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Key Challenges for the German Energy Transition and its Market Design

US-System-Operator Study-Tour

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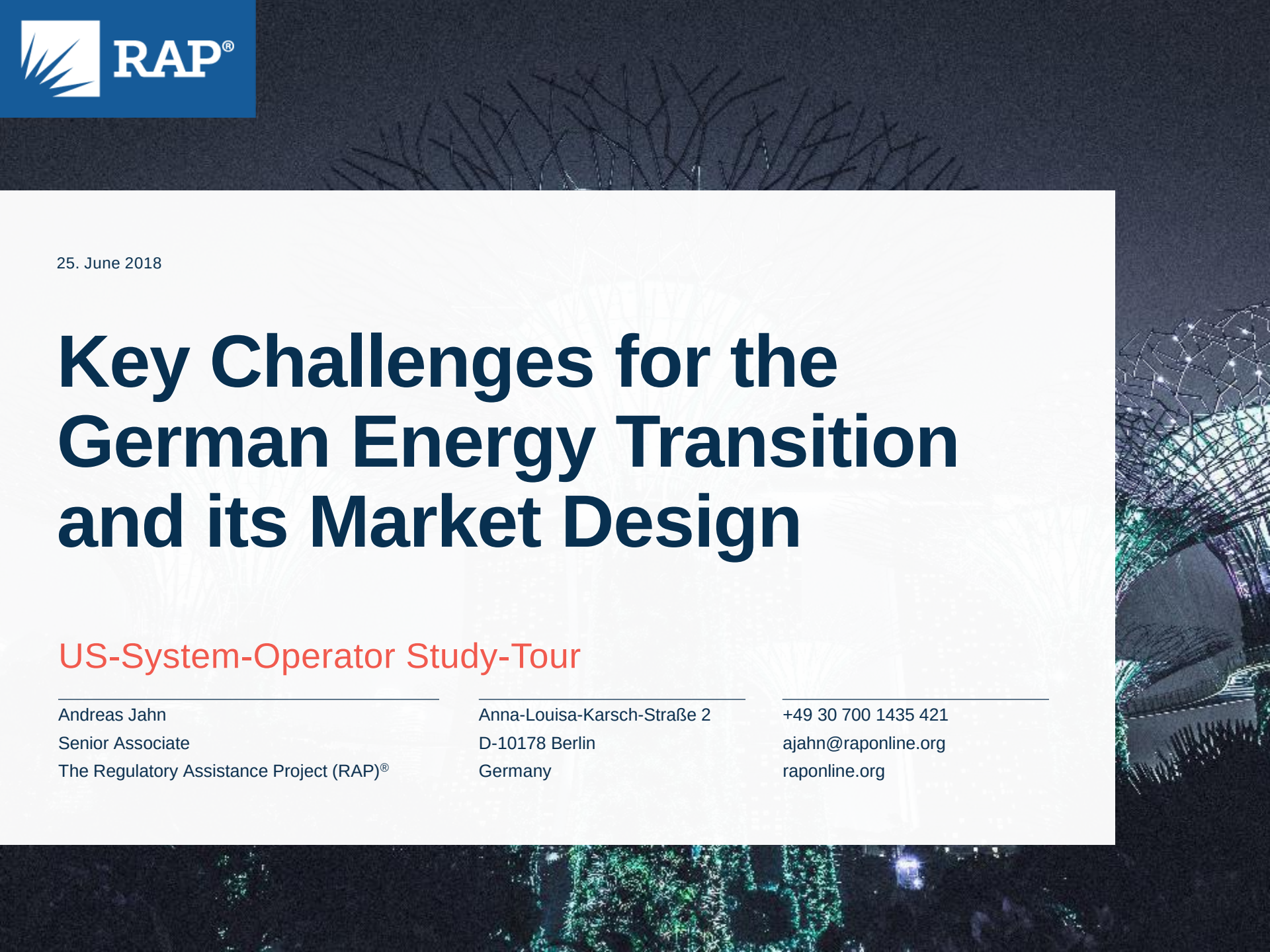


