

# THE GERMAN PERSPECTIVE ON “ENERGIEWENDE”: MARKETS, PROJECTS, INVESTMENTS

**MARCH 2019**

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Germany Trade & Invest



# Who we are

Foreign trade and inward investment agency  
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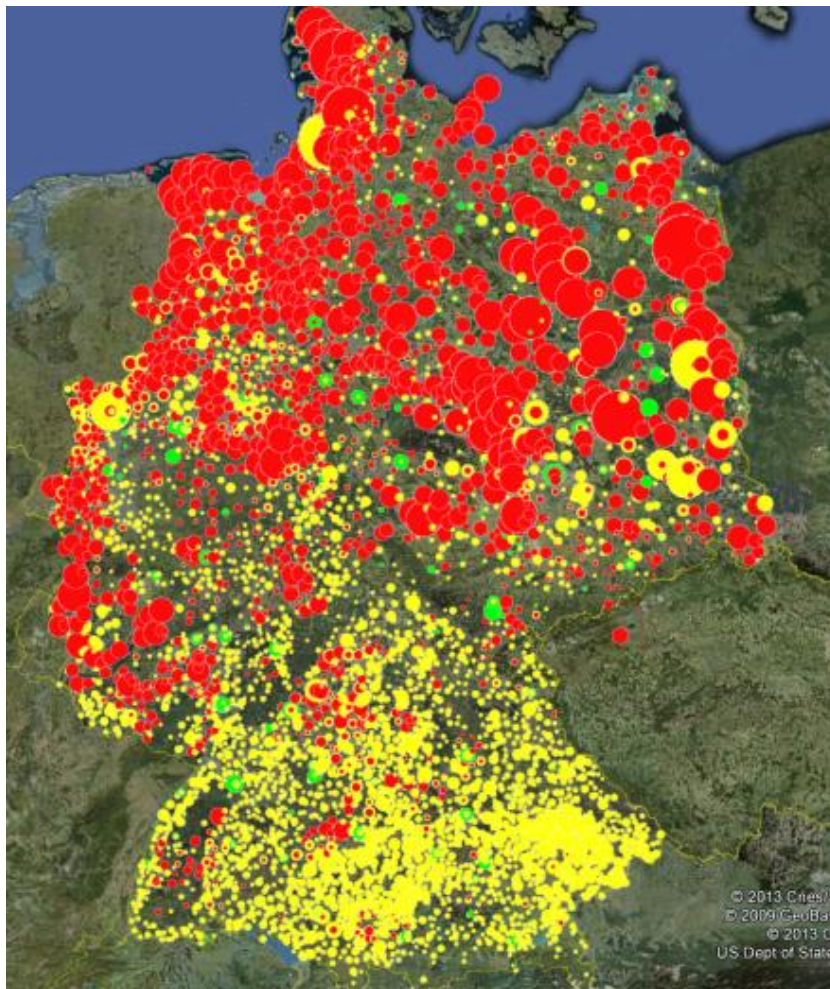


Federal Ministry  
for Economic Affairs  
and Energy



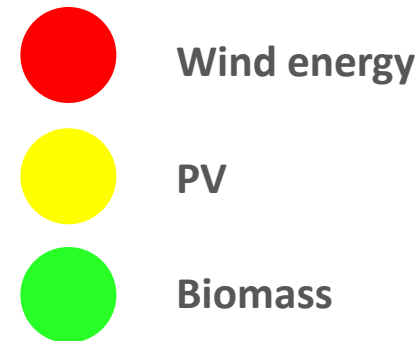
# Development of Renewable Energy Systems

Feed-in-Tariff causes dynamic growth



Total capacity of renewables  
(2018)

