



# *Electricity Grid Planning in Germany*

Knowledge-exchange between US and German power system operators  
Berlin, 25 May 2018

**Arne Genz**

German Federal Ministry for Economic Affairs and Energy

Division IIIC1 - National and European electricity grids and electricity grid planning

# 4 German Transmission System Operators (220 and 380 kV)

## Amprion

- Circuit length: 11,000 km
- Maximum load: 31 GW
- Generation capacity: 64 GW

## 50Hertz

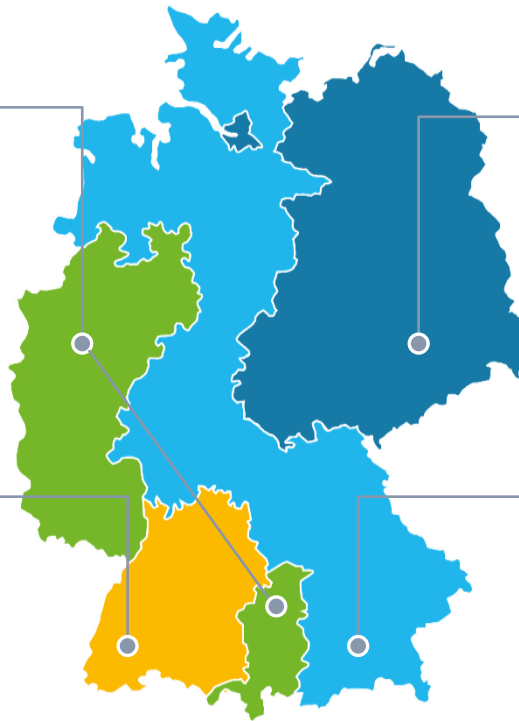
- Circuit length: 10,200 km
- Maximum load: 16 GW
- Generation capacity: 50 GW

## TransnetBW

- Circuit length: 3,100 km
- Maximum load: 10 GW
- Generation capacity: 21 GW

## Tennet

- circuit length: 12,400 km
- Maximum load : 25 GW
- Generation capacity: 66 GW

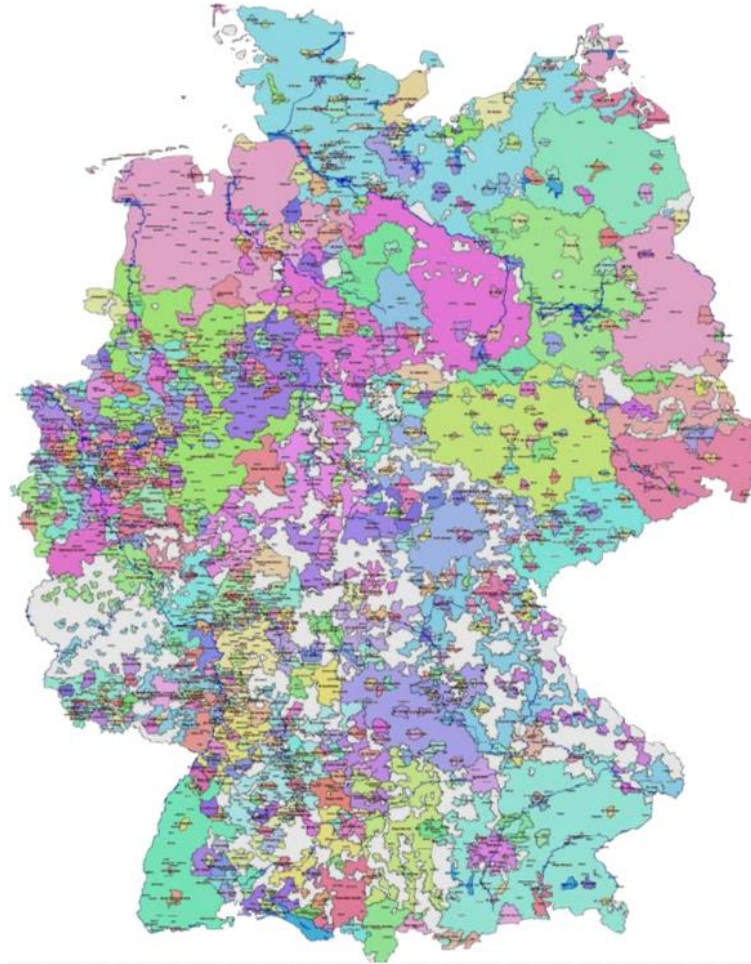


The 4 German TSO are either completely ownership unbundled or Independent Transmission Operators (ITO) („third option“ according to European Law)

