

Challenges and Scenarios for Transmission Systems in Germany and Europe

European Electricity Workshop

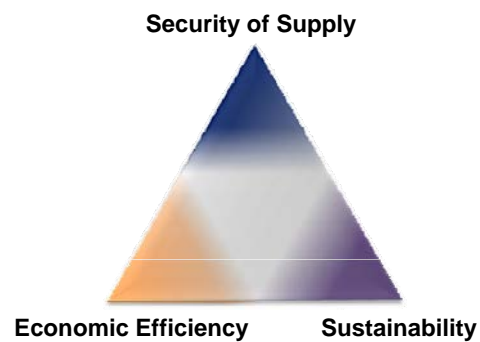
July 16, 2010
Berlin

Dr. Christoph Maurer



The Role of Electricity Transmission

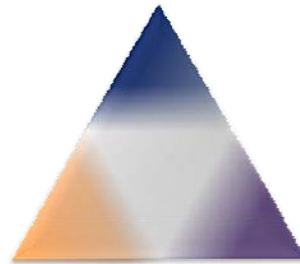
- Electricity supply is always located in the stress field of several objectives



The Role of Electricity Transmission

- Electricity supply is always located in the stress field of several objectives
- Electricity transmission affects all these related objectives

Stable and Secure
System Operation



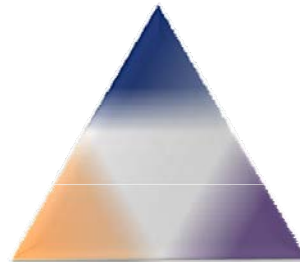
Platform for EU
Internal Electricity Market

Integration of
RES Generation

- ➔ Electricity policy means important challenges for transmission systems

Important Challenges for Transmission Systems

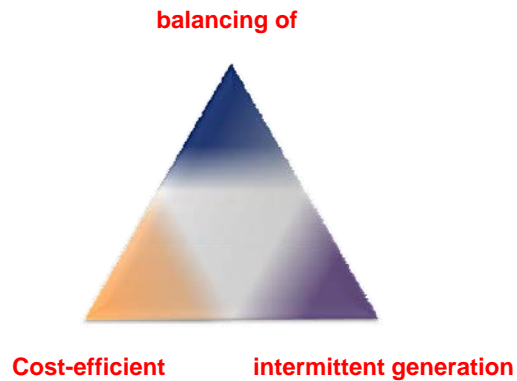
Adequate system capacities



to meet changes in generation infrastructure

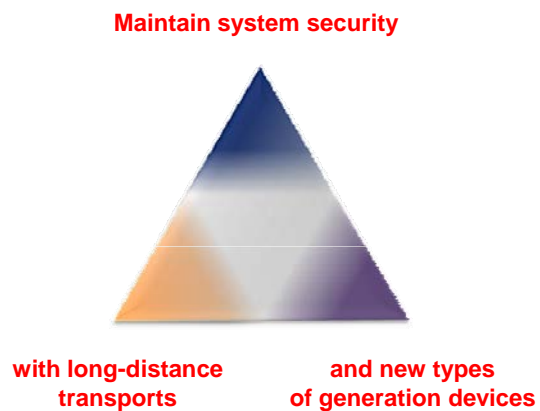
Important Challenges for Transmission Systems

- Adequate system capacities to meet changes in generation infrastructure



Important Challenges for Transmission Systems

- Adequate system capacities to meet changes in generation infrastructure
- Cost-efficient balancing of intermittent generation