Agenda

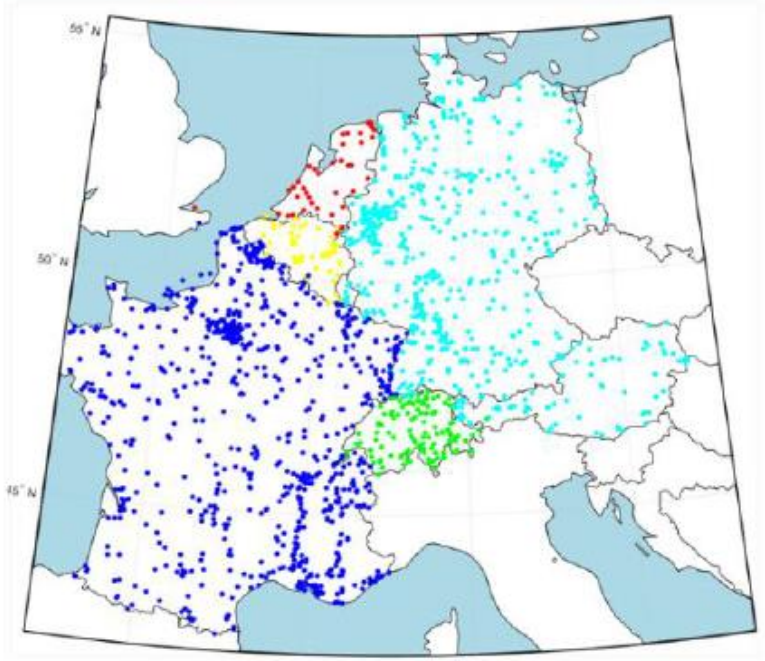
Challenges for today's market design

- EOM 2.0
- Coal phase out
- EEG reform/auctions
- Tariff design
- Electrification of transport and heat

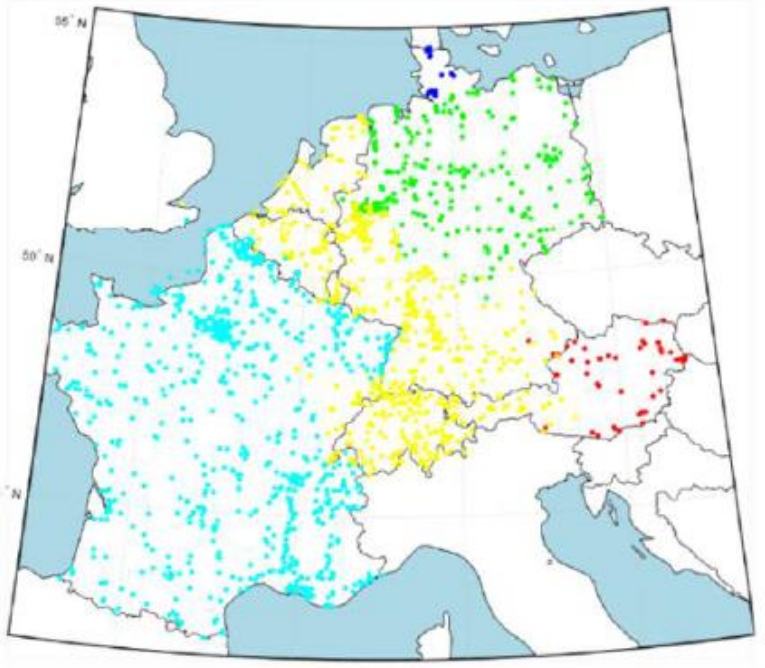
1 German/EU market design

Power market configuration along national borders – without LMP

Current Configuration



Optimized 5-zone Configuration



Source: CEREG (Belgium Regulator 2016)