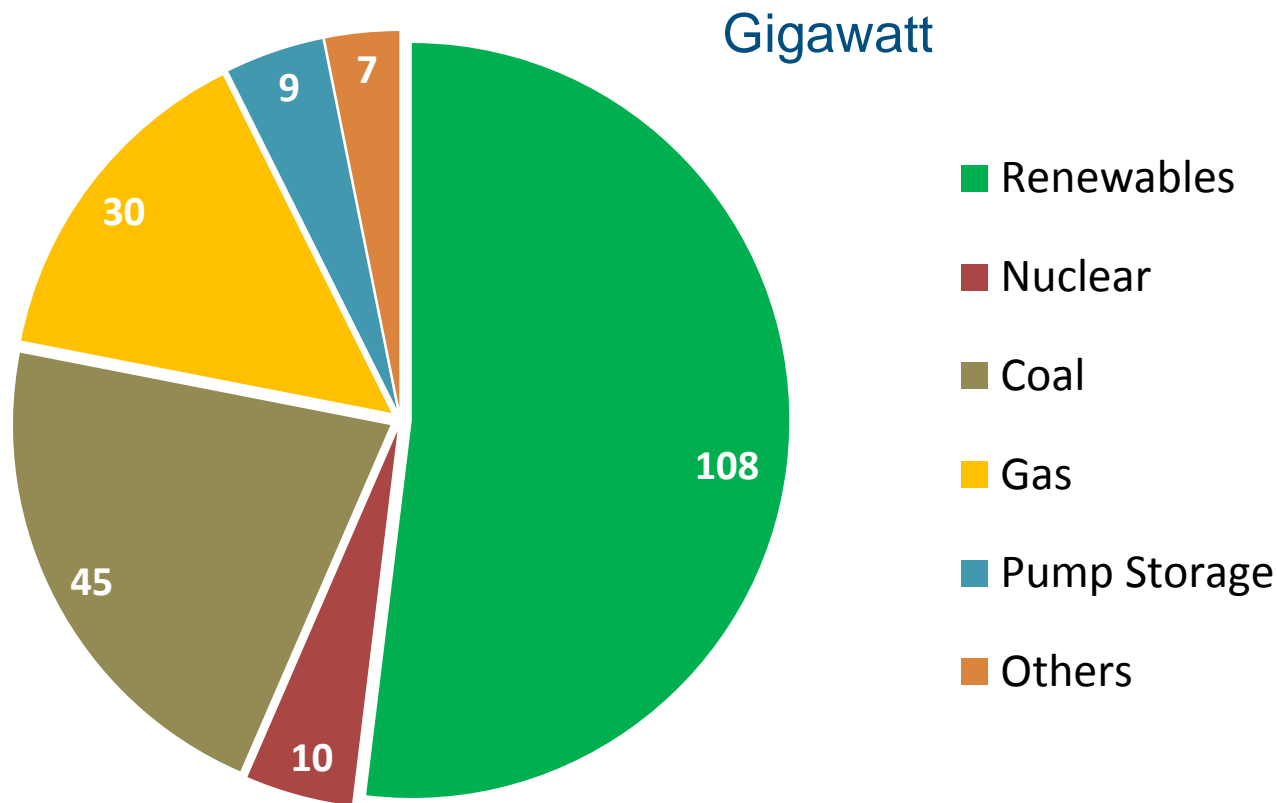
---

# 878 Distribution Grid Operators in Germany ( $\leq 110$ kV)

---



# Installed Generation Capacity in Germany

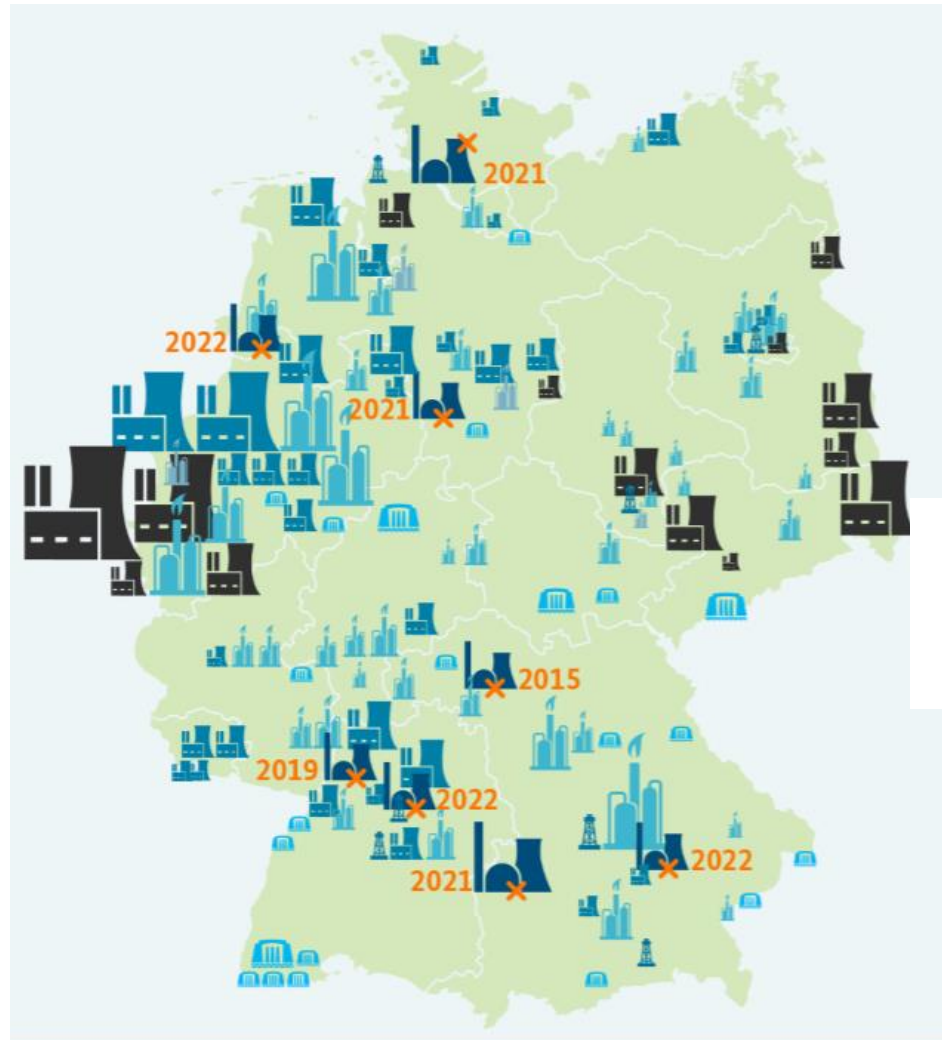


Status by January 2018

