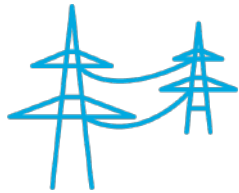


Coordinated reactive power exchange between electrical transmission and distribution grid

Marcel Ludwig, Asset Management,
Department of grid stability



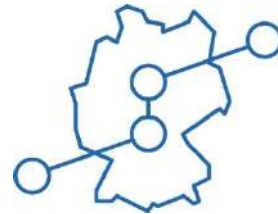
GRID OPERATIONS

We operate an 11,000-kilometer EHV grid in an area that stretches from the North Sea to the Alps.



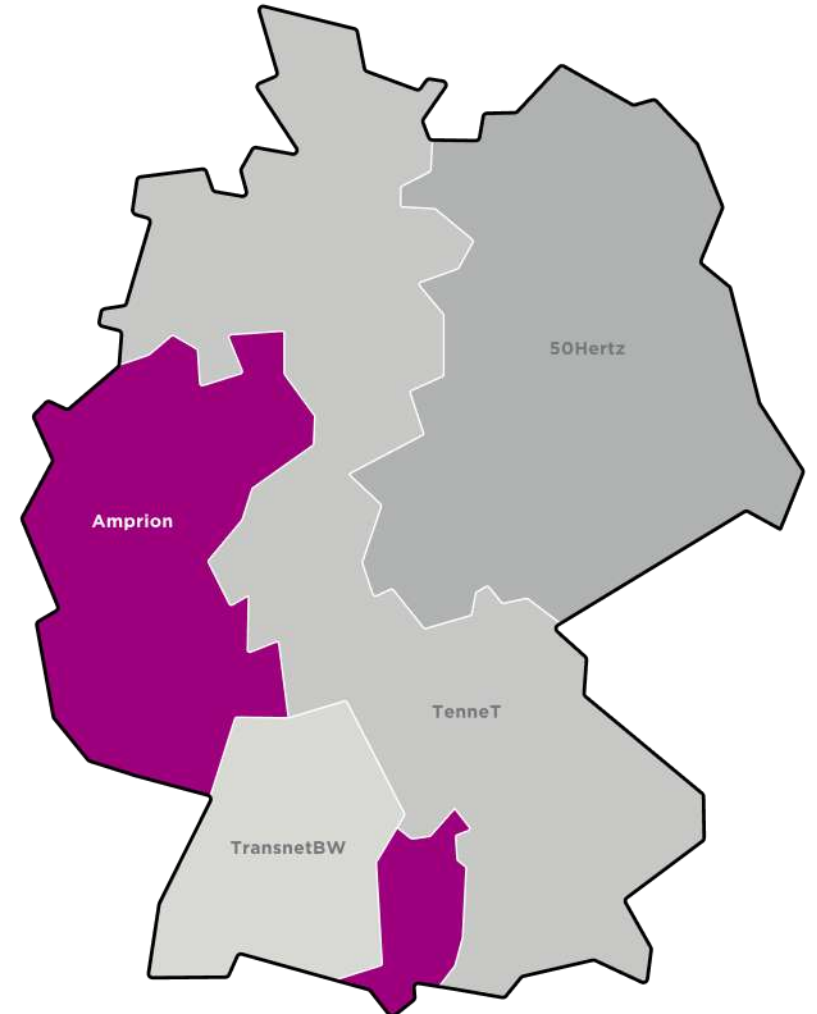
GRID STABILITY

We keep the grid stable and safe so that electricity can flow for some 29 million people.



COORDINATION OF POWER FLOWS

We monitor and coordinate electricity flows in Germany and Northern Europe.



