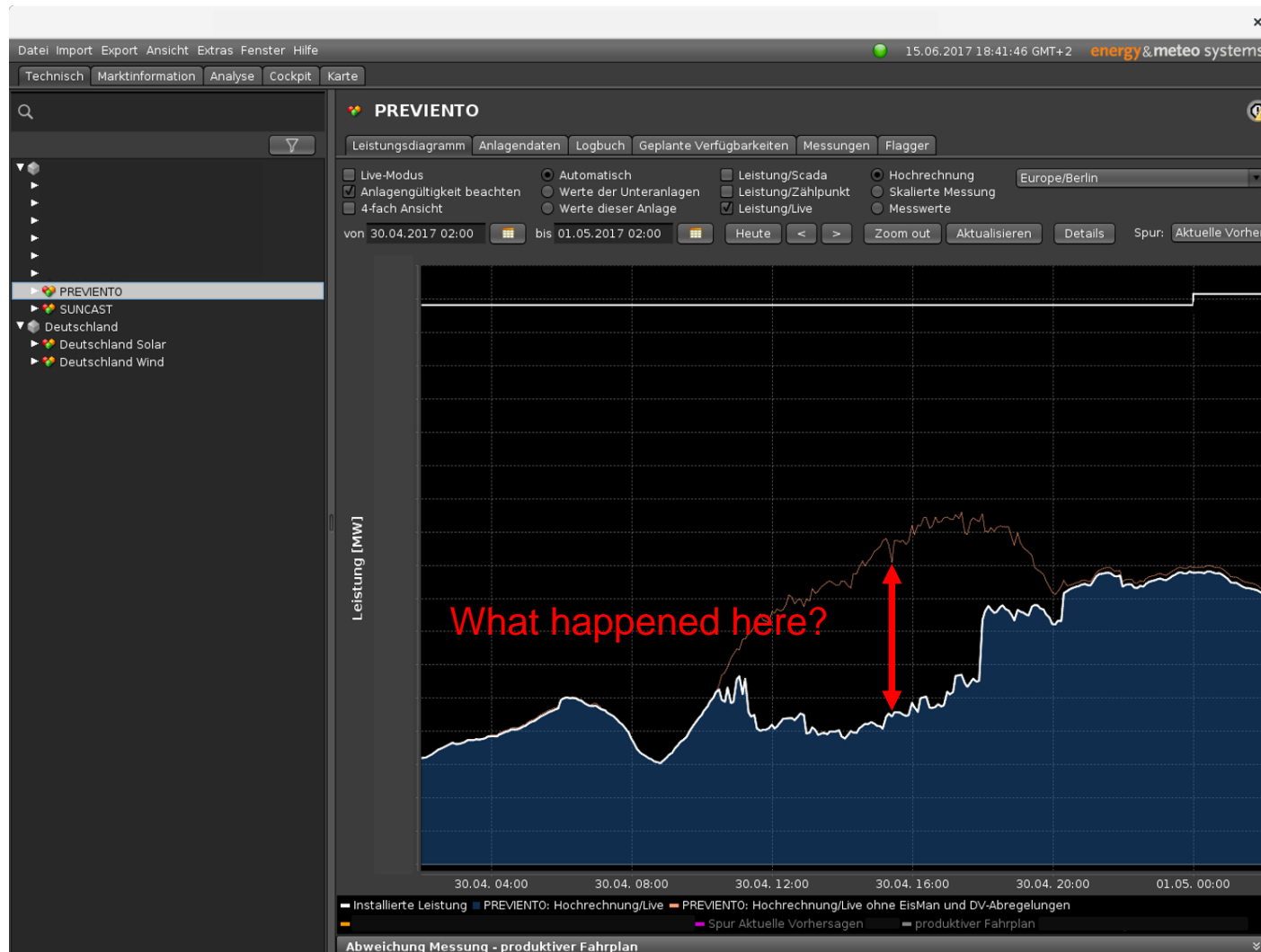
Negative Energy Prices on April 30th 2017



