

Shifting investment from coal to renewable energy resources »

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„Big picture“ - Projection Energy sector Germany in 2050

Renewable electricity

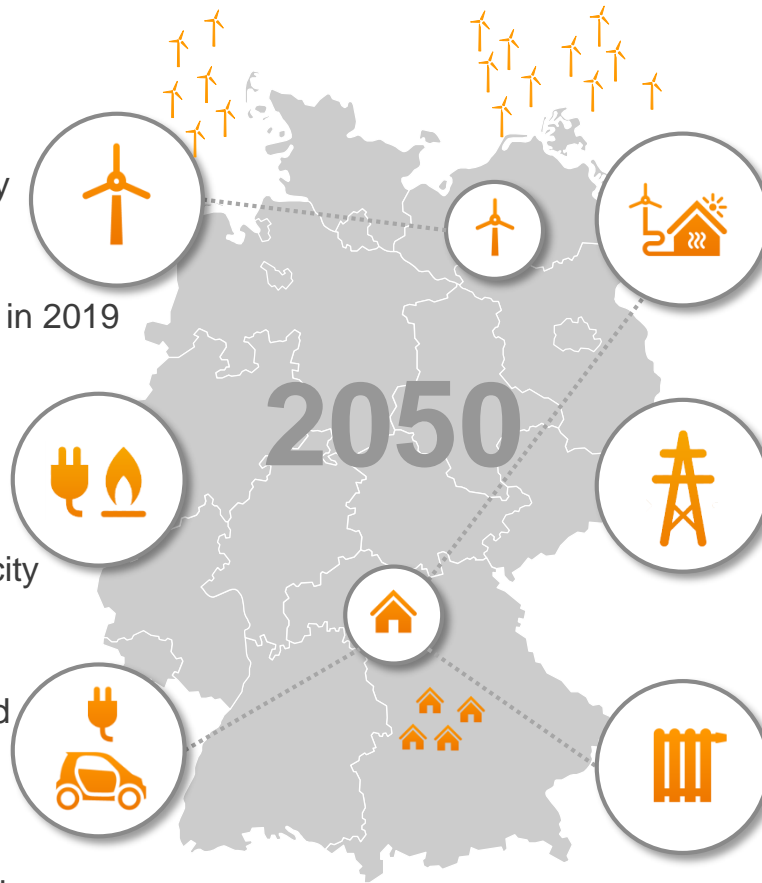
- › Provide > 80% of electricity generation
- › Installed capacity: appr. 250 GW vs. 100 GW in 2019

Security of supply

- › 60-80 GW gas-fired and storage (hydro and batteries) capacity

E-mobility

- › 28 Mio. passenger cars and light trucks on the roads
- › High car sharing rates in metropolitan areas
- › Electricification of trains and buses close to 100%



Electricity demand

- › Growing to > 700 TWh vs. 500 TWh today
- › Growth mainly driven by E-mobility and heat

Electricity grids

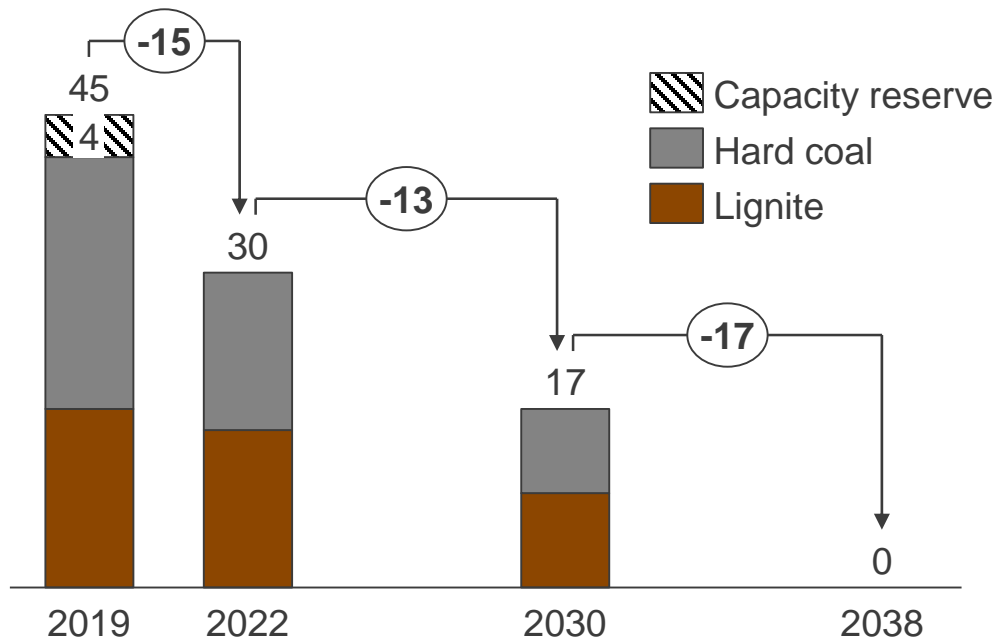
- › +100 % of transmission and distribution grid capacities within Germany and to neighbouring countries

