Current and future challenges of the European power grid

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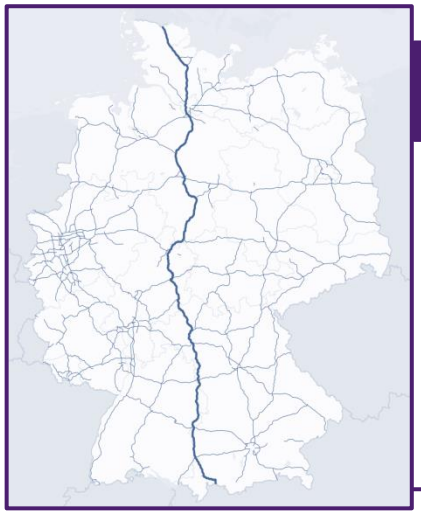
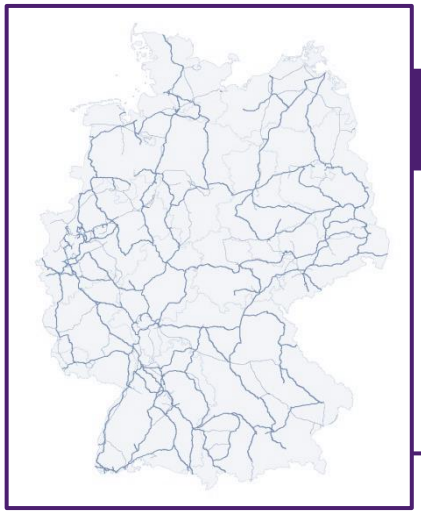
Bulk power wheeling: the new challenge for the grid

Transmission grid in comparison to motor highways in Germany



German highway A7

- Germany‘s longest highway: nearly 1.000 km.
- One of the busiest highway sections nationwide is located in the region of Hamburg.
- It‘s frequented by up to approx. 165.000 vehicles per day until 2025. This nearly equals a **triplication** of the planned and foreseen usage in the 1970s.



… compared to the transmission grid

- Today 1 MW is transported up to 175 km before reaching the customer. This nearly equals a **quadruplication** of the transportation load with reference to 1990s.

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The European scope: cross-border congestion management

Physics sets our limit – system security is our responsibility!

temporary congestion

structural congestion

TSO cooperation on congestion management

- guarantee secure system operation
- enable a functioning energy market

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Interconnectors cannot be judged separately

Highway compared to transmission grid:

If a 2-lane highway is progressively expanded section by section up to a 4-lane highway, the relevant transport capacity is the two lanes until the construction work is finished.

What does that mean for the transmission grid?

- Projects to extent and develop internal lines are „en route“.
- The German network development plan and the European TYNDP are completely integrated.
- The capacity of tie lines and internal lines commonly set the limit.

Coordinated extension of interconnectors and internal lines is needed to increase economic efficiency and social welfare.

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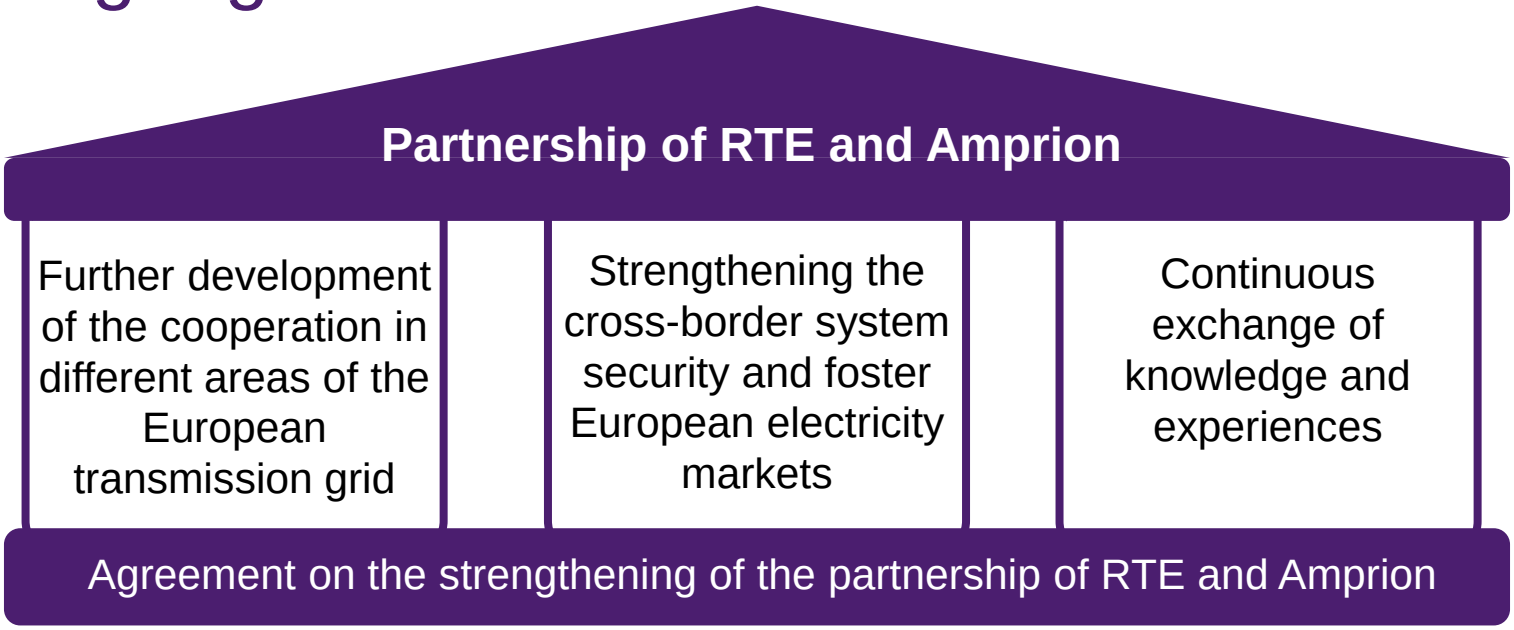
Best way of tackling the various challenges: working together