# The larger share of conventional generation is located in Northern Germany

## Power plants (>100 MW):

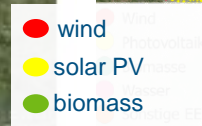
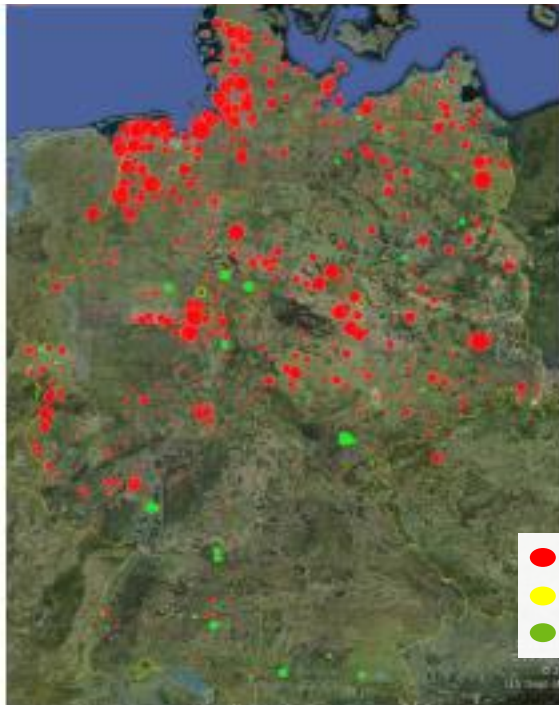
- Nuclear
- Lignite
- Hard coal
- Oil
- Natural gas
- Gas (various resources)
- Hydropower