> 1.7 million installations

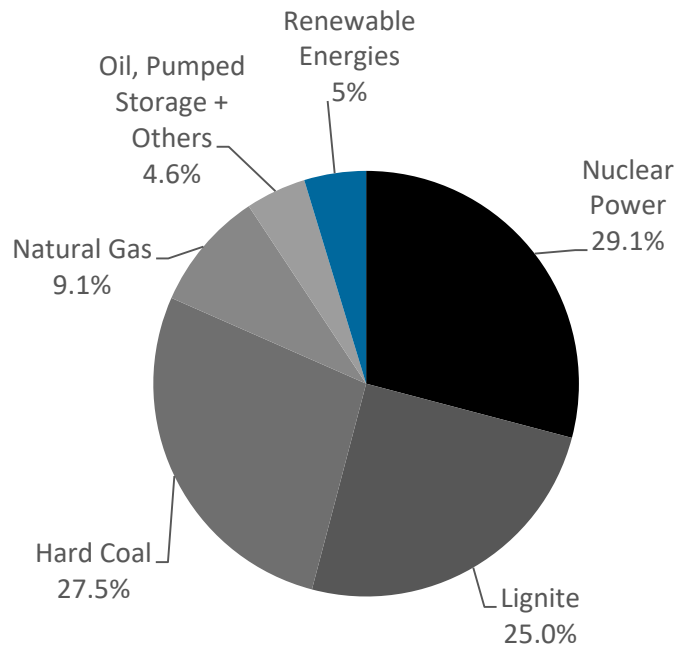


The circle **diameter** is proportional  
to the electrical capacity

# Electricity Generation

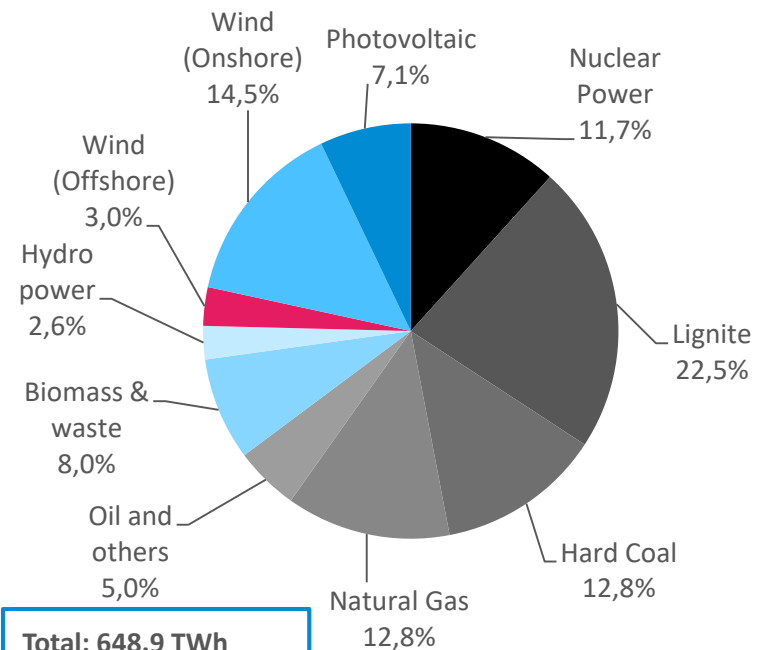
## Renewable shares increase up to one third

Energy Source Share in Electricity Generation<sup>1</sup>  
(1998)



**Total: 557.2 TWh**  
**Export: 0.6 TWh**

Energy Source Share in Electricity Generation<sup>1</sup>  
(2018)



**Total: 648.9 TWh**  
**Export: 50.0 TWh**

Source: AG Energiebilanzen December 2018; 1) Gross Electricity Generation

# Coal exit

In January 2019, Germany's coal exit commission proposed how to phase out coal-fired power plants



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BPA, 2019; clean energy wire, 2019

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## Germany's exit

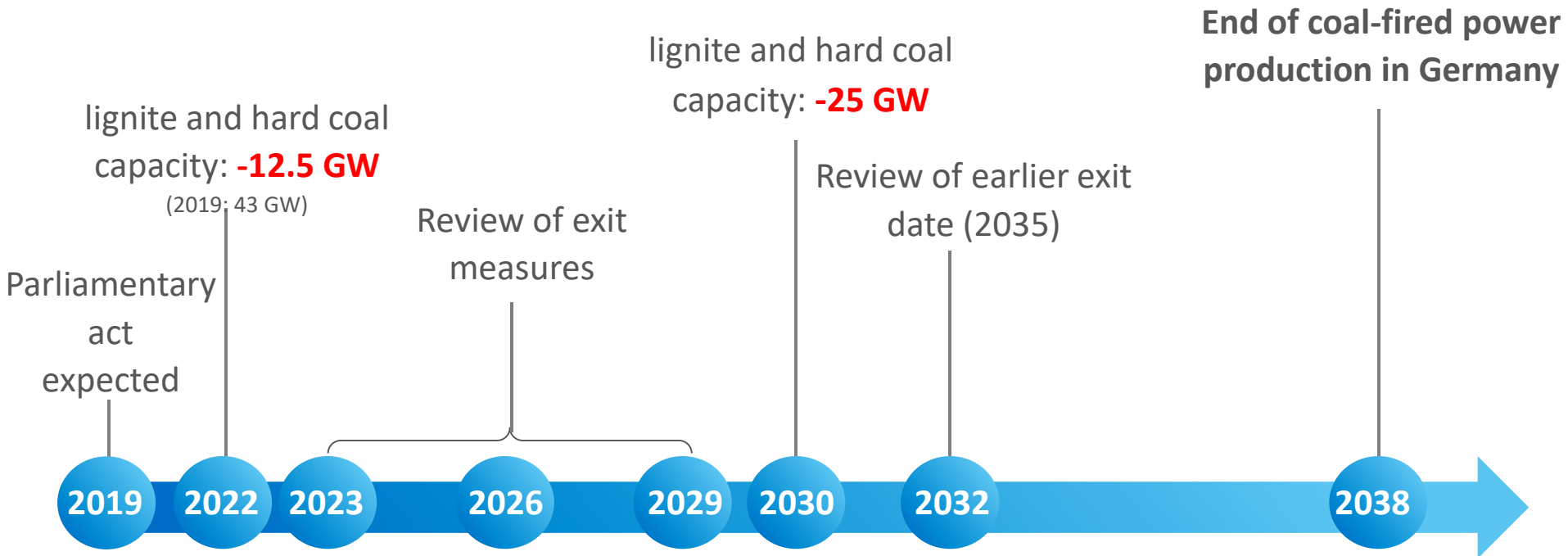
- In 2018, commission with representatives from industry, government, civil society was set up to propose exit strategy
- In April 2019, the German government will present parliamentary act based on strategy

## Propositions of the exit commission

- 40 bn € assistance for states affected by coal phase out
- Creation of 5000 jobs in coal-dependent regions over the next 10 years
- Min. 2 bn € subsidy to mitigate increasing electricity prices
- compensation for plant owners recommended (without sums yet)

# Coal Exit

The proposal presents 2035 as latest end date for coal-fired power production and includes several points of review