Transmission: Ownership and operation in one hand

25% owned by RWE-utility

100% owned by EnBW-utility

TSO doing jointly

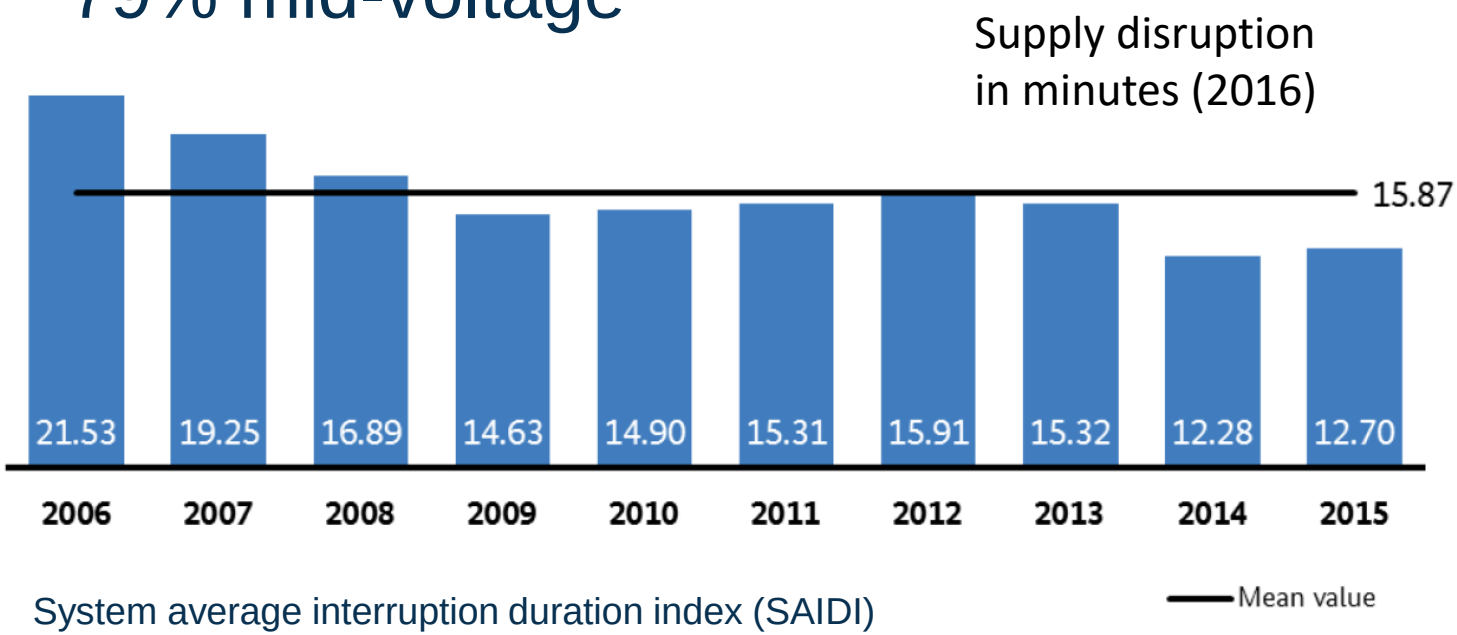
- network planning
- auctions on balancing resources/ancillary services

Source: KWH-Netz

System resiliency

Increased share of underground cables

- 89% low voltage
- 79% mid-voltage



System average interruption duration index (SAIDI)

Source: BNetzA

Decentralized dispatch

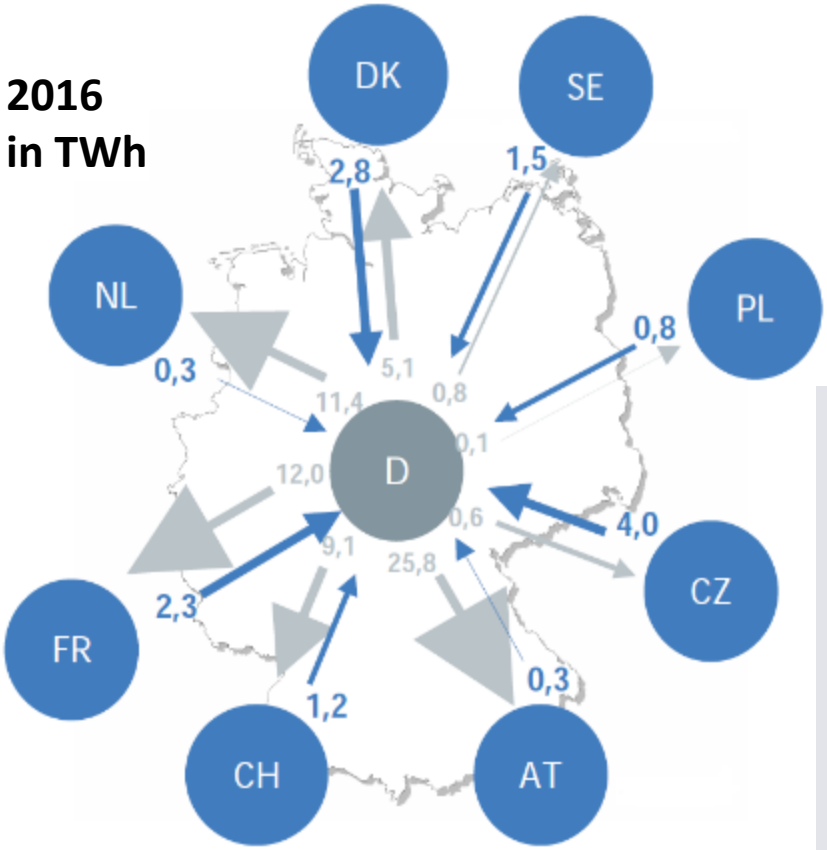
- „Balancing responsible parties“ are private enterprises (generators, suppliers, retailers)
- Central dispatch by system operators after gate closure, only