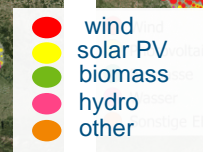
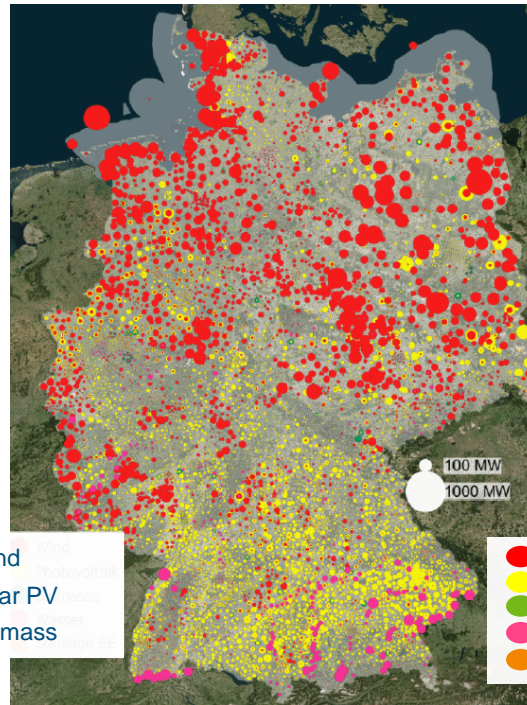