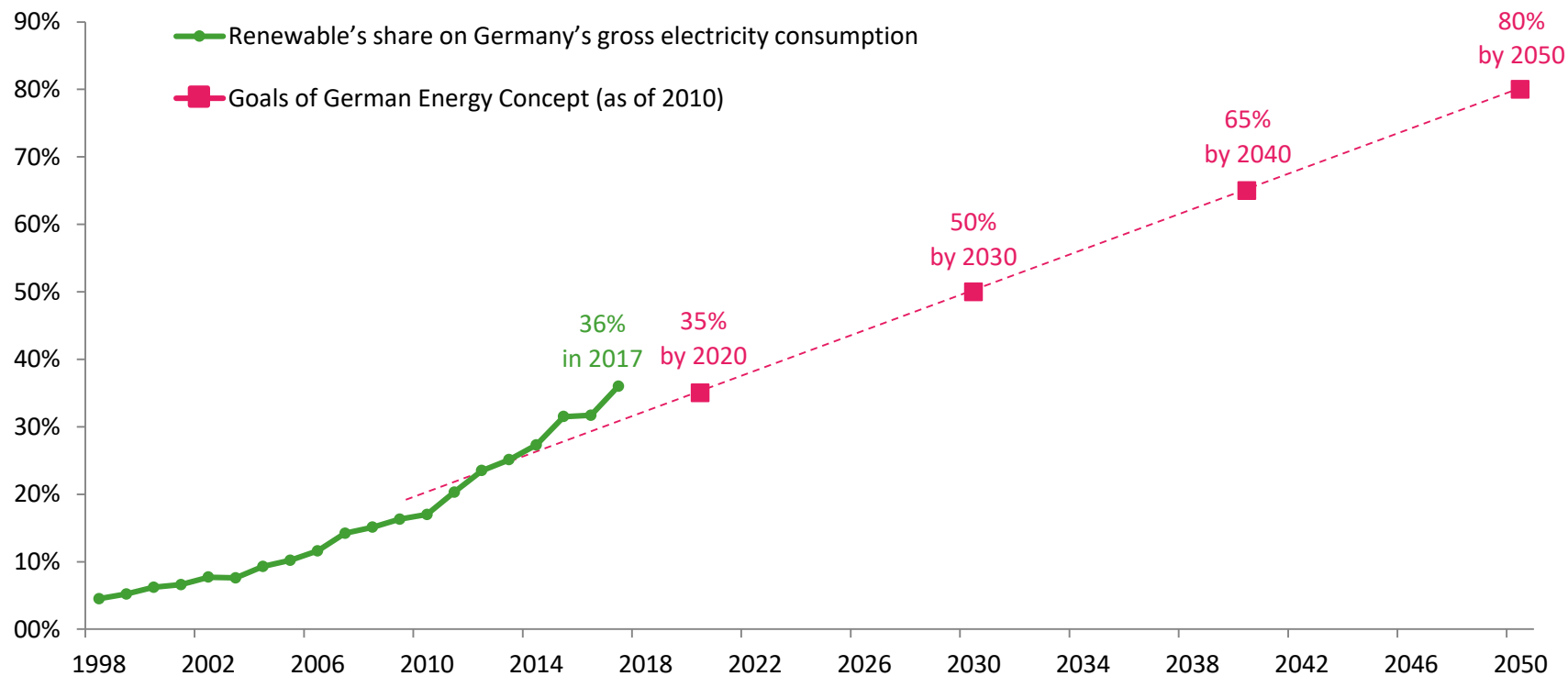


Sources: BPA, 2019; clean energy wire, 2019

# Goals of Renewable Consumption

## Developments on target

### Renewable's share on Germany's gross electricity consumption vs. goals of German Energiewende



Sources: BMWi, December 2018

# Auction System

Expansion of large-capacity renewable energies under a tender scheme

	<b>Onshore</b>	<b>Offshore</b>	<b>Solar</b>	<b>Biomass</b>
<b>Tender conditions</b>	> 750 kW	> 750 kW	> 750 kW	> 150 kW
<b>Quantities that will get tendered yearly</b>	<b>2017-2019</b> 2.8 GW	<b>2021-2030</b> 0.730 GW	<b>2017-ongoing</b> 0.6 GW	<b>2017-2019</b> 0.150 GW
	<b>2020-ongoing</b> 2.9 GW			<b>2020-2022</b> 0.2 GW
<b>Targeted amount of total generation (in 2030)</b>	82 GW	15 GW	50 GW (54GW)*	10 GW**

Source: BMWi, 2016; Deutsche WindGuard, 2016; Fraunhofer ISE, 2013, \*2016

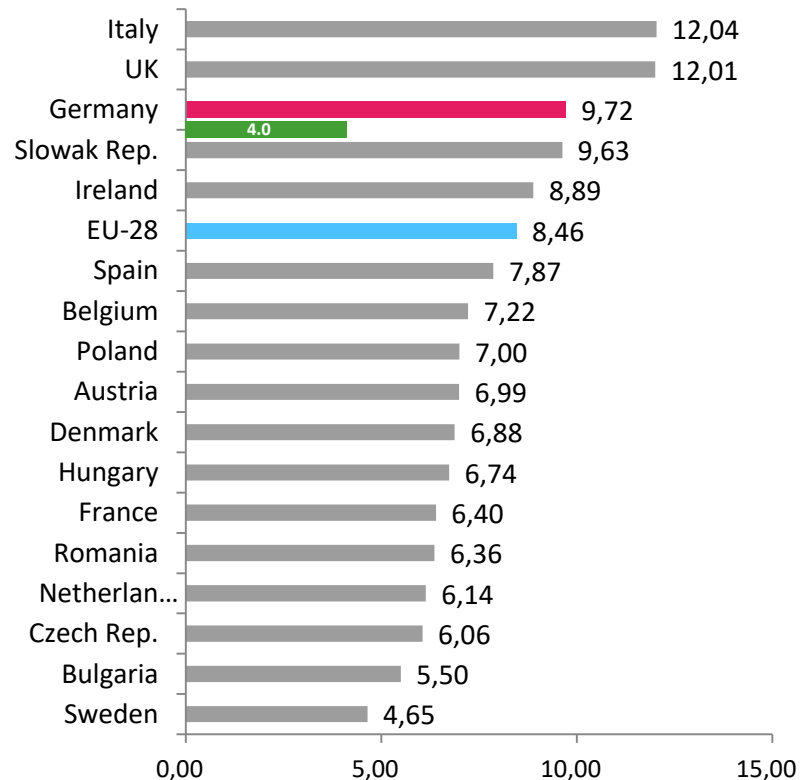
\*Including solar plants < 750 kW \*\*By 2022