Joint Generation Adequacy Study

- Exchange of results and basic methods for the preparation of the respective national reports on security of supply and on adequacy forecasts
- Creation of a commom European data set and common use of a simulation software
- Sucessful implementation of the joint study on the assessment of security of supply

Joint study: innovative probabilistic approach to assess security of supply

Methodology

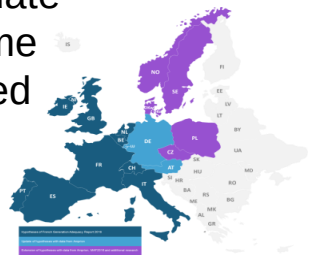
Generation adequacy has been analysed by using the **probabilisitic adequacy simulator ANTARES**

➔ This is useful to account for a large number of combinations of uncertainties that the power system could face in the future.

A remarkable strength of the adopted methodology is the use of **1.000 Monte-Carlo scenarios** (combination of different stochastic variables), including **200 climate scenarios** (on which were derived load, wind power and solar power time series), 60 hydrologic scenarios and 60 thermal outages and maintenance scenarios.

Perimeter of the study

- Analysed horizon: winter 2020-2021
- RTE's adequacy report plus neighbouring countries of Germany (update of data for some countries based on internal data of Amprion)



Generation adequacy assessment aims to analyse situations when shortfalls (e.g. due to unscheduled outages of resources or low intermittent RES generation) occur.

➔ To foster the understanding of these complex situations, it is important to **analyse the security of supply <u>continuously</u>**.

➔ **Methodology improvements** should always be considered and investigated in order to understand the complex interaction of different input parameters on the resulting adequacy indicators.

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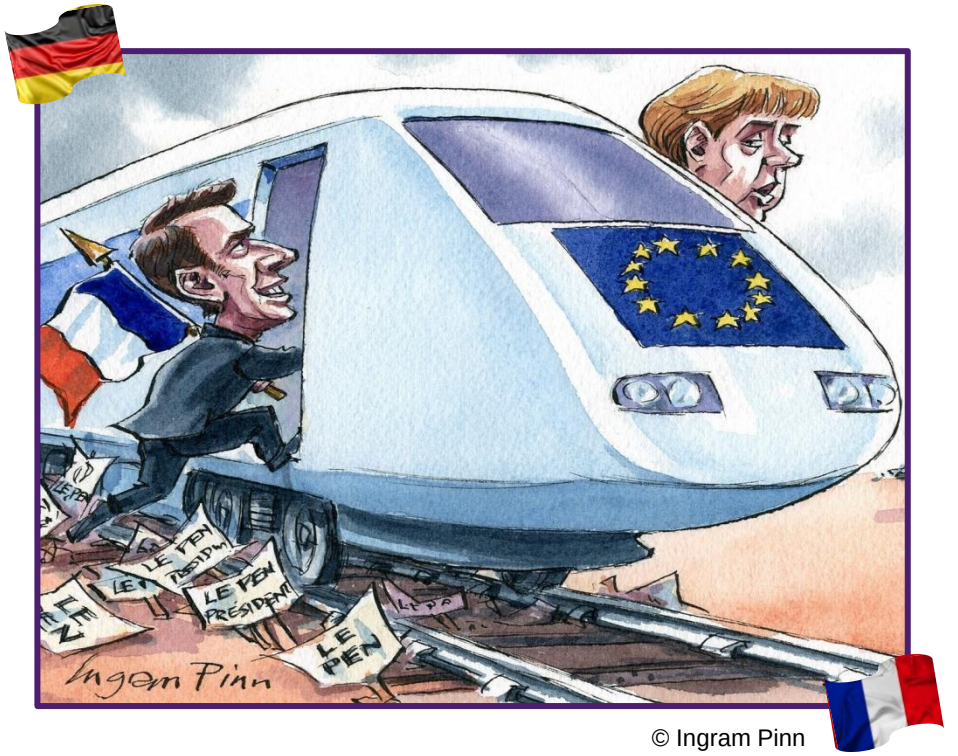
Close French-German cooperation is vital to keep the lights on

- As of today (11/2017) **power shortages are <u>not</u> expected for Germany** with respect to the forthcoming winter, but **there may be shortages in neighbouring countries**.
- **Critical situations may occur in winter time again** when there is high load and reduced feed-in of renewables (no wind, no photovoltaic – „Dunkelflaute“).