Challenges of the German energy transition

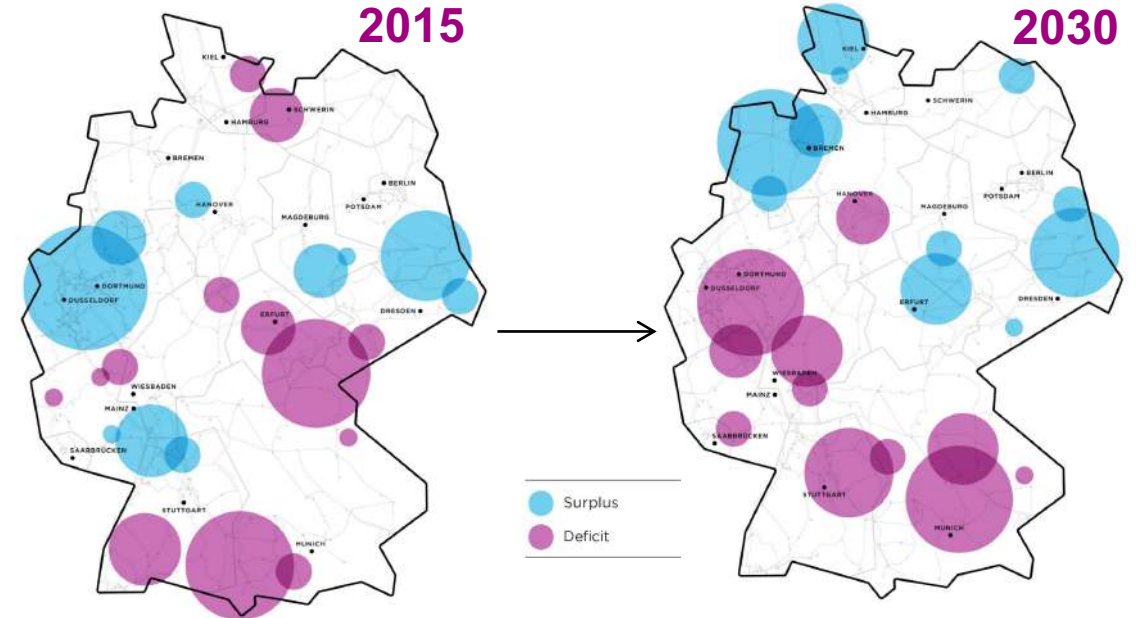
Motivation of the reactive power exchange

- Expansion of renewable energies changing the energy landscape
- Decommissioning of conventional power plants (coal and nuclear)
- Surplus in the north, deficit in the south

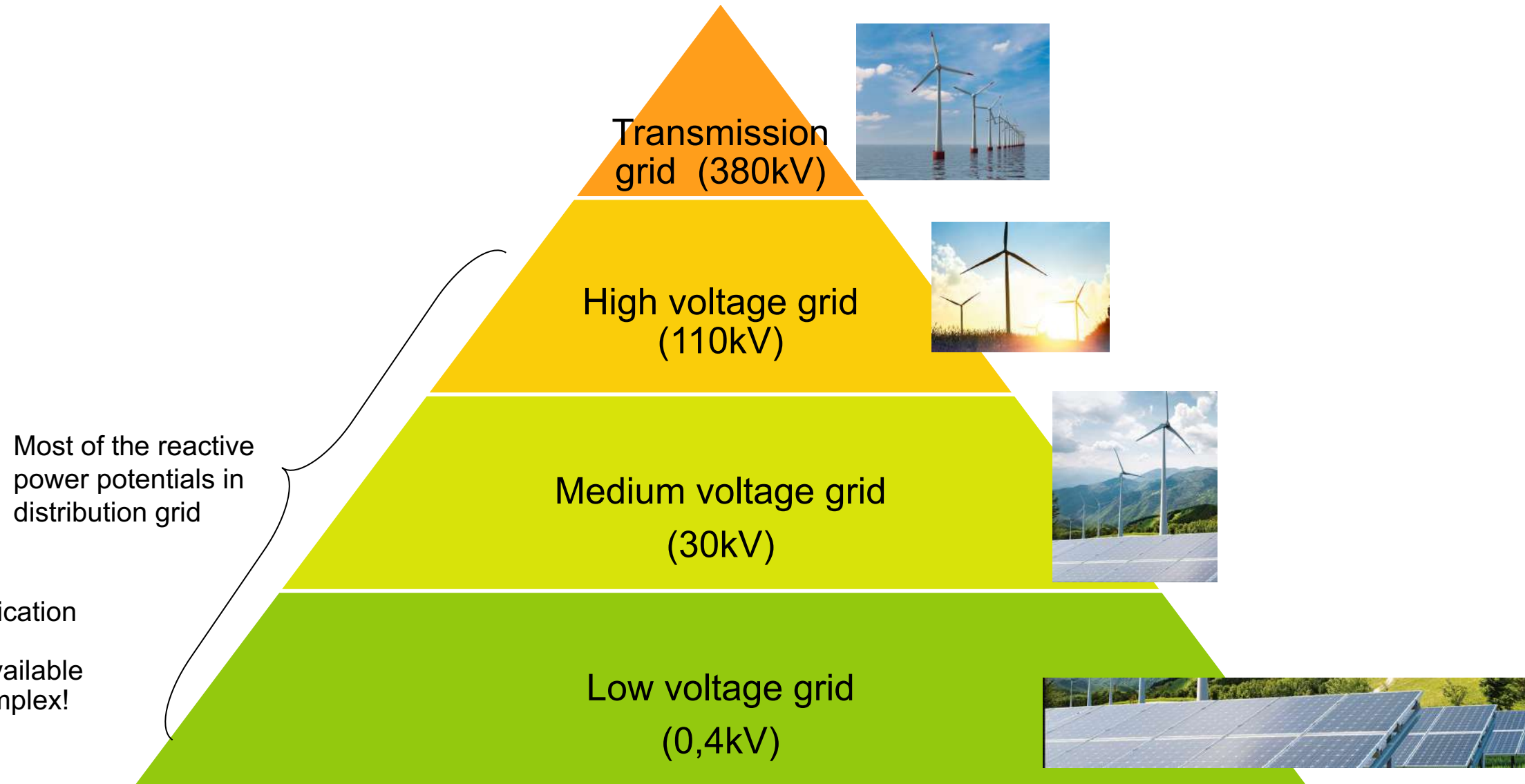
- **Higher transits from north to south**
- **Increased efforts for voltage control**