# Industrial Electricity Prices

Industrial consumer costs in Germany among the highest and lowest in EU

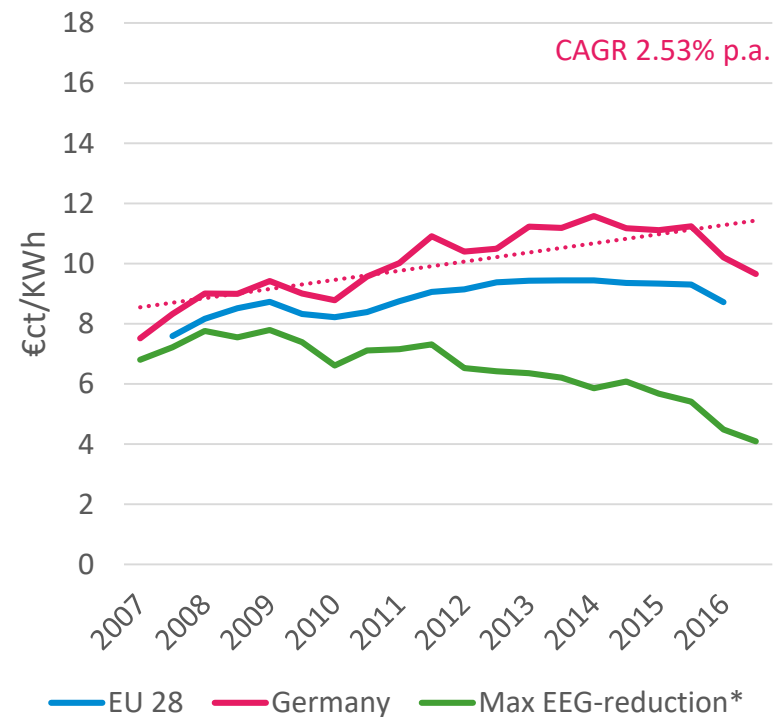
Average annual industrial electricity prices in 2017 with a consumption of 20,000-70,000 MWh<sup>1</sup>



Note: <sup>1</sup>2017 estimates, including taxes except VAT. All data in EUR-cent per kilowatt hour. Source: Federal Ministry for Economic Affairs and Energy

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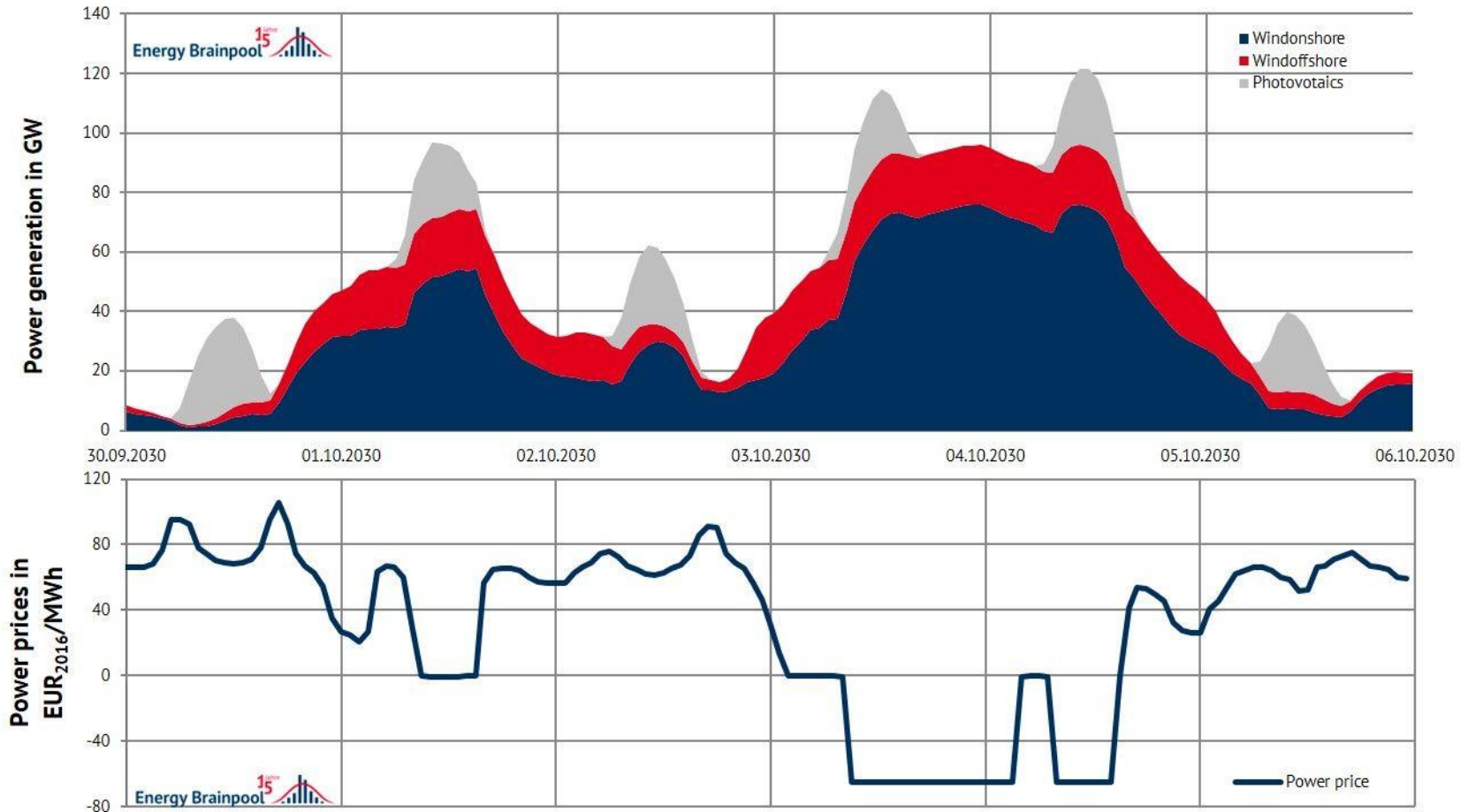
20,000 MWh < Consumption < 70,000 MWh  
Ex. VAT and other recoverable taxes and levies