2 Challenges

German power market design

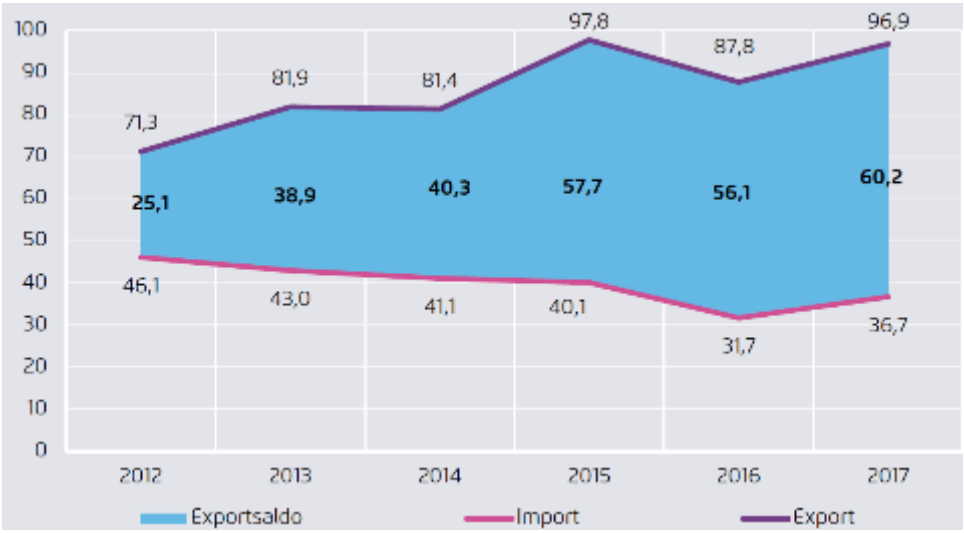
- EOM 2.0 provides price incentives (shortage pricing) for investments into peak generation, DR and storage, without capacity payments.
- Backup by out-off-market “strategic reserves”
- Flexibility has time value only, no locational value in todays market design.
- Consumer benefit from Internal European Energy Market, but policies and operation mostly national…

Interconnectional power flows



Germany, the EU power hub

Germany, the EU power house



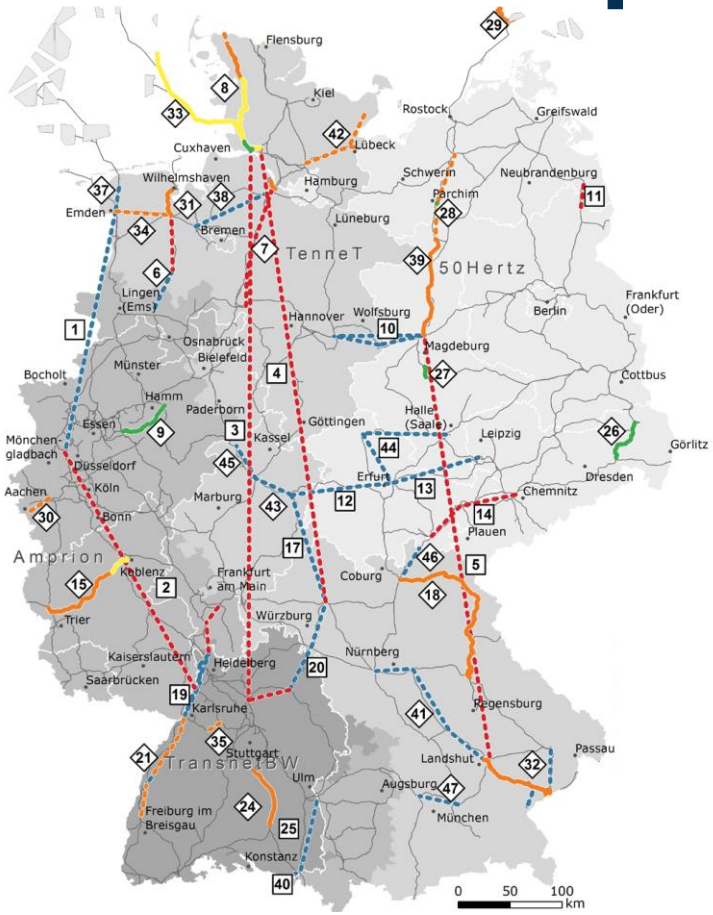
Source: BNetzA Monitoring /Agora Energiewende