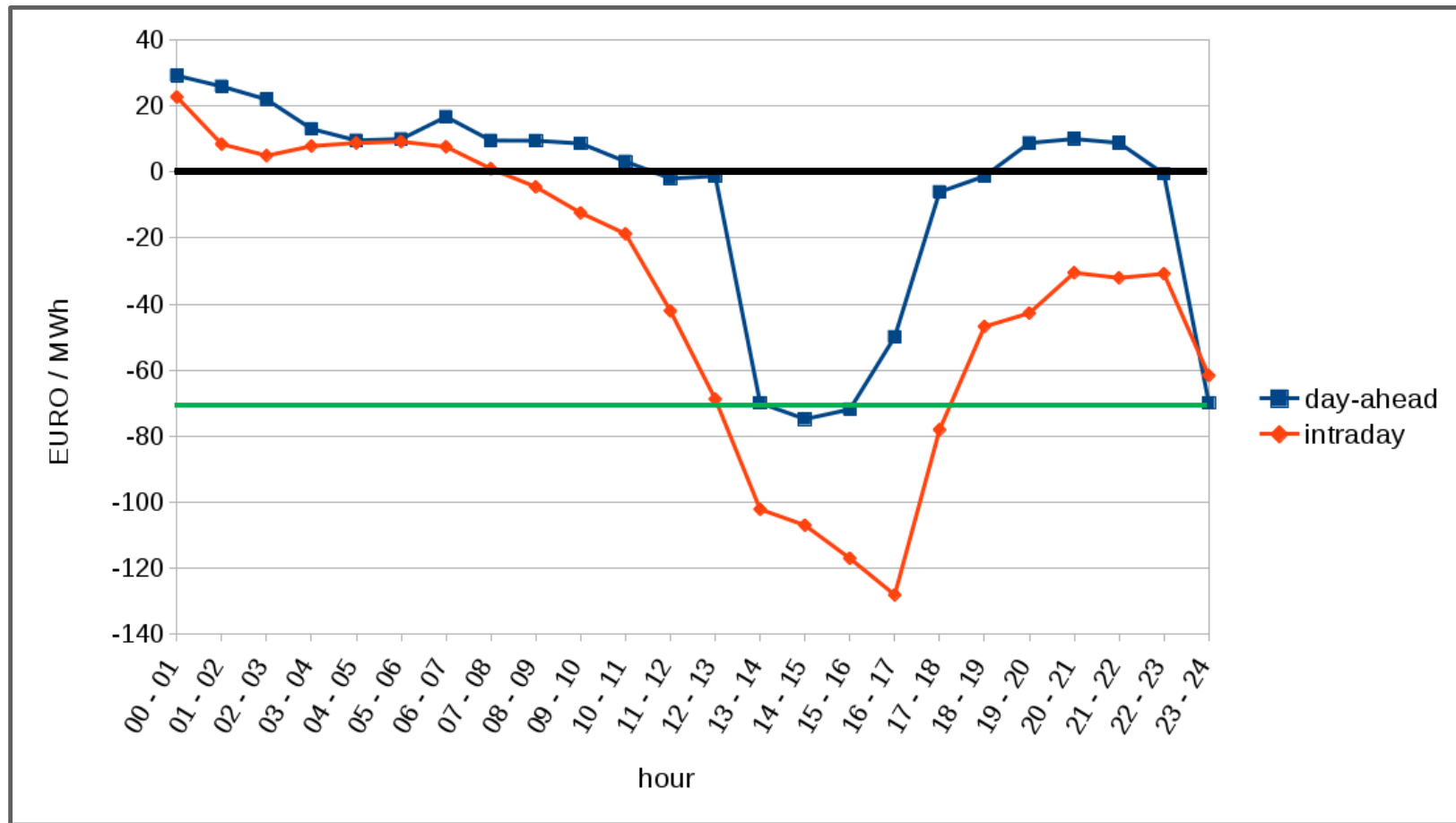
Negative Energy Prices on April 30th 2017