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Regional cooperation proves to be **<u>the</u>** tool for guaranteeing a stable system

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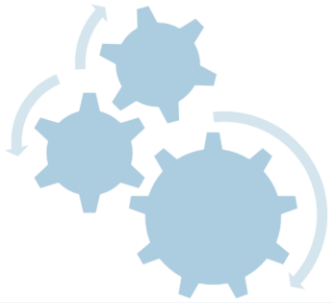
Clean Energy Package: Europe is on the brink of a green energy revolution

Sector coupling:
innovation to help integrating the renewables into the system



In using existing gas infrastructure grid congestions could be reduced in a mid term perspective

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Sector coupling – e.g. Power to Gas (PtG) – could contribute to the reduction of grid congestions

- A grid beneficial use of Sector coupling, e.g. PtG allows to transform and feed-in renewable energies like wind power or solar power in the existing gas infrastructure.
- To realize significant effects on the grid congestions there are capacities of several GW necessary, today plants have a capacity of several MW. A scale up factor of 1.000 is necessary.

- PtG – intelligently used – reduces grid congestions. That's why PtG is a **key element from 2030 onwards**.
- EU framework has to go forward by **starting the development** of pilot plants in order to have the political option for large scale PtG plants at hand in 2030 and to reap the beneficial effects on the energy system.

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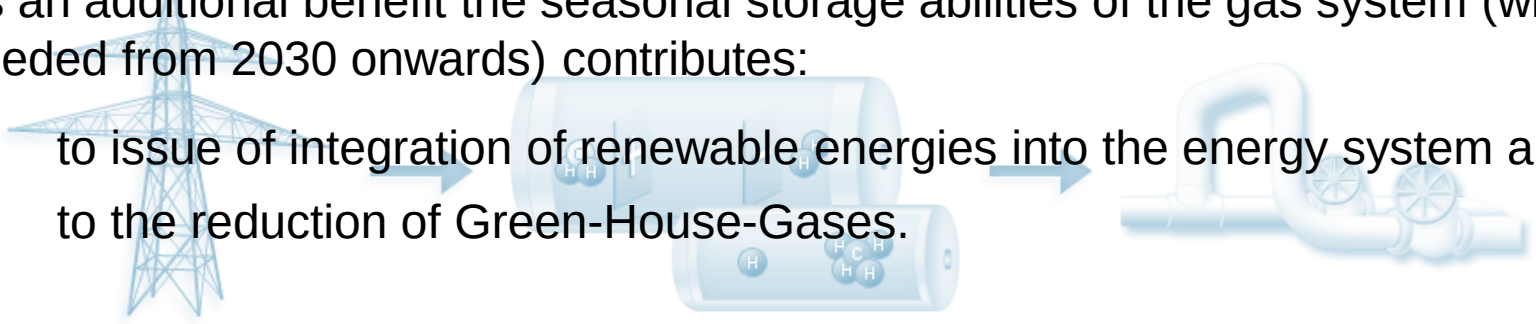
Sector coupling – e.g. PtG – opportunity to meet the challenge of seasonal storage of green energy

- As an additional benefit the seasonal storage abilities of the gas system (which is needed from 2030 onwards) contributes:
  1) to issue of integration of renewable energies into the energy system and
  2) to the reduction of Green-House-Gases.



- PtG opens up two simultanuous opportunities by reducing congestion management and meeting the challenge of seasonal storage of clean and green energies.
- Innovation needs stable framework conditions and the right incentives. Politics should support these projects, e.g. by EU-funding-pools.
- The time has come to set the right course.

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Right course: EU energy goals bring welfare to EU citizens…

CEP sets framework to address future challenges and should further increase value for citizens as electricity customers:

- Grid interconnection (TYNDP) brings a value of up to 300 bn €
- Integration of volatile renewable energies
- Risk Preparedness Regulation reduces risk for citizens
- Strengthening of customers
- Empowerment of customers

… but a few important improvements are needed to strengthen areas that bring **added value to citizens**, **reduce risks for system security** and facilitate **buy-in from citizens**.

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TSOs are ready to enhance cooperation and contribute to enhance the Energy Transition

Prerequisites to tackle the current and future challenges

- Clear responsibilities for system security and security of supply: in line with political and physical realities to support the energy transition.
  - Responsibility for system operation and system security is not dividable and is the responsibility of the TSOs
- Flexibility: with regards to regional/local requirements and RES development
- Incentivize measures that help to increase acceptance to support a timely implementation and system resilience
- A well balanced and sufficient governance that facilitate a secure electricity system and functioning market
- It's not about markets per se, but about contributing to an efficient and secure market design. No grid, no trade!

TSOs will continue their efforts to realize the vision of an integrated European Electricity Market

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