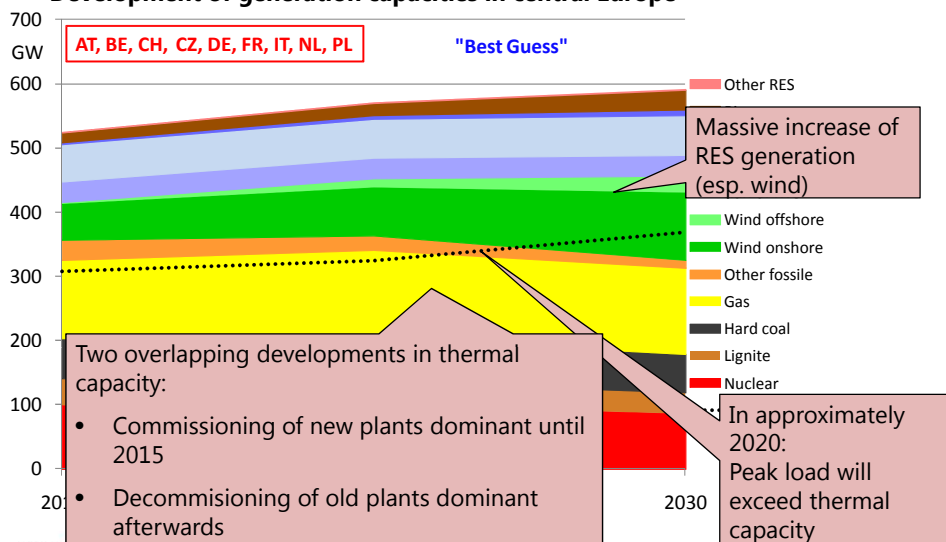


Important Challenges for Transmission Systems

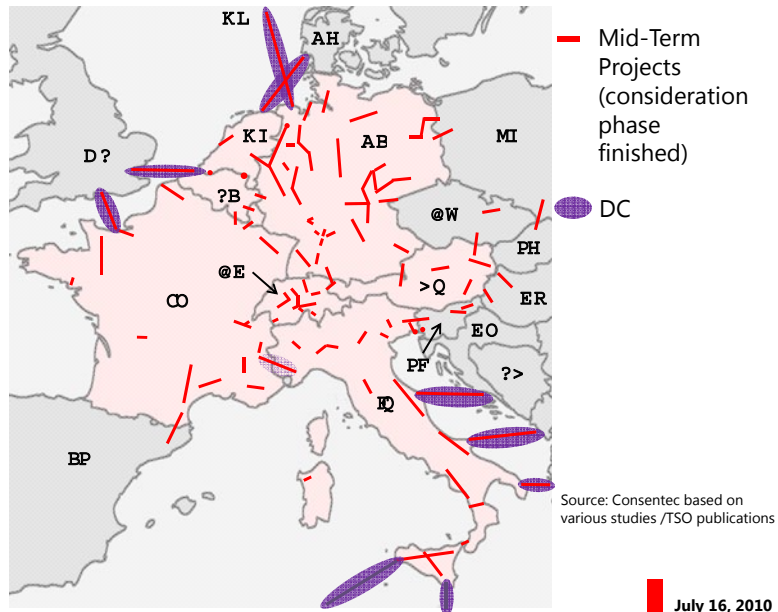
- Adequate system capacities to meet changes in generation infrastructure
- Cost-efficient balancing of intermittent generation
- Maintain system security with long-distance transports and new types of generation units

Expected Changes in Generation Infrastructure

■ Development of generation capacities in central Europe



Foreseen Mid-Term Grid Extension Projects



Grid extension is inevitable and needs support from all stakeholders

■ Enormous Grid Extension Plans published

- ENTSO-E TYNDP: Projects of European importance with a total length of 42,100 km, of which 18,700 km are needed in mid-term (until 2015)
- German TSOs have announced about 1,400 km of new lines until 2015 and have already published so far plans for another 2,500 km until 2030
 - Ongoing studies show demand for 5,000 to 6,000 km until 2030

➔ **But only 90 km out of 850 km of new lines identified as necessary for German transmission grid until 2015 in DENA grid study published in 2005 have been built up to now**

➔ We will have to think on further measures to

- avoid administrative risks by
 - accelerating permission procedures
 - setting appropriate investment incentives for TSOs
- coordinate generation and transmission planning

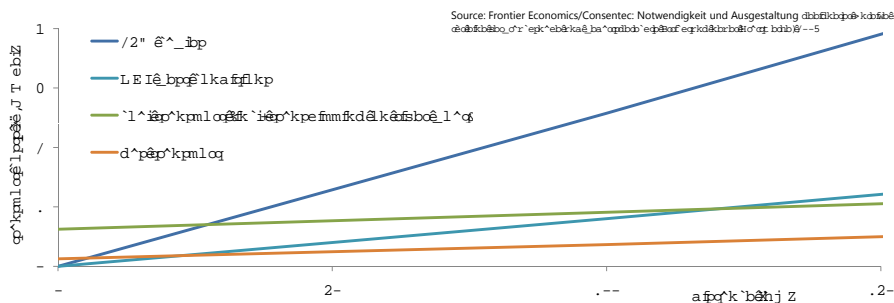
Avoiding administrative risks for grid extension

- **Grid planning means making decisions under uncertain boundary conditions**
 - Especially relevant for transmission systems where transport requirements change faster than new lines can be built
- ➔ **Typically, ex-post optimal solutions are not achievable**
- ➔ **Hence, we should concentrate to find a wide consensus on an optimal solution from an ex-ante perspective and do everything to realise it**

- **Measures which can support such realisation if appropriately applied**
 - Clear definition of scenarios under consultation of stakeholders
 - Laws/directives on necessary projects → avoid assessment of technical and economic necessity in individual permission procedures (e.g. Enlag (DE), Strategic Transmission Grid (CH))
 - Take away regulatory efficiency risk from TSOs for these projects, potentially combined with incentives for efficient project realisation (idea of so-called investment budgets in DE)