\*Large consumers can be freed from EEG surcharges under certain circumstances  
Source: Eurostat, April 2017

# Increasing Volatility

## Price Development



Source: Energy Brainpool

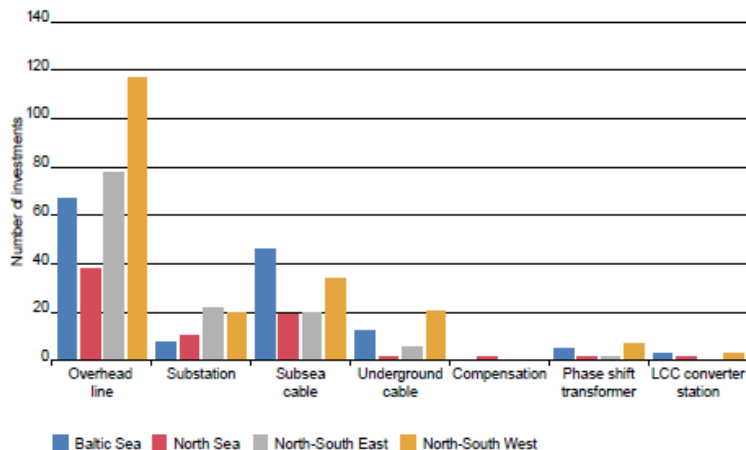
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# European Grid Extension projects

## Ten-Year Network Development Plan 2018

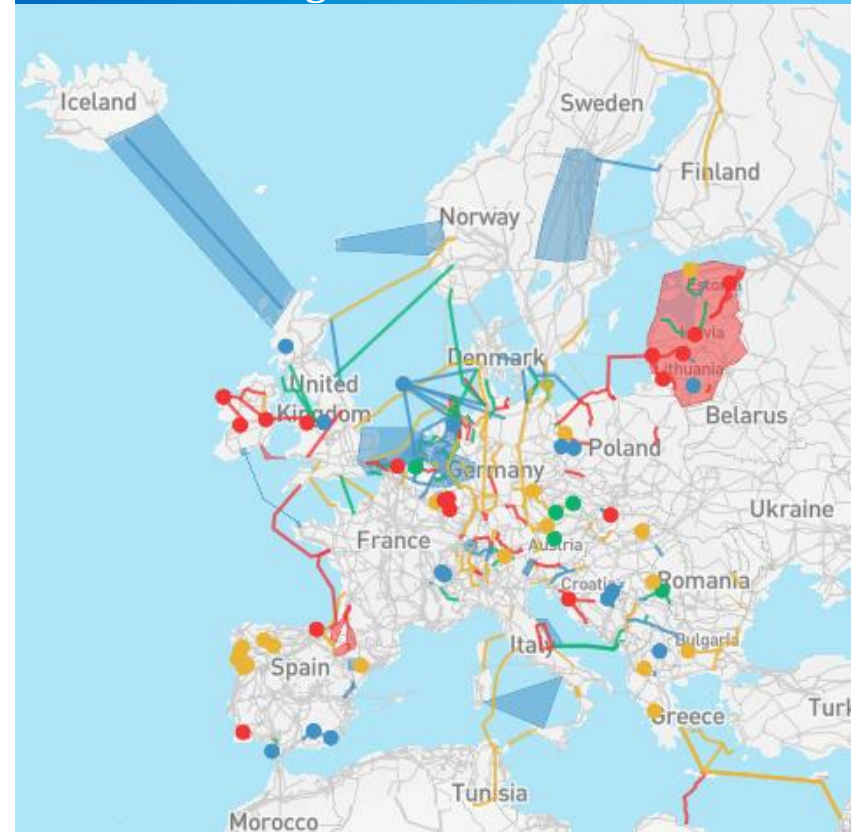
- € 114 billion grid expansion investments by 2030 proposed by the TYNDP 2018
- Enhanced market integration will save generation costs of € 2 to 5 billion by 2030
- 3 to 14 €/MWh cost reduction by 2040