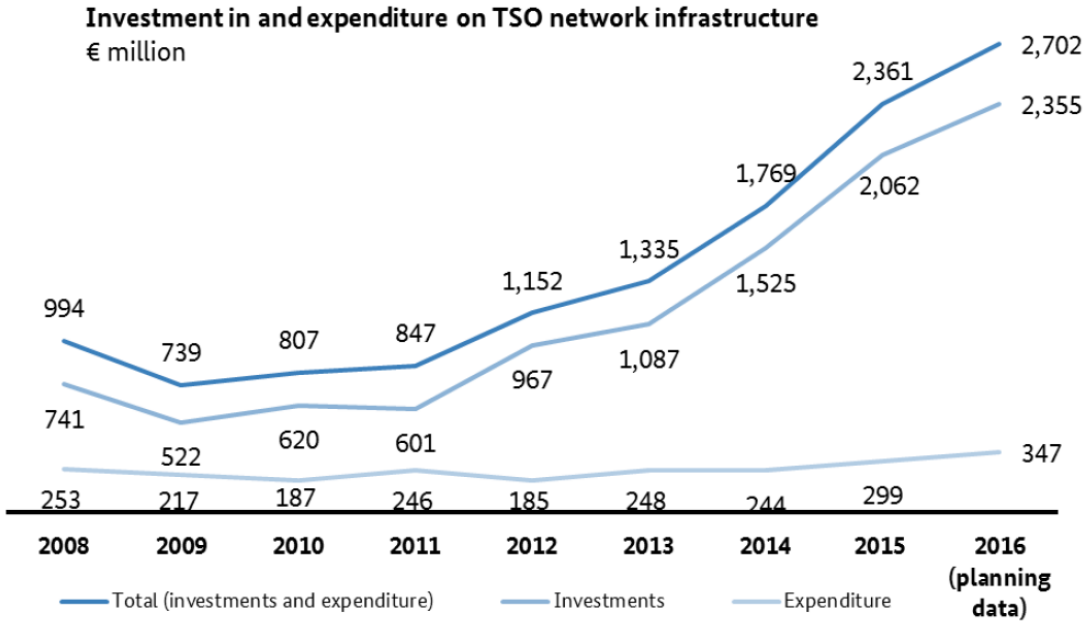
Capacity surplus – how to get rid of the wrong resources, best?

- RES has been added successful
- Emission prices (EU-ETS) are relatively low
- Existing (high emission) resources still generating (lignite is cheaper than gas)

⇒ Gov. installed “coal commission”, should determine coal (lignite) phase out and required support for mining regions until Dec. 2018