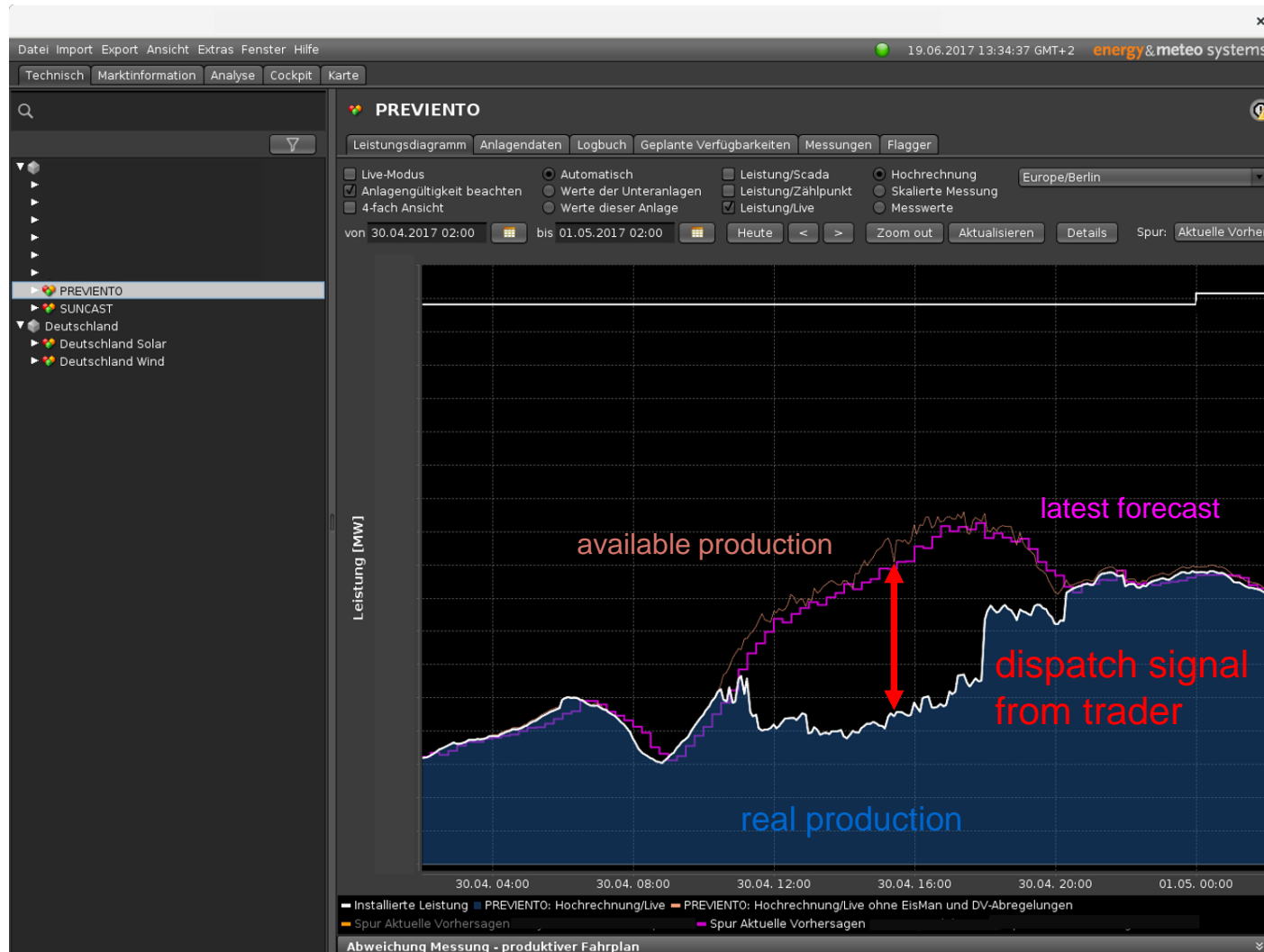
Negative Energy Prices on April 30th 2017