### TYNDP 2018 investment portfolio – investments by technology and region



Source: TYNDP 2018 Ten-year network development plan ENTSO-E

### Pan-European Significance investments – mid- and long-term horizon

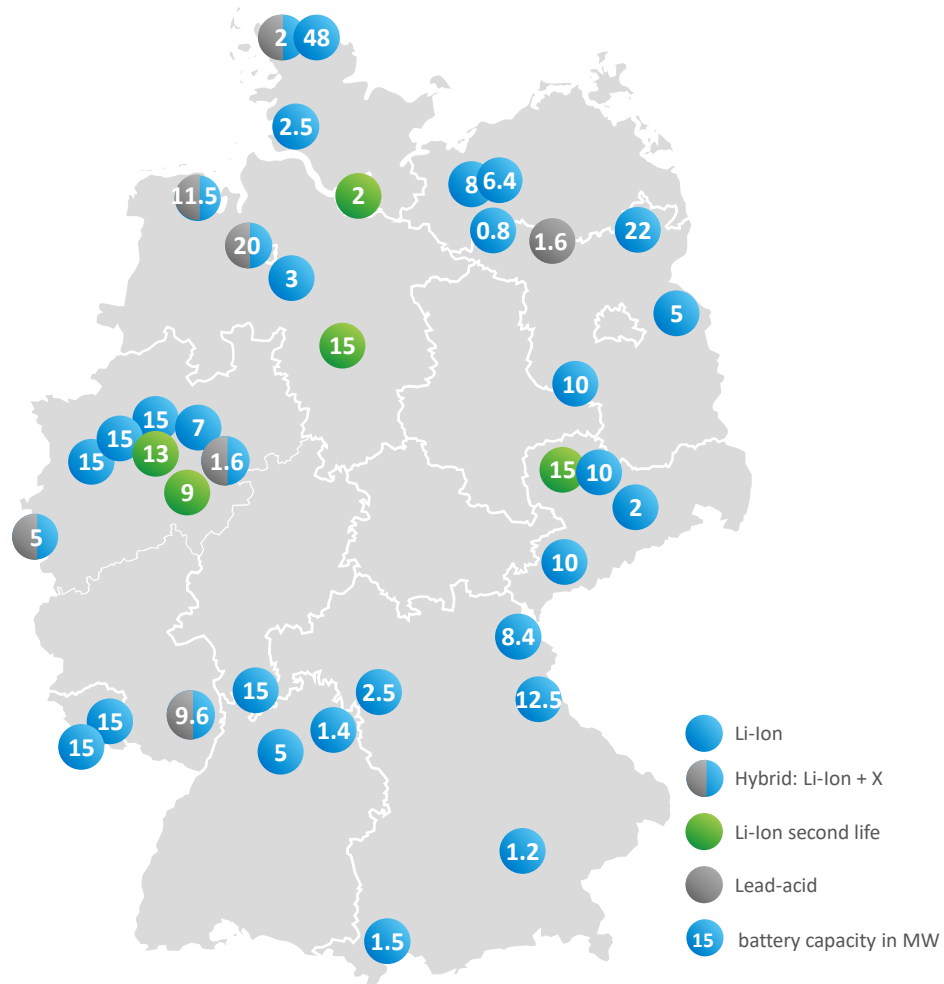
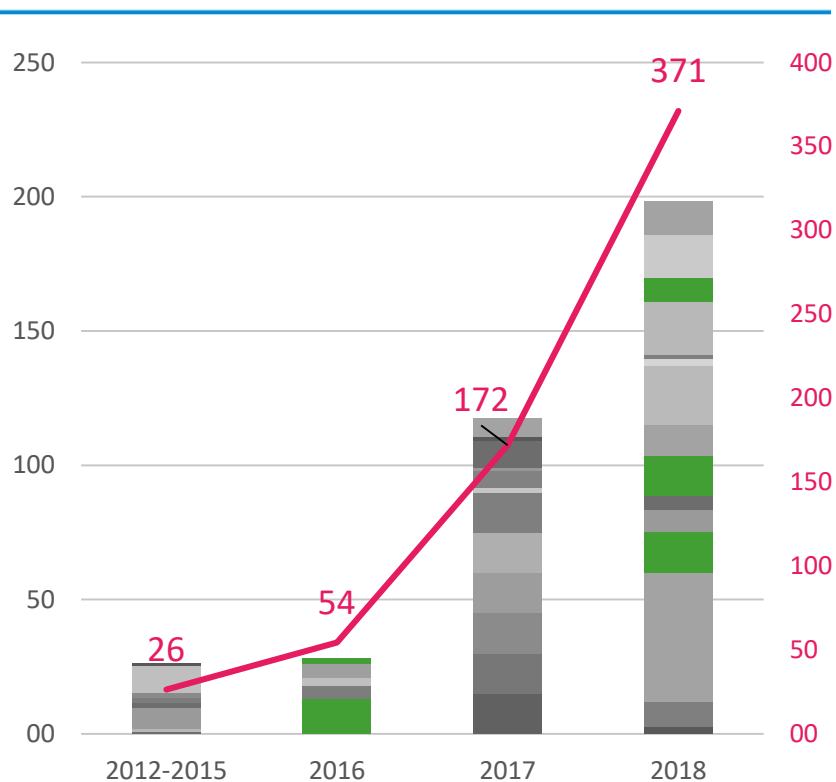


Source: ENTSO-E 2018

# Large Scale Battery Systems for PCR

From small pilot projects to large commercial projects

**Total large-scale batteries in Germany**  
Power capacity [MW]



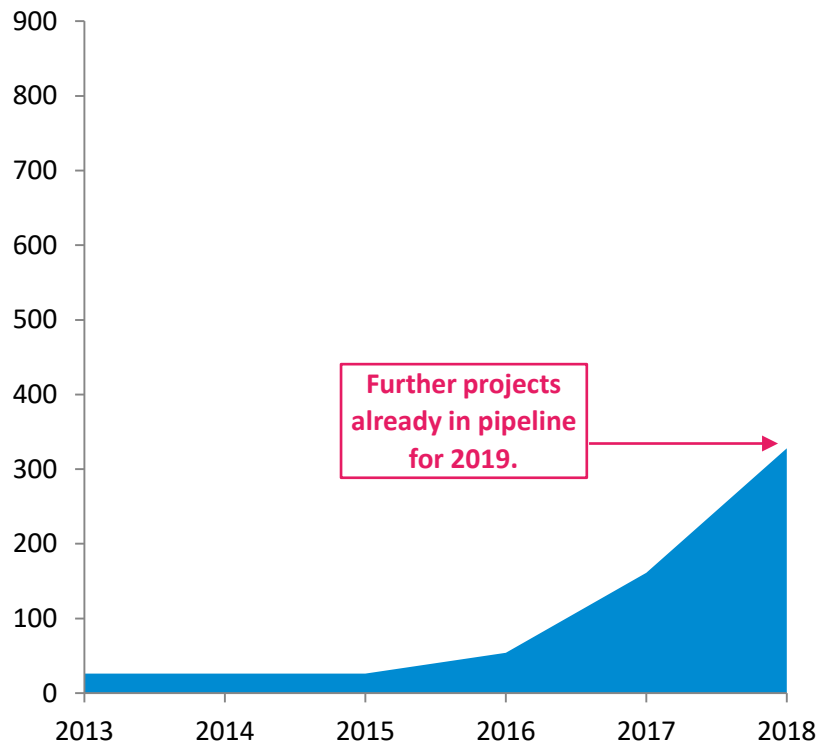
\*preliminary figures;

