

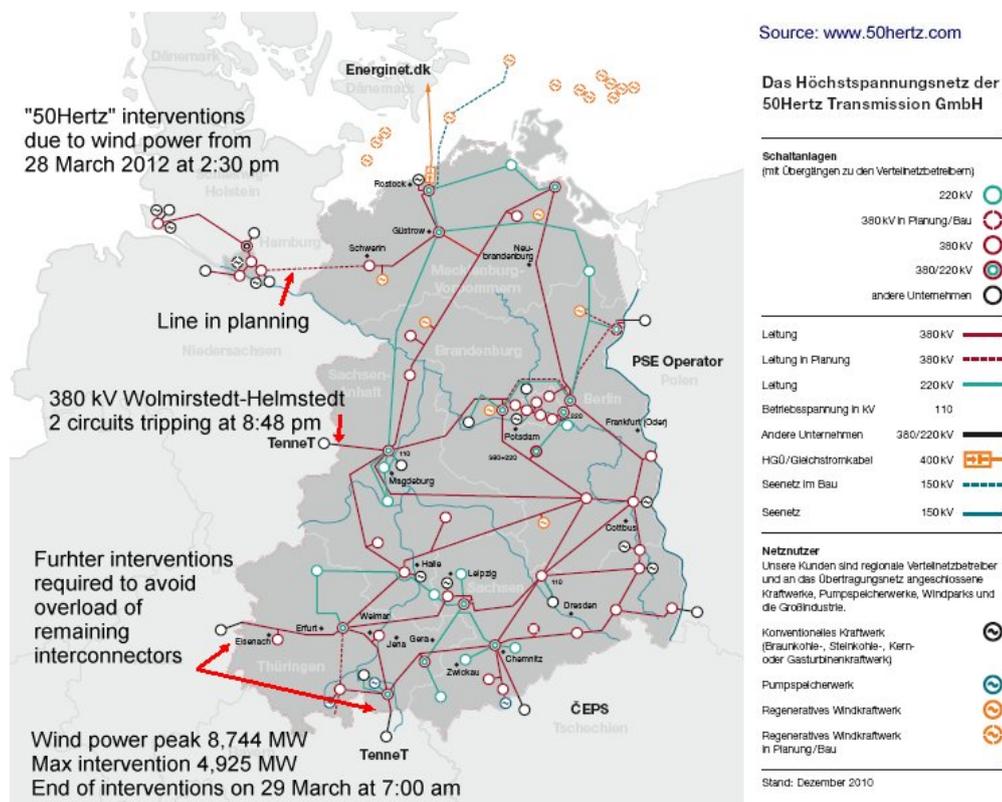
Frequent German Wind Power Curtailments

Reports on critical grid conditions

Recently "Welt Online" reported on "alarm level yellow" for German power grids on 28 and 29 March 2012¹. The story says that similar events have occurred in December 2011 and in February 2012.

Against the background of phasing out German nuclear power plants and rapid expansion of wind power and photovoltaic (PV) this is alarming news which deserves attention. The interesting question is if it is possible to establish a realistic assessment of the reliability of the German grid.

German grid operators are obliged to report all operational interventions aimed at avoiding overloads or power failures. The grid operator for the eastern Germany, 50hertz, has published a very brief report on the event in German². The following overview is based on this report.



The wind power peak level was not extreme. The tripping of the two circuits of the 380 kV line Wolmirstedt-Helmstedt is probably the main reason why this particular case caught the attention of the media. Unfortunately the report does not tell why the circuits tripped.

¹ <http://www.welt.de/dieweltbewegen/article106143921/Stromnetz-geht-ploetzlich-auf-Alarmstufe-gelb.html>

² http://www.50hertz.com/transmission/files/sync/Netzkennzahlen/Massnahmen-EnWG/Information_EEG11_mit_13-2_vom_28.03.2012_bis_29.03.2012.pdf

The case reveals the vulnerability of the German power system. Until 9 April 50hertz has issued 23 similar reports on strained grid conditions in 2012.