Heat supply

- › Mainly based on green gases and electric heating (heat pumps, boilers)
- › **Heating demand decreases by 1/3** due to raising efficiency (insulation and new design)

Phase-out of German lignite and coal power plants - recommendations on their way to legislation

Capacity development Lignite and hard coal power plants in Germany (Installed capacity, in GW)



Recommendations of German „Coal-commission“

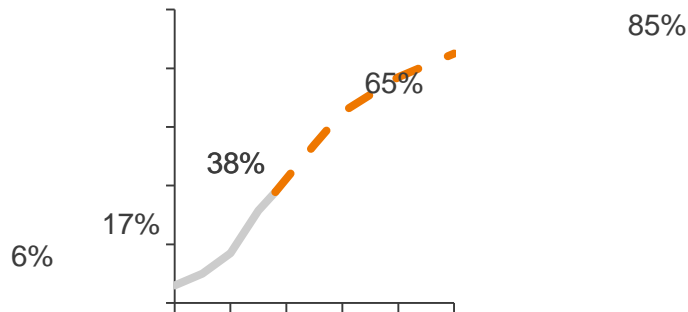
- › Stepwise phase-out of coal-fired electricity generation in Germany
- › Older coal plants with low efficiency and high emission intensity will be shut down at first
- › „Closing auctions“ for hard coal plants will be implemented
- › Lignite regions with governmental support for infrastructure



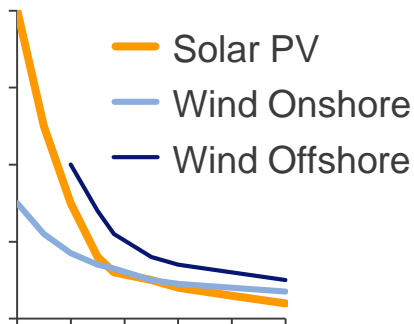
Coal phase-out flanked by supporting incentives to safeguard acceptable socio-economic implications, legislation expected to be complete by the end of this year

Renewable shares in Germany vs. Technology cost development

RES-E share Germany in % of gross electricity consumption



Levelised cost of electricity In EUR/MWh



First steps were costly...

- › Appr. EUR 25 bn. annual need for support of existing plants in Germany
- › „EEG-Umlage“ almost reached EUR 70/MWh for electricity customers