- Voltage control by reactive power control
(Lifting and Reducing voltage)

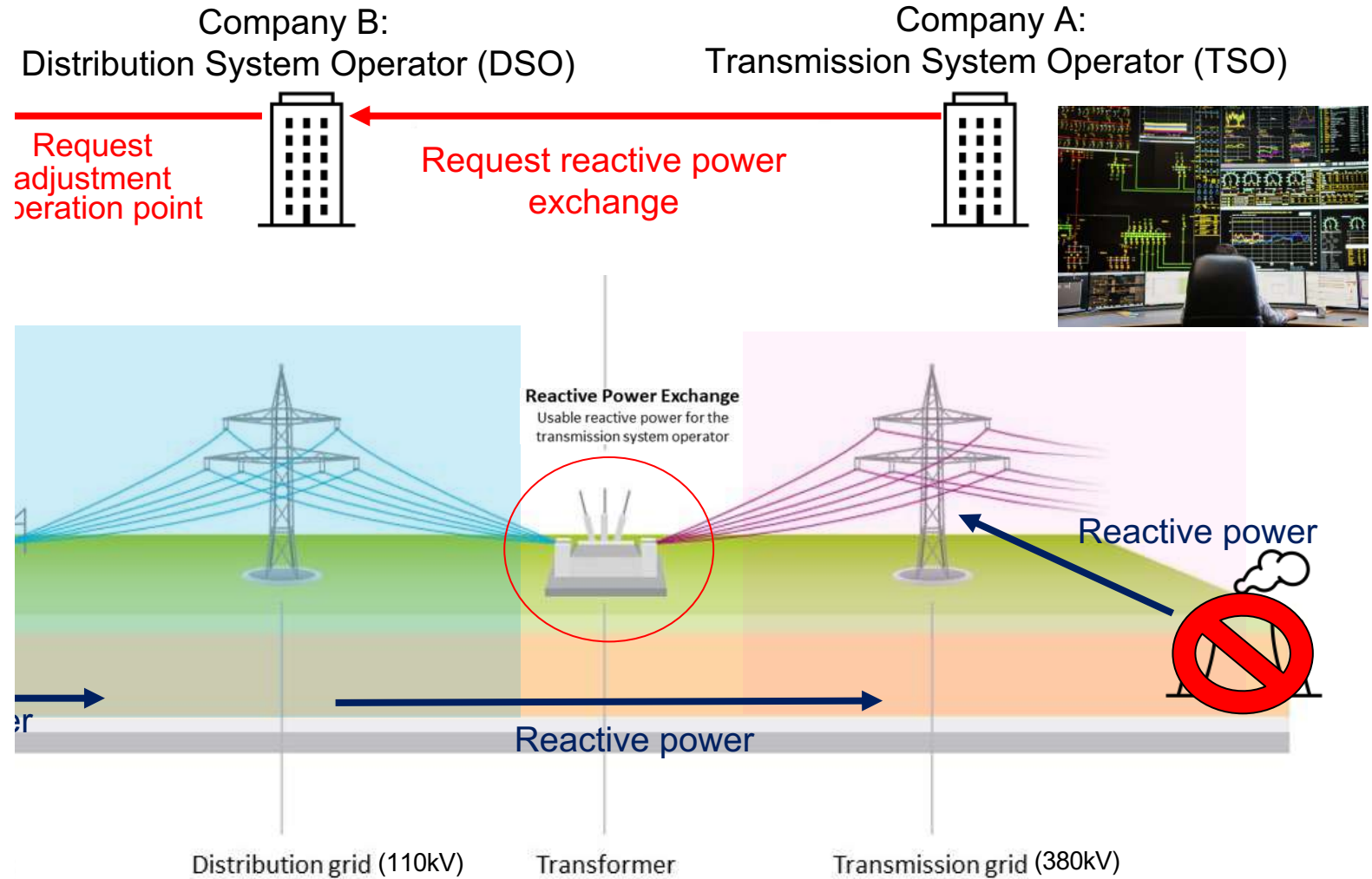
- Need of reactive power
- **Missing provision of reactive power (Decommissioning of conventional power plants)**
- Solutions:
 - **Own compensation assets**
 - **Utilization of existing reactive power potential from the distribution grid from solar and wind (high potentials)**