# Renewable installations grow increasingly in Germany

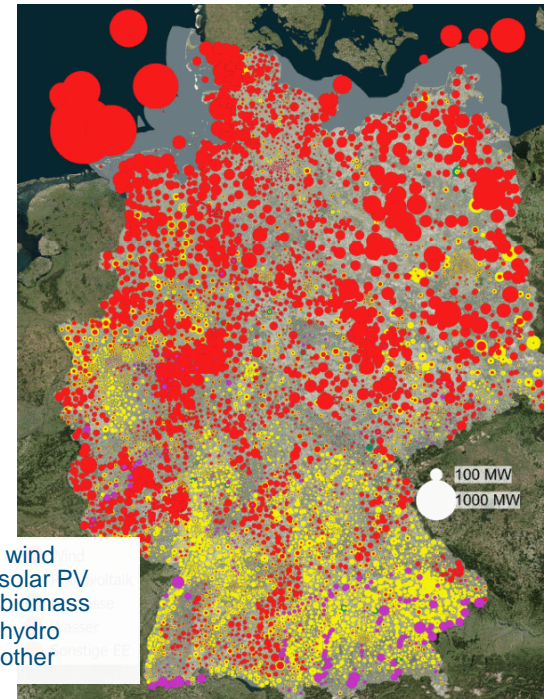
2000



2013

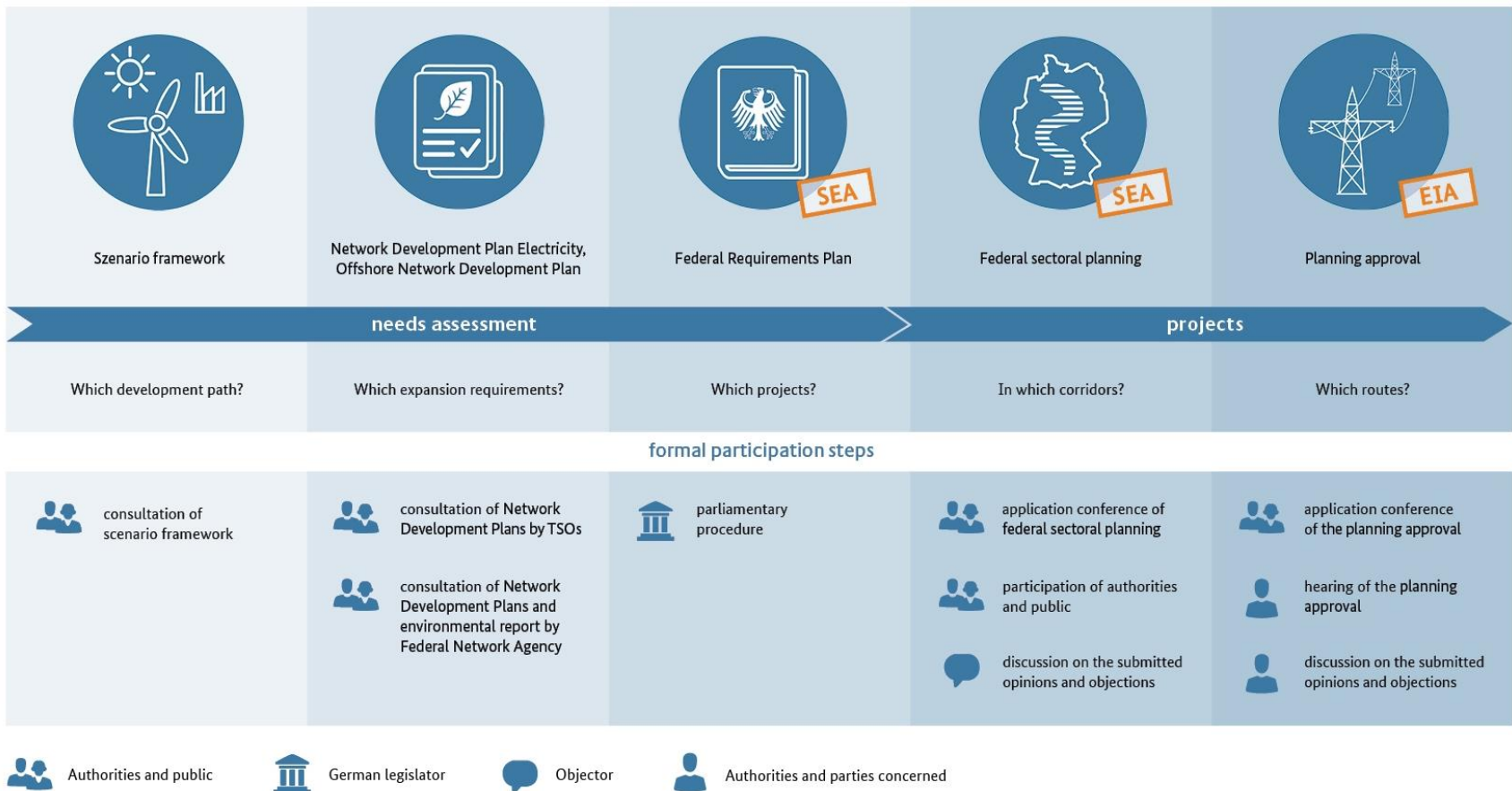


2025



Source: Bundesministerium für Wirtschaft und Energie (BMWi)

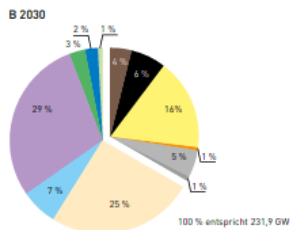
# Five steps of grid development in Germany