...but cost decline outreaches expectations

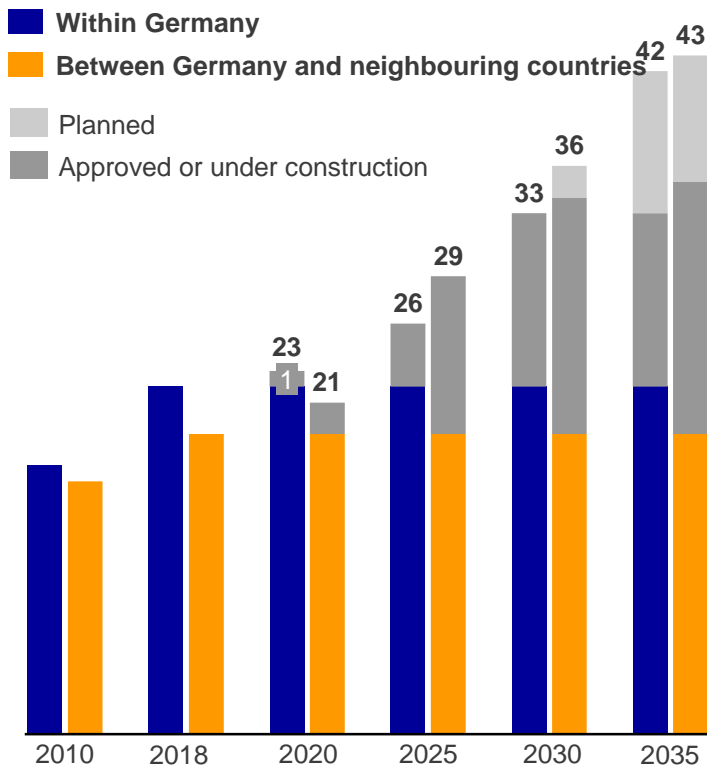
- › Technology cost with radical downtrend (i.e. PV module cost fell 80% during last 10 years)
- › Growing number of PV and wind projects without need for financial support



In many cases Renewables are the cheapest generation source in an overall cost perspective

Electricity transmission grids in Germany - Doubling of capacities until 2035

Development of transmission capacities Germany until 2035, GW



Key developments

- Expansion of physical international capacities to be accessible for markets to 70%
- International grid extensions with good progress, DC-lines between Scandinavia and Central Europe allow higher volumes of RES to be absorbed
- Investment in transmission grids obligatory to open the way for renewable growth



European market integration enables enhancement of international cooperations within the electricity sector

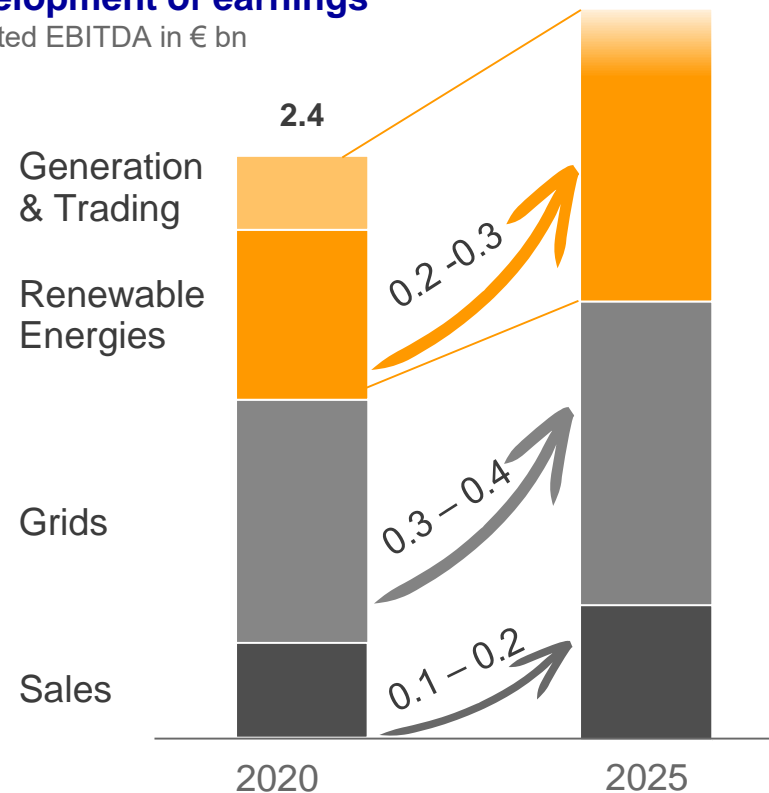
German utilities' strategy development „Fear waned and yielded to willingness“

German energy regulations have driven strategy and business transformation among utilities

- › Since 2013 business strategies have been adapted continuously
- › Before 2013 survey results showed more than 80% of utilities' employees feared „Energiewende“ would lead to significantly lower profits for their companies
- › Today, former nuclear, lignite and hard coal based business models have mainly replaced by investments in renewable energies and electricity grids

Example: EnBW's corporate strategy Development of earnings > 3.0

Adjusted EBITDA in € bn



➤ German utilities' today's strategies mainly focused on „new“ business models such as RES, grids and other infrastructure



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