Reactive power potentials by grid levels

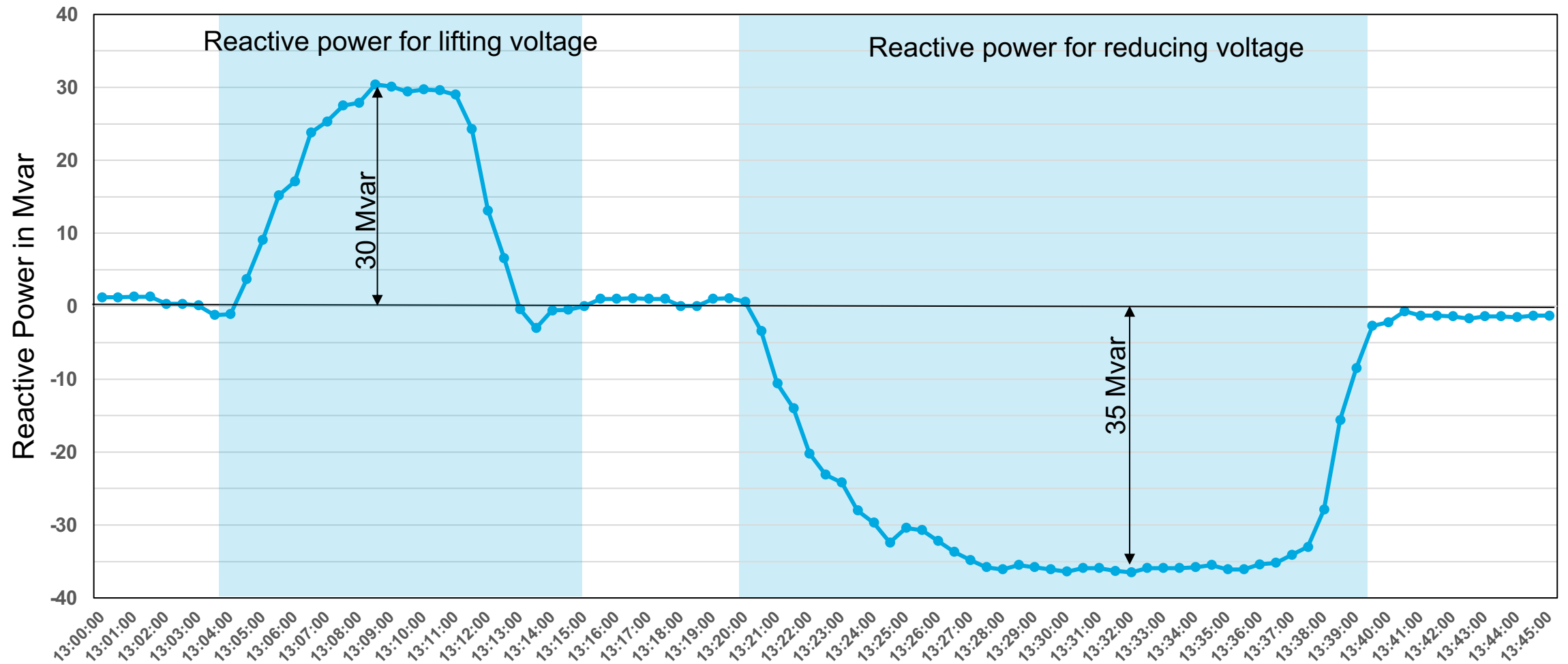


STORY AND EXPERIMENTAL PROCEDURE