The grid operator's options for intervention

§ 11 of the German Act on Granting Priority to Renewable Energy Sources (EEG) defines the rules for feed-in management for the generation of electricity from renewable energy sources, combined heat and power (CHP) and mine gas. In exceptional cases when the grid would otherwise be overloaded the grid operator shall be entitled to assume the necessary technical control of the installations concerned. The owners of affected power plants are entitled to economic compensation for intervention.

More generally § 13.1 of the German Energy Industry Act (EnWG) allows the grid operator to employ network or market-related measures such as re-dispatch and counter-trading in order to rectify a problem with, or a threat to, uninterrupted supply.

If these measures are insufficient, further measures must be taken in order to maintain system security. The network provider is then entitled and obligated to adjust inflow of power (including transit) and the electricity consumption (load shedding) (§13.2 of German Energy Industry Act).

All use of these measures must be reported publicly.

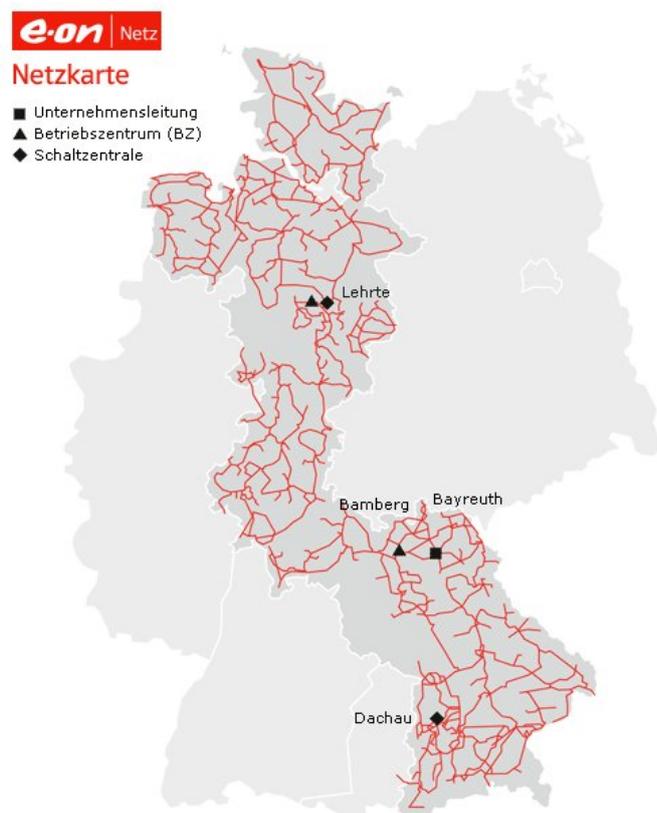
In the report on the events on 28 March 2012 50hertz is using all the three rules (EEG § 11 and EnWG §§ 13.1 and 13.2) for the justification of the interventions.

Grid operators at different levels

The practical administration of the rules and the compensation is quite complex. There are 4 grid operators for the primary level (380 kV) and a number of grid operators at lower voltage levels. Bottlenecks are often detected in local grids. It makes no difference to the owner of a wind turbine if local or national grids are congested.

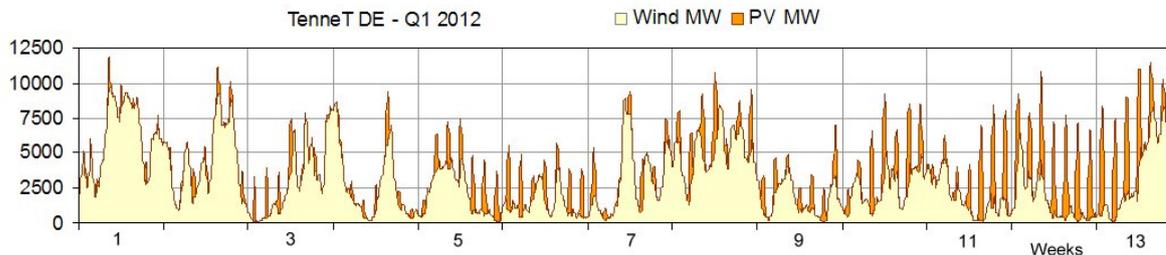
In an attempt to establish an impression of the extent of interventions in Germany EON Netz will be used as an example. EON Netz is operating the largest secondary grid in Germany. The primary grid in the same area is operated by TenneT.