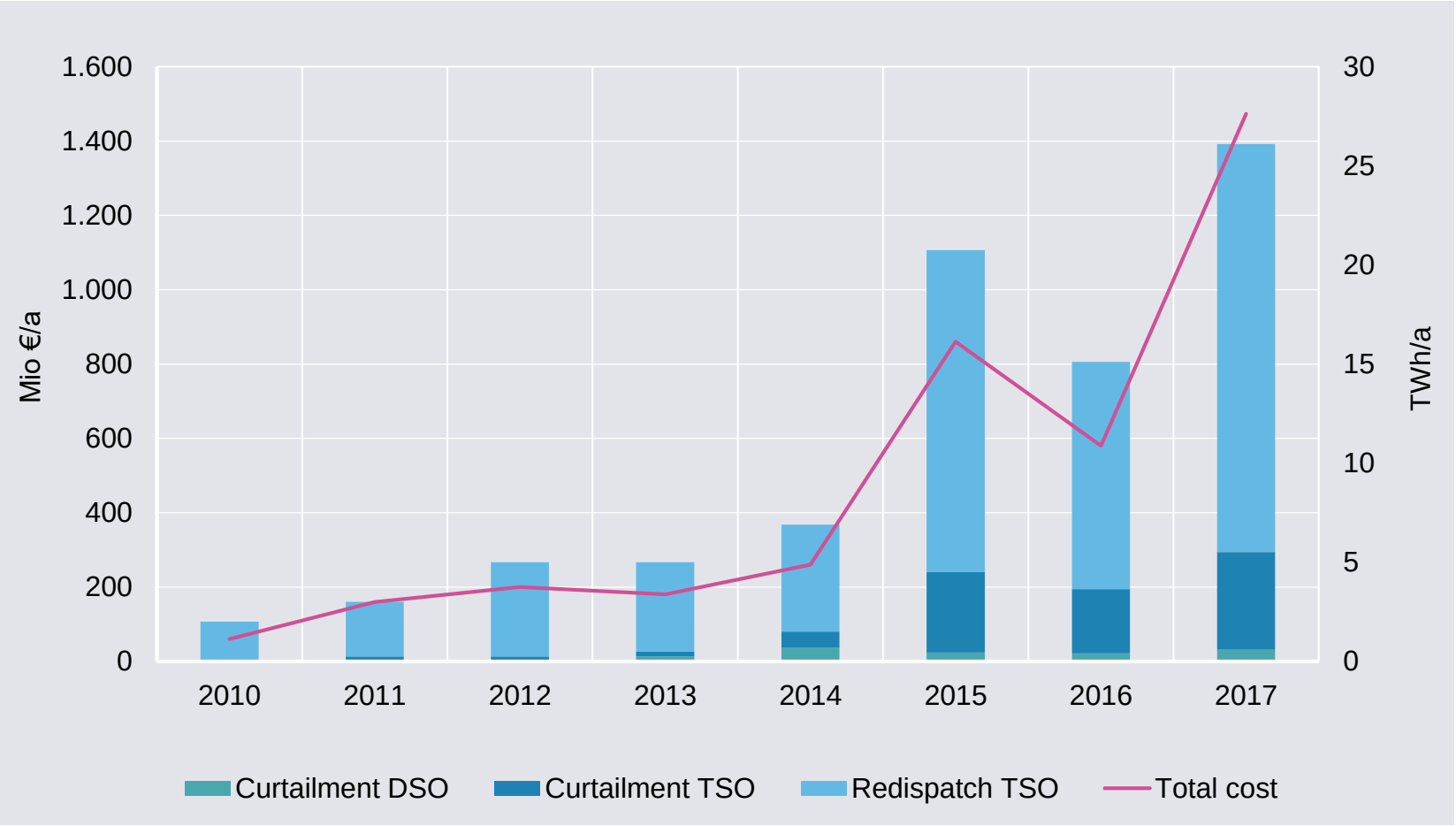
Transmission network investment plans and costs





Source: BNetzA

Development of redispatch costs



Source: Agora Energiewende

RE support: From FiT to auctions

Auction results are lower than Feed-in-Tariff:

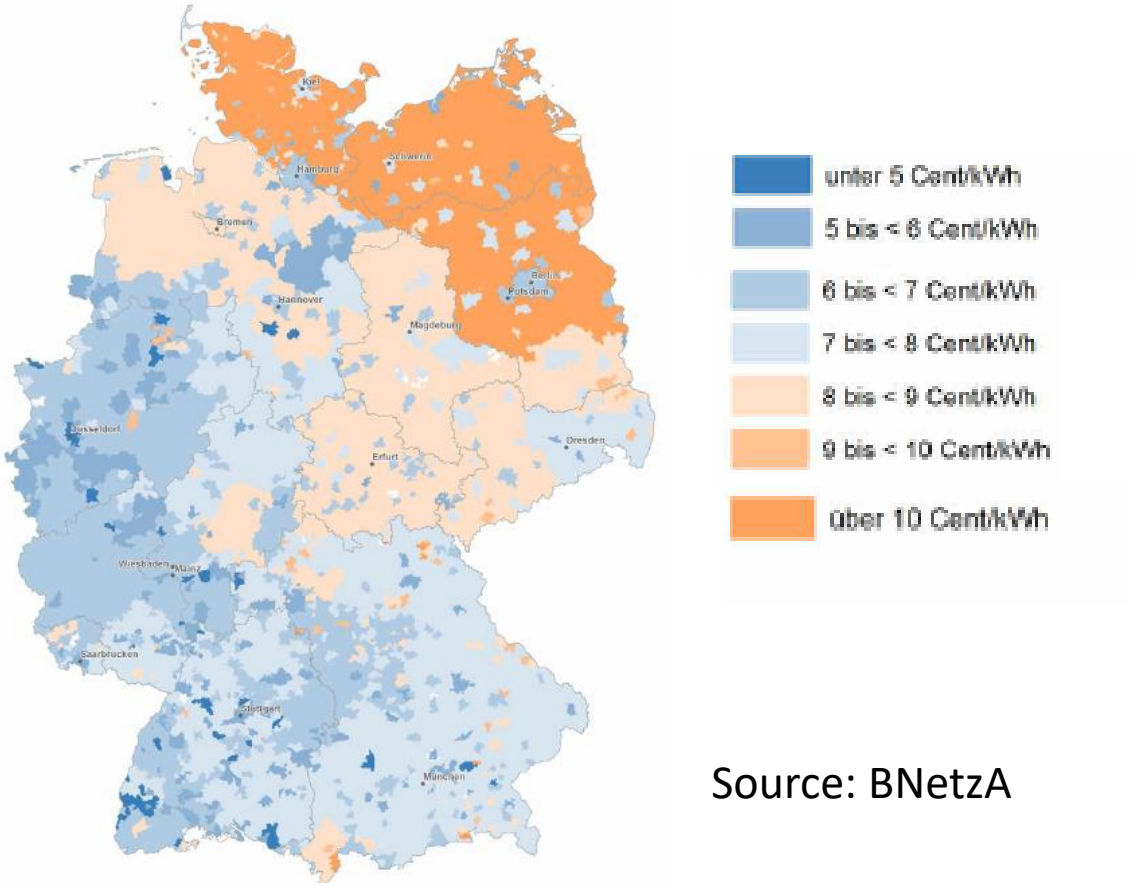
- Price increase is screenshot
- Investors revenue streams are wholesale markets or auction results as backup
- Offshore grid costs are socialized

Technologie	Gebotstermine 2018	Zuschlagswert* (ct/kWh)	letzte Zuschlagsliste
Solar	**1. Februar** **1. Juni** 1. Oktober	4,33 4,59 -	**06/2018**
Onshore	**1. Februar** **1. Mai** 1. August 1. Oktober	4,73 5,73 - -	**05/2018**
KWK	**1. Juni** 1. Dezember	4,31 -	**06/2018**
innovative KWK-Systeme	**1. Juni** 1. Dezember	10,27 -	**06/2018**
Biomasse	1. September	-	**09/2017**
Offshore	**1. April**	4,66	**04/2018**
Technologie-übergreifend	**1. April** 1. November	4,67 -	**04/2018**

Source: BNetzA

Increasing Price Differences

Distribution network fees for household in 2016 (at 3500 kWh)