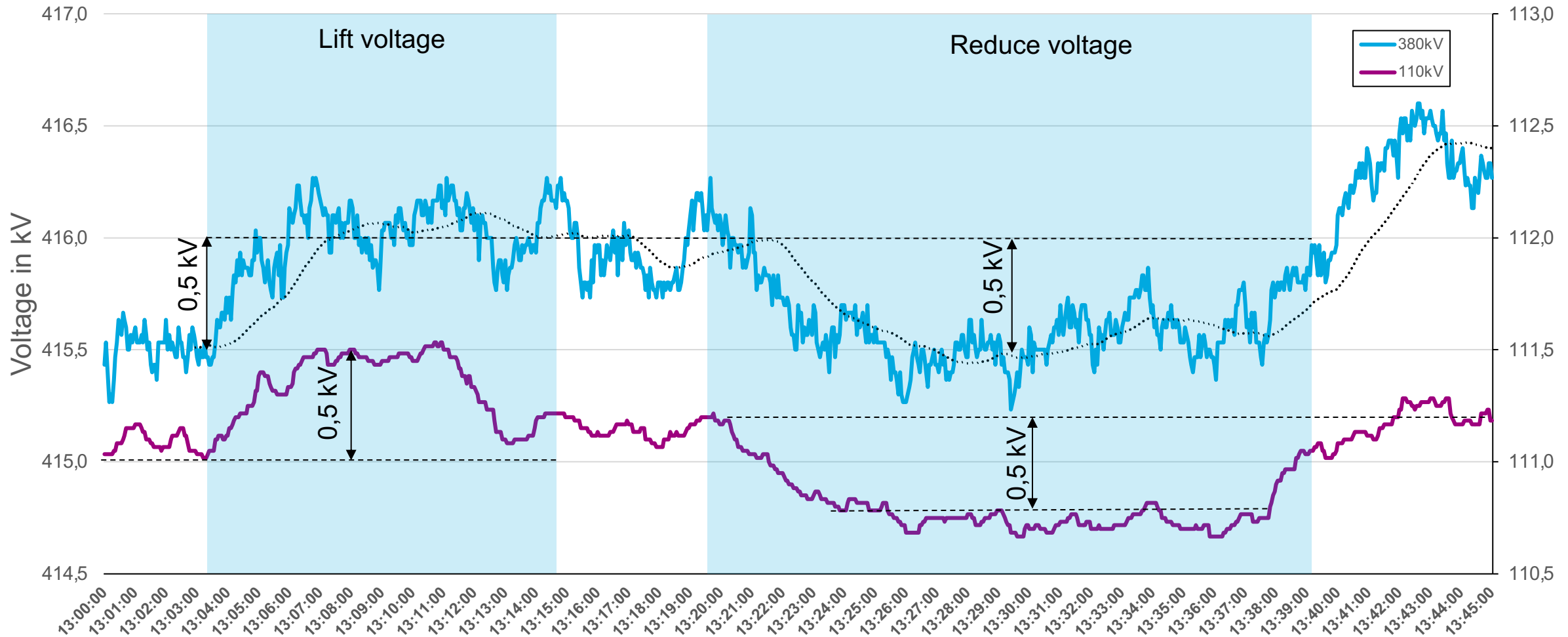
Measurements from field test

Reactive Power at TSO/DSO-Transfer point (transformer)