Coordination of generation and transmission planning

- **Traditionally, such coordination has been pursued quasi automatically in vertically integrated companies**
- **Nowadays replaced by "transmission follows generation" policy**
- ➔ **General efficiency of this policy seems to be questionable**
- **Study for BMWi: Comparison of costs for transport of power and primary energy (hard coal along river Rhine and dedicated pipelines for gas)**



- ➔ **Incentive schemes (e.g. locational grid tariffs or cap & trade/auctioning) are necessary in order to influence location of new conventional plants**

Consequences of nuclear phase-out in Germany

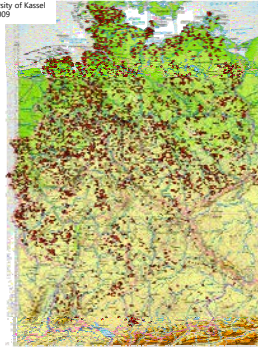
■ Internal congestion due to transports from North-East to South-West

Source: Physik University of Munic



Location nuclear plants

Source: ISET University of Kassel
status: 2009



Location wind generators

- Plants in the south are threatened by decommissioning first (in blue)
- ➔ This will even worsen congestion in the transmission grid and increase mid-term investment needs

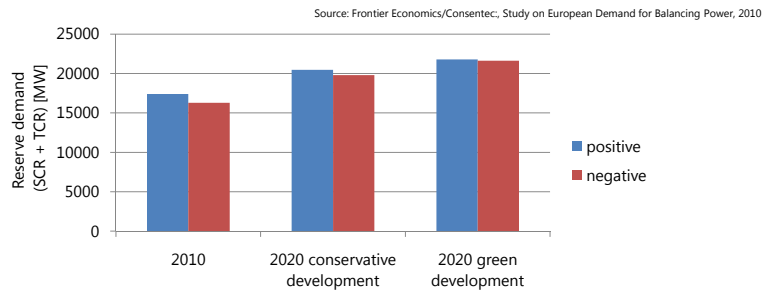
Important Challenges for Transmission Systems

- Adequate system capacities to meet changes in generation infrastructure
- Cost-efficient balancing of intermittent generation
- Maintain system security with long-distance transports and new types of generation units

Cost-efficient balancing of intermittent generation

■ Expected changes in demand for reserve power (secondary/tertiary) in central Europe (DE, FR, Benelux, AT, CH) from today until 2020

- Probabilistic dimensioning with accepted deficit probability of 0.1% per country
- Optimistic assumptions for improvements in forecast accuracy → in reality even higher amounts might be required



➔ Additional reserve demand requires pan-European approach for balancing

Cost-efficient balancing of intermittent generation

■ Hydro-based systems like AT, CH, NO could efficiently provide reserve power and balancing energy

➔ Reservation of cross-border transmission capacity for balancing purposes?

- Has been shown to be efficient from a theoretical perspective
- Sensible amount of capacity reservation is difficult to determine ex-ante, however
- Any capacity reservation might be a risk for competition where a withhold of capacity cannot be excluded

➔ A TSO-to-TSO exchange of balancing services seems to be the favourable solution

- Grid control cooperation in Germany and its international extension are an important first step

➔ But additional measures are needed

- Market integration of renewables, possibility to provide reserve with RES
- New storage capacities
 - Market based, no direct coupling with RES infeed!

Important Challenges for Transmission Systems

- Adequate system capacities to meet changes in generation infrastructure
- Cost-efficient balancing of intermittent generation
- Maintain system security with long-distance transports and new types of generation units

Maintain system security with long-distance transports and new types of generation units

- **Locally concentrated RES generation**
 - often located in areas with low load and distant from load centers
 - negative loads for the transmission grid
 - Long distance transports and local generation shortage
- Technically necessary minimum of conventional generation? → Needs to be quantified
- Additional data-requirements on status/infeed of distributed RES generation (forecast and online data)
- (n-1) as general security criterion still sufficient in systems with huge exports/imports and long distance transport?

Summary

- **Electricity transmission in Europe is facing enormous challenges**

- **Appropriate solutions to these challenges are a prerequisite to fulfil the targets of EU energy policy**
 - Grid extension is inevitable but needs support by additional measures
 - Remedies to administrative risks
 - Improved coordination between generation and transmission planning

 - Balancing of intermittent generation is a challenge which needs strong cooperation of producers and TSOs all over Europe

 - Whilst system planning and extension are in the focus of all stakeholders, increasing risks for system operation require attention, too.

Thank you for your attention.

**Dr. Christoph Maurer
CONSENTEC Consulting für
Energiewirtschaft und -technik GmbH**

**Grüner Weg 1
52070 Aachen
Deutschland**

**Tel. +49. 241. 93836- 20
Fax +49. 241. 93836- 15**

**maurer@consentec.de
www.consentec.de**