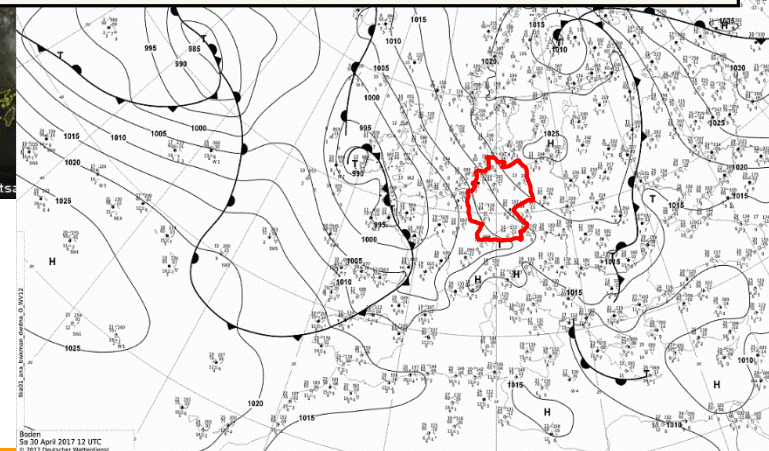
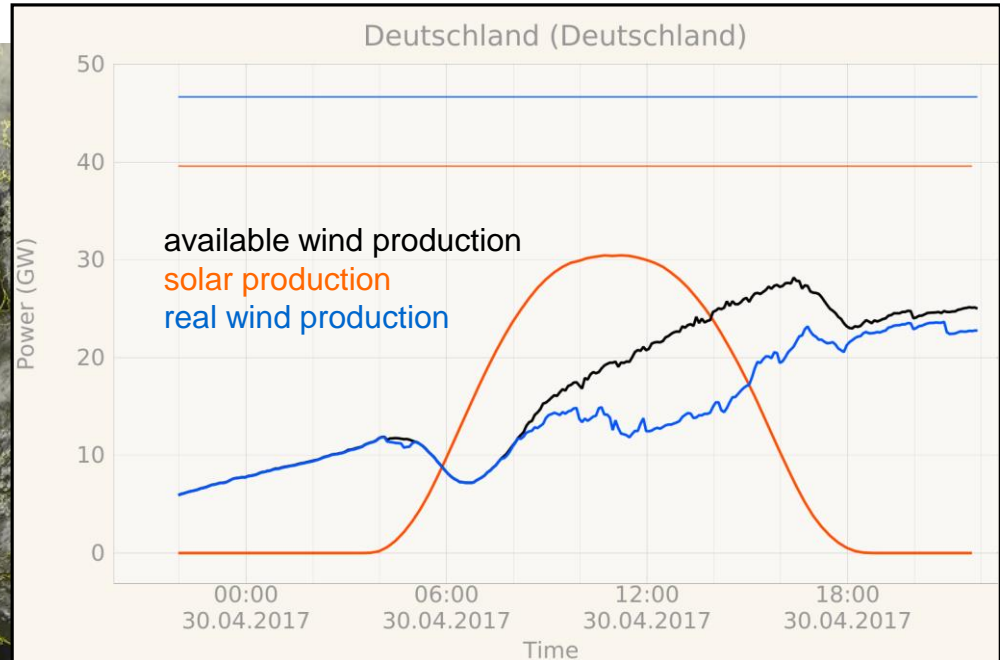
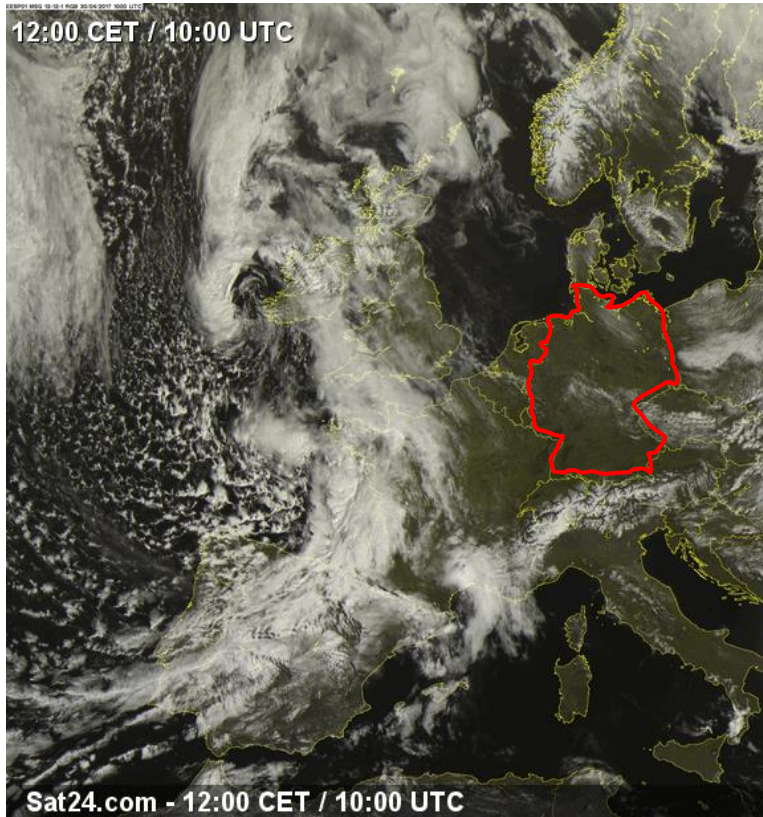
Negative Energy Prices on April 30th 2017



Negative Energy Prices on April 30th 2017



Negative Energy Prices on April 30th 2017



Conclusions and Outlook

- Virtual power plant is a tool for complete portfolio management:
 - connection of renewable energy plants
 - data management (static data, measurements, forecasts)
 - visualization of all relevant time series
 - combination of forecasts to generate trading schedules
 - remote control of units

- Present and Future:
 - many ideas and possibilities: ancillary services, storage, demand side management with controllable loads (e.g. cooled warehouses, greenhouses), e-mobility, sector coupling

A photograph of a wind farm at sunset. The sky is a gradient of blue and orange. Several wind turbines are visible, with the largest one in the foreground on the right, and a long line of smaller ones receding into the distance on the left. The ground is dark and silhouetted.

Thanks for your attention !

www.energymeteo.com

Contact:

Anne Lenz

anne.lenz@energymeteo.com