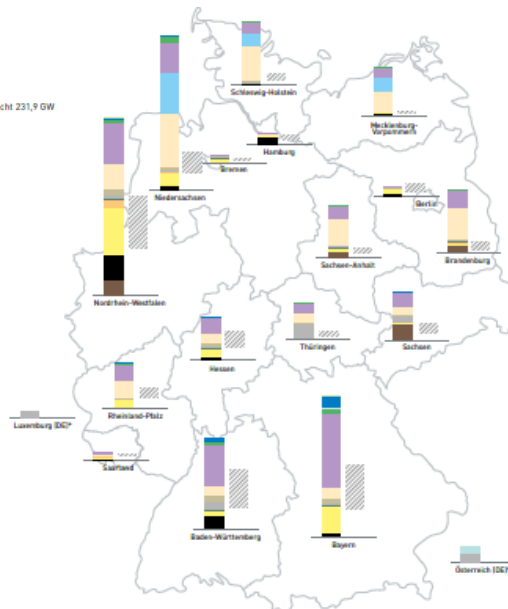
# Step 1: Scenario framework



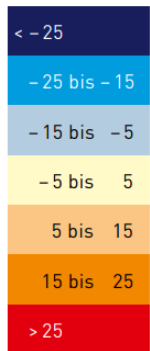
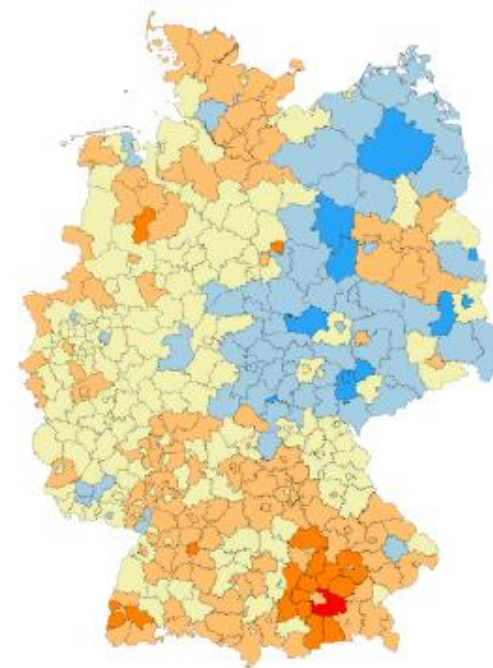
## Generation in 2030



Band der Nachfrage (ungleichzeitig)



## Consumption in 2030



relative change (%)

## Export situation in 2030

	in MW	AT	BE	CH	CZ	DK-O	DK-W	FR	LU	NL	NO	PL*	SE
2030	von Deutschland nach ...	7.500	2.000	4.300	2.000	1.000	3.000	4.800	2.300	5.000	1.400	2.000	1.315
	von ... nach Deutschland	7.500	2.000	5.700	2.600	1.000	3.000	4.800	2.300	5.000	1.400	3.000	1.315



## Step 2: Grid Development Plan



Approval by  
Federal Network  
Agency



**Scenarios for 2030**  
(including regionalization)



**Market simulation**



**Grid analysis**



**Necessary projects for grid expansion**

Grid optimization  
Grid enforcement  
new transmission lines

Approval by  
Federal Network  
Agency



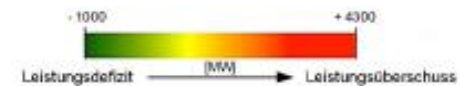
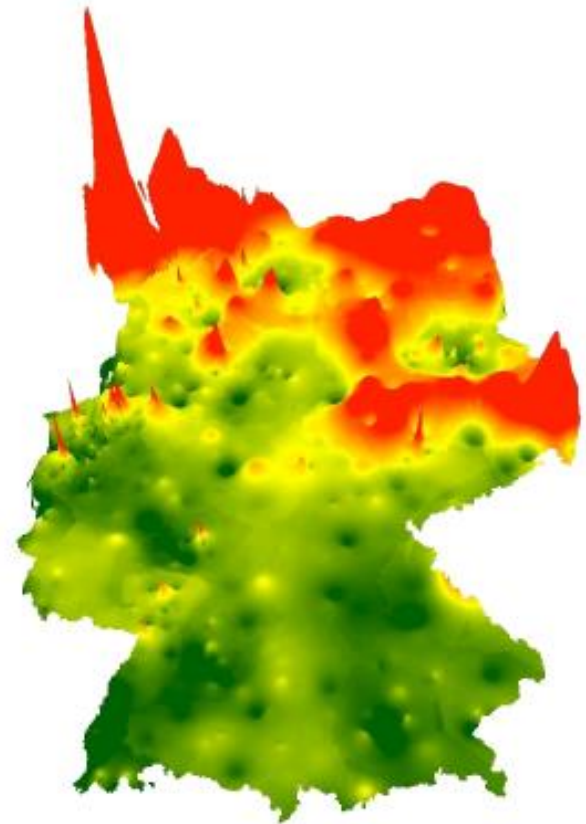
## Step 2: Grid Development Plan