The control area is divided into a number of local areas (Landkreise). An intervention concerning EEG § 11 is valid for electricity production in one local area. The severity is indicated in steps between 0% and 100%.



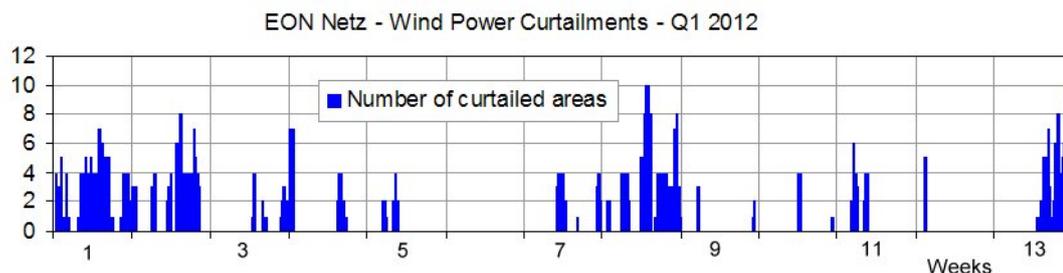
Curtailments in 23% of the hours in first quarter 2012

Each intervention record specifies start time and duration. Interventions for different local areas are usually overlapping. It is a main purpose of the lists of interventions to support the calculation of economic compensations for the owners of the affected power plants.



The inflow of wind and PV for the TenneT area is shown as background information. This is a quite normal image with increasing influence of PV at the end of the period. There are no extreme conditions such as a PV peak on the top of a wind peak.

It has not been possible to estimate the curtailed wind energy. The following image is based on the EON Netz reports for first quarter 2012.



During first quarter EON Netz has issued 257 interventions. The average length was 5.7 hours. Up to 10 interventions have been issued for the same hour. 504 hours had one or more interventions. Thus there have been interventions active for 23.1% of the hours in first quarter.

The total amount of curtailed energy from wind and CHP is probably modest, but the observations seem to indicate that German grids are frequently loaded to the capacity limits. Strained grids have a higher risk of cascading outages caused by single events.

The impact of wind power is obvious in the charts. The geographical distributions of wind power and PV are probably different for the TenneT control area. Therefore it may be more difficult to detect the impact of PV.

An unstable German grid would be a danger to the reliable electricity supply in several neighbouring countries. Therefore there is good reason to observe the development in Germany carefully.

It may be possible to extract better characteristics of the performance of German grids from the available data. Hopefully somebody will do the necessary development effort and publish informative observations on a regular basis.

What Happens During a Blackout?

In 2011 the Office of Technology Assessment at the German Bundestag (TAB) published an interesting report on the consequences of blackouts lasting up to two weeks.

The following infrastructure sectors are considered:

- Information technology and telecommunications
- Transport and traffic
- Water supply and wastewater disposal
- Food supply
- Health care system
- Financial services
- Public institutes – case study on »prisons«

The conclusion is that an interruption of the power supply will be tantamount to a national disaster already after a few days. Though the probability of this event is very low the report recommends further efforts at all levels in order to “increase the resilience of critical infrastructure sectors in both the short and medium-term and also to further optimise the capacities of the national system for disaster control”.

Fortunately this inspiring report is available in English³.

³ <http://www.tab-beim-bundestag.de/en/pdf/publications/books/petermann-et-al-2011-141.pdf>