Measurements from field test

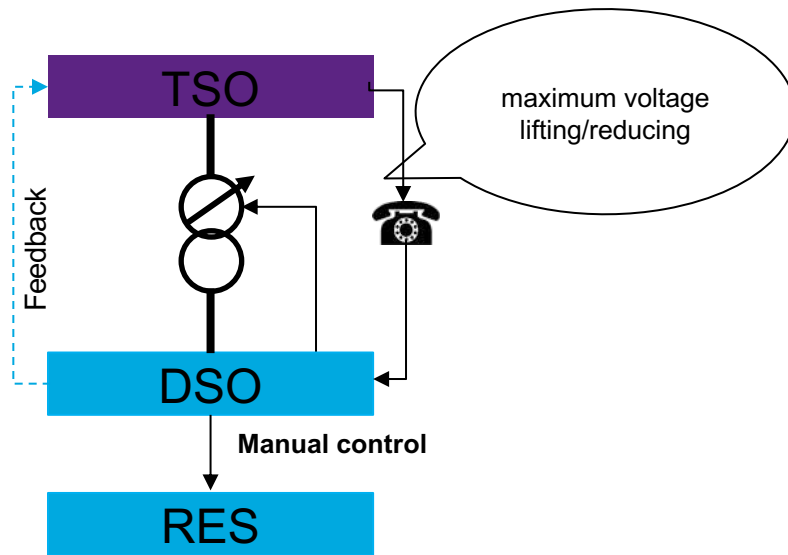
Voltages in 380kV and 110kV grid



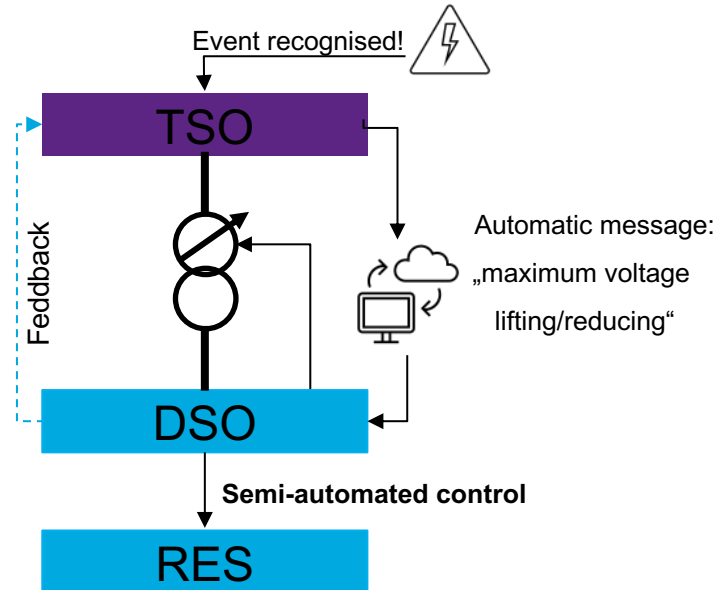
Activation concepts

High flexibility and scalability

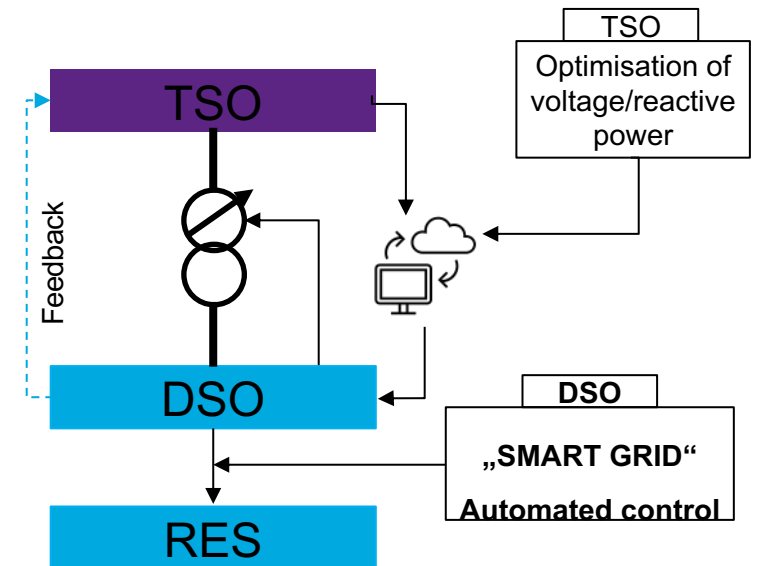
Level of automation 1



Level of automation 2



Level of automation 3



TSO	Transmission system operator
DSO	Distribution system operator
RES	Renewable Energy Sources

RESULTS AND BENEFITS OF THE PROJECT

- **Real field test for testing the coordinated reactive power exchange**
- **Agreed activation concept between TSO/DSO**
- **High scalability:** the concept for coordinated reactive power exchange can be used in any electricity grid in the world.
- **High influence:** Amprion and E.ON are the two biggest grid operators in Germany, the influence within Germany is very high.
- **Practicality:** if required, the concept can be used on a daily basis in operational use.
- **Independence from conventional energy sources :** by using the available reactive power potential of renewable energies, especially wind power plants, grid operators are no longer dependent on the reactive power of conventional power plants.



Thank you for your attention 😊

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