Note: no claim for completeness; usually 75% of installed capacity is qualified for Primary Control Power

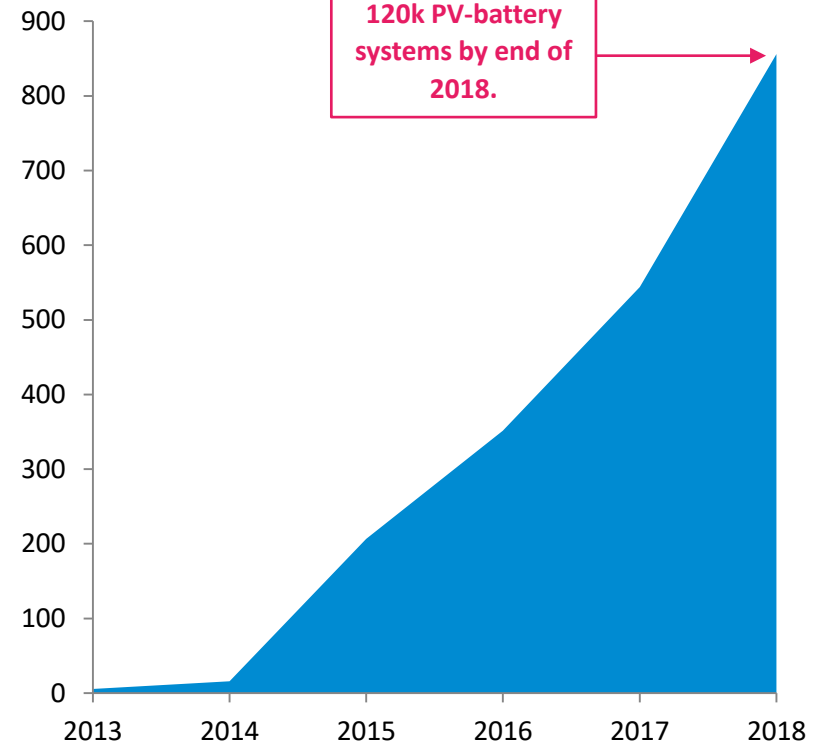
# Market Development for Stationary Batteries

Strong growth for private PV-batteries and large-scale grid batteries

Installed Batt. capacity for Primary Control Reserve (MWh\*\*)



Installed capacity of PV-battery systems (MWh\*)