Result of Market simulation (2030)

generation surplus

generation deficit

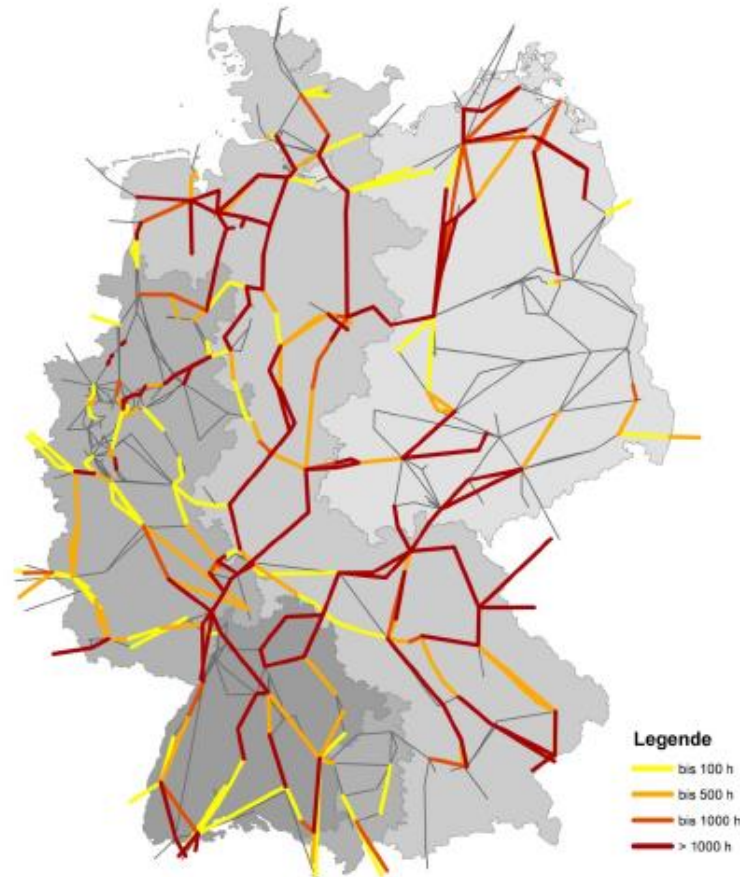


# Step 2: Grid Development Plan



## Grid Analysis (2030)

Basis:  
„**Start Grid**“ =  
existing lines  
+ lines close to realization



# Step 3: Federal Requirements Plan



## Investment needs:

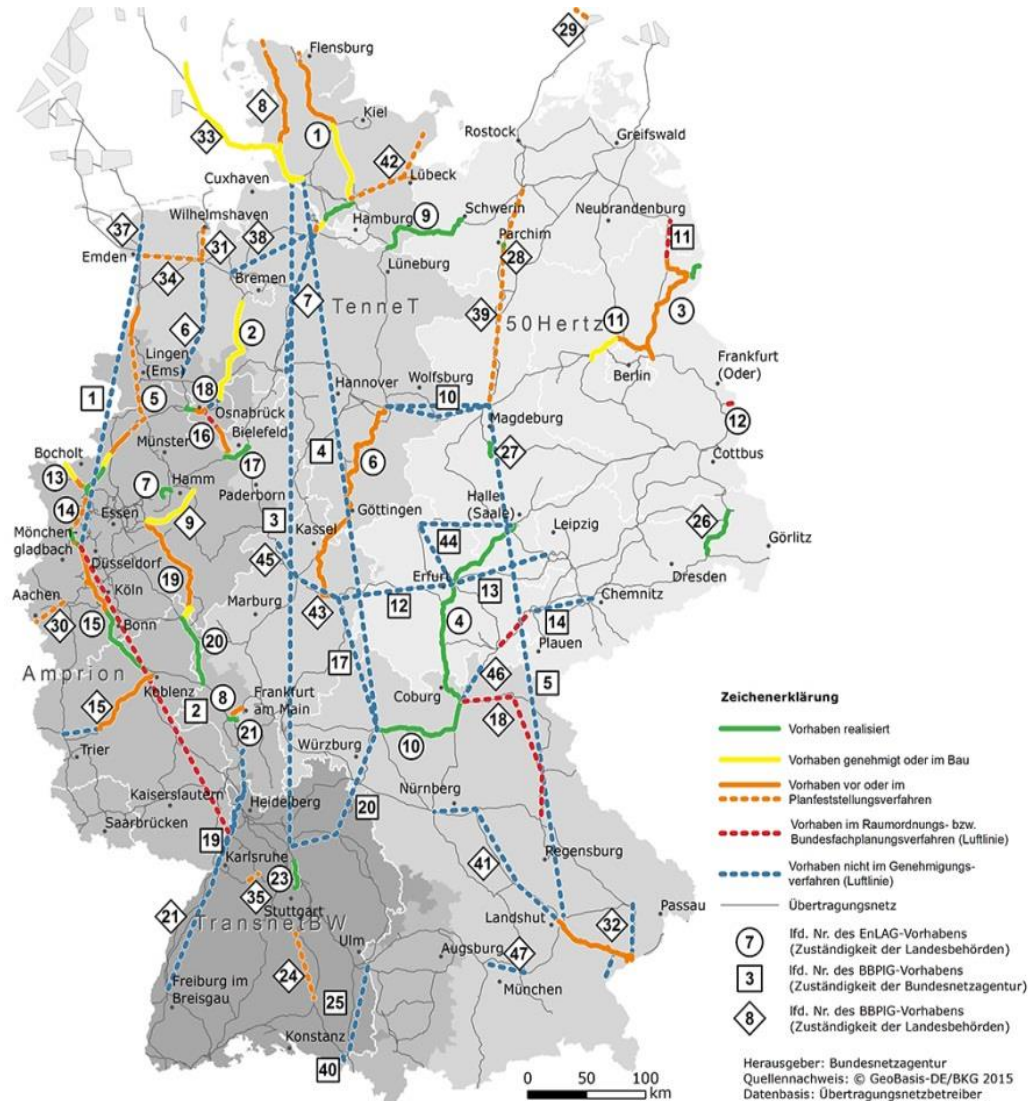
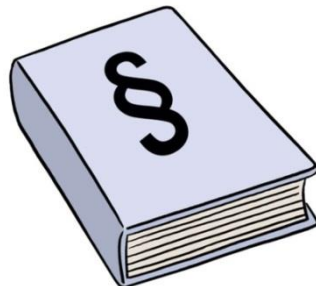
≈ 50 billion € (transmission and distribution grid until 2025)

## 65 high-priority projects:

4600 km new lines

3000 km enforcement

determined by law



# Steps 4 and 5: Federal Sectoral Planning and Plan Approval



## Federal Sectoral Planning

## Plan Approval



**Project investor**  
Proposal of  
preferred route  
and alternatives



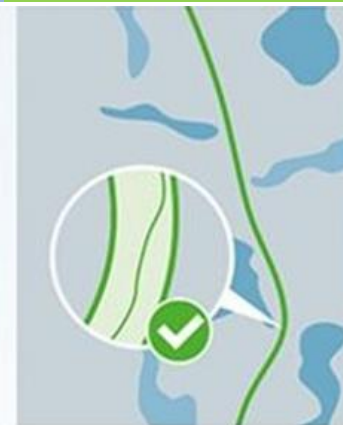
**Network Agency**  
Fixing of routes  
to be examined  
in detail



**Project investor**  
Comprehensive  
examination in  
detail, esp.  
environmental  
impact



**Network Agency**  
Fixing of corridor  
(width 1000 m)



**Network Agency  
together with  
project investor**  
Determining  
exact route of  
cable within the  
1000 m corridor



---

# Construction Phase

---



Source: Amprion



Federal Ministry  
for Economic Affairs  
and Energy



Thank you  
for your attention