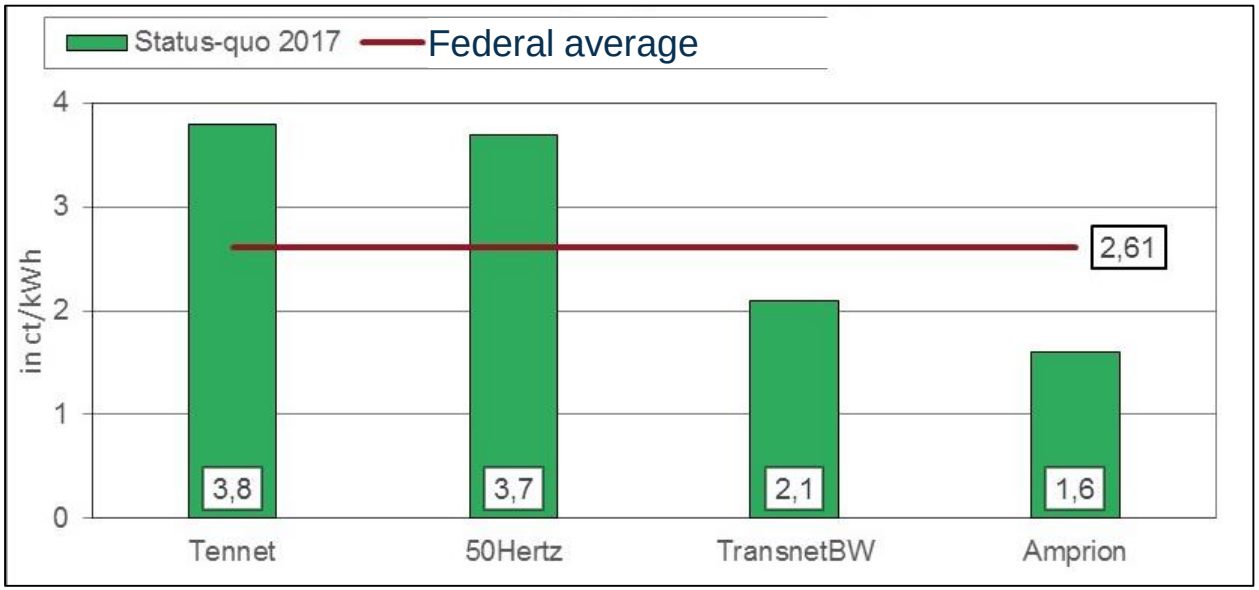
Source: BNetzA

⇒ Rural networks with high RE-penetration and low demand becoming more and more expensive

⇒ Demand in cites, far from supply is less effected and cheaper

Regional transmission fees become harmonized until 2023

States (Länder): „Differences in transmission fees are an unfair (dis-)advantage to local economy“



Source: 50Hertz, Vereinigung sächsische Wirtschaft

Increasing fixed charges

Due to missing regulation, distribution networks increased fix charges over the last couple of years.

Fixed Charges for Consumers below 100,000 kWh/year (SLP) in Germany

	2013	2014	2016	2018	
Average Fixed charge	14.16	16.44	20.71	60.5	€/year
Max. Fixed charge	33.96	36.50	50	96	€/year
Networks without fixed charge	29	24	15	(?)	Out of 860 in total

Source: BNetzA Netzentgeltsystematik 2015, Spiegel-Background/Verivox

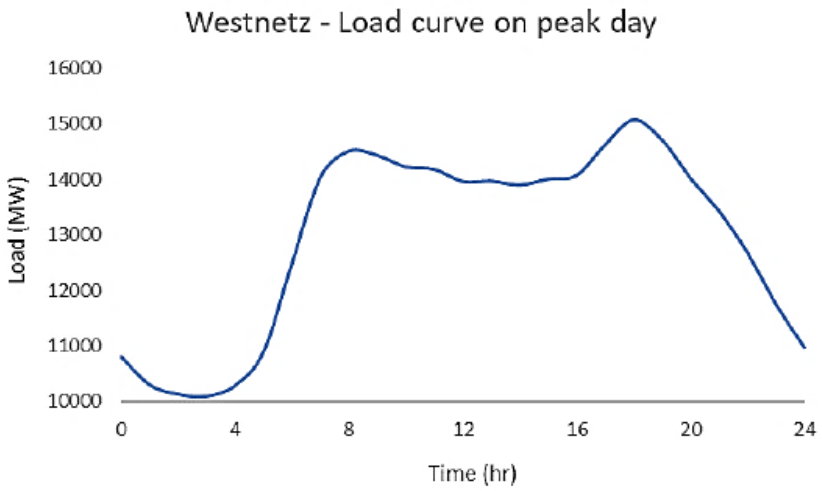
⇒ Up to 50% of network costs are paid fix by low demand customers (e.g.in appartments) in some networks

New demand is flexible

To achieve 2030 German decarbonization target, fossil assets need to be replaced by

- 2 to 4 million heat pumps
- 5 million EV

Network infrastructure is good/underutilized. Smart electrification will be beneficial, but network owners are keen about investments…



Source: RAP

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

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