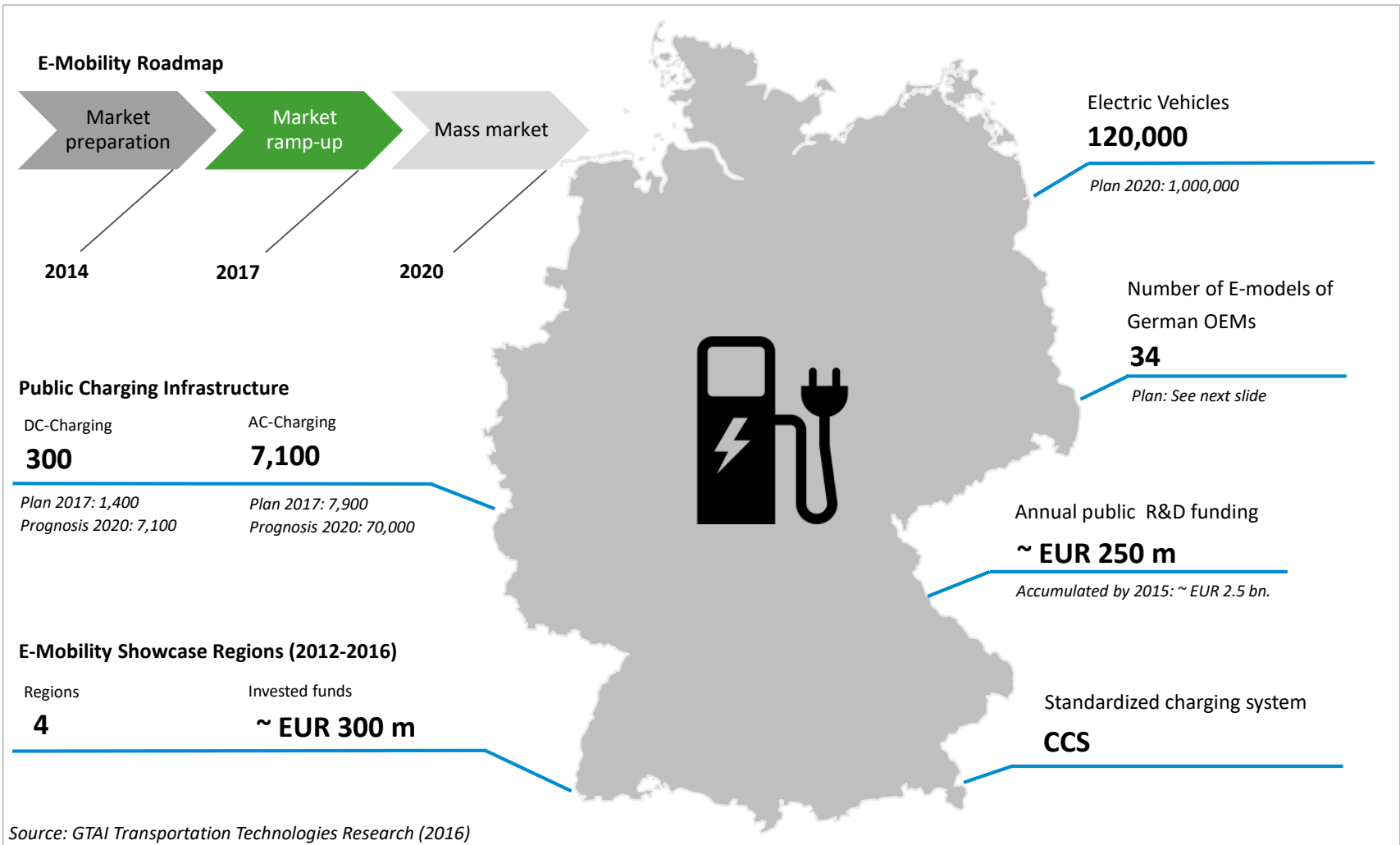


Note: \* average system size: 6.8 kWh; \*\* anticipating 1C (1 MW = 1 MWh); usually 75% of the installed usable capacity is qualified for PCR

Source: RWTH 2017, BSW 2017

# E-Mobility in Germany – Status quo

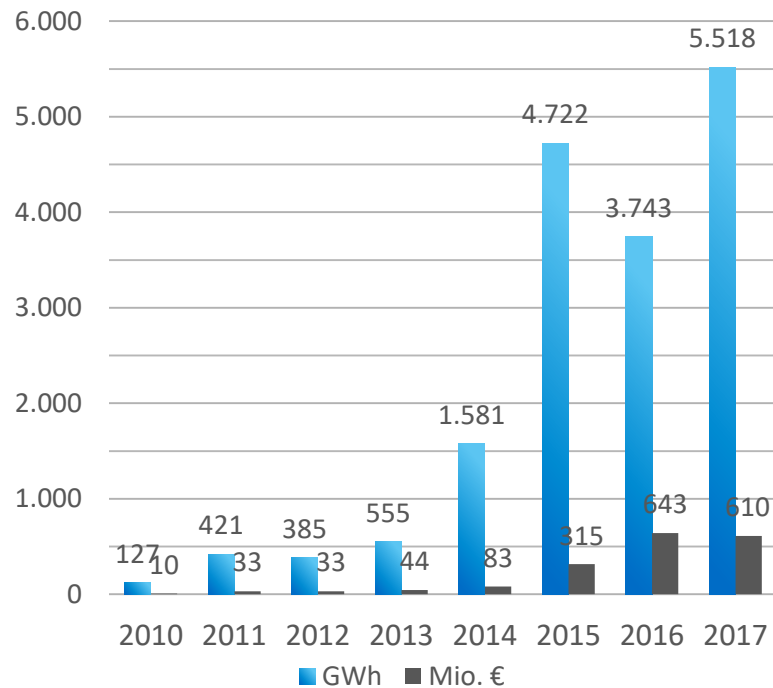
## E-Mobility in Numbers (Q2/2018)



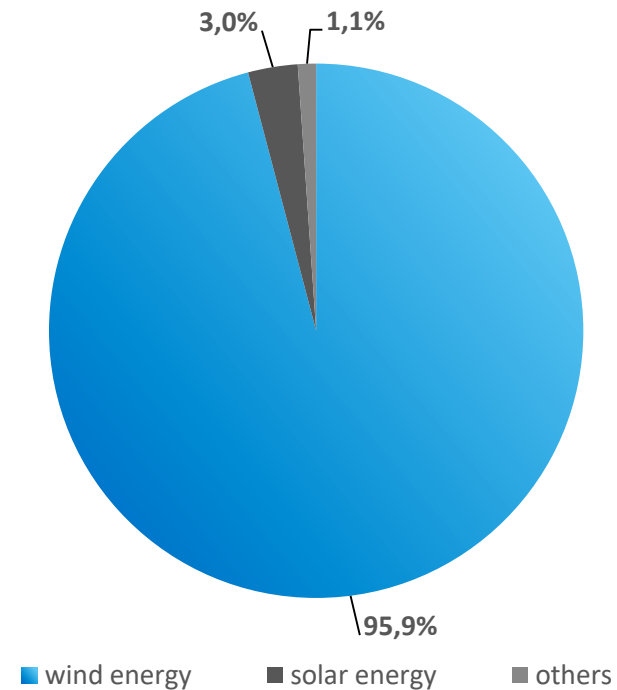
# Development of Renewable Energy Curtailment

Long term energy storage technologies are needed

**Disconnected energy for grid stabilization and compensation**  
(2010-2017)



**Disconnection for grid stabilization by energy source**  
(2017)



# Example: Energiepark Mainz

## Worldwide Largest Power-to-Gas Plant with PEM Electrolysis

### Key Parameters

- 6.3 MWeI (3 stacks, each 2.1 MW)
- Hydrogen production: 200 tons/a
- Start of construction: October 2012
- Start of operation: December 2016
- Partners: Stadtwerke Mainz, Linde, Siemens, Hochschule RheinMain



### Goals

- Local grid integration by storing fluctuating renewable power
- Provision of ancillary services in the electricity grid (including negative control reserve)
- Intelligent and efficient hydrogen conditioning, storage, smart management structure





# Contact Us

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