Westfälische Wilhelms-Universität Münster

ENERGIE DER ZUKUNFT
Kommission zum Monitoring-Prozess

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The Energy Transition and the Politics of Coal in Germany

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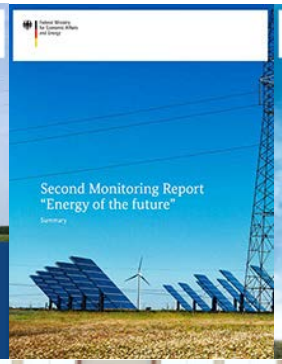
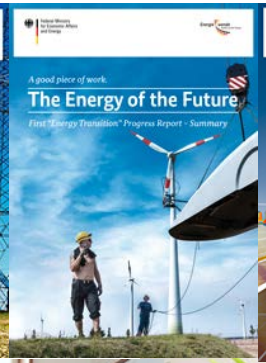
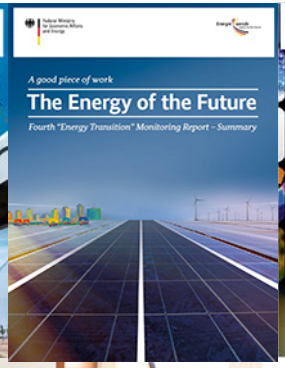
Monitoring the Energy Transition
http://www.bmwi.de/Redaktion/EN/Artikel/Energy/monitoring-implementation-of-the-energy-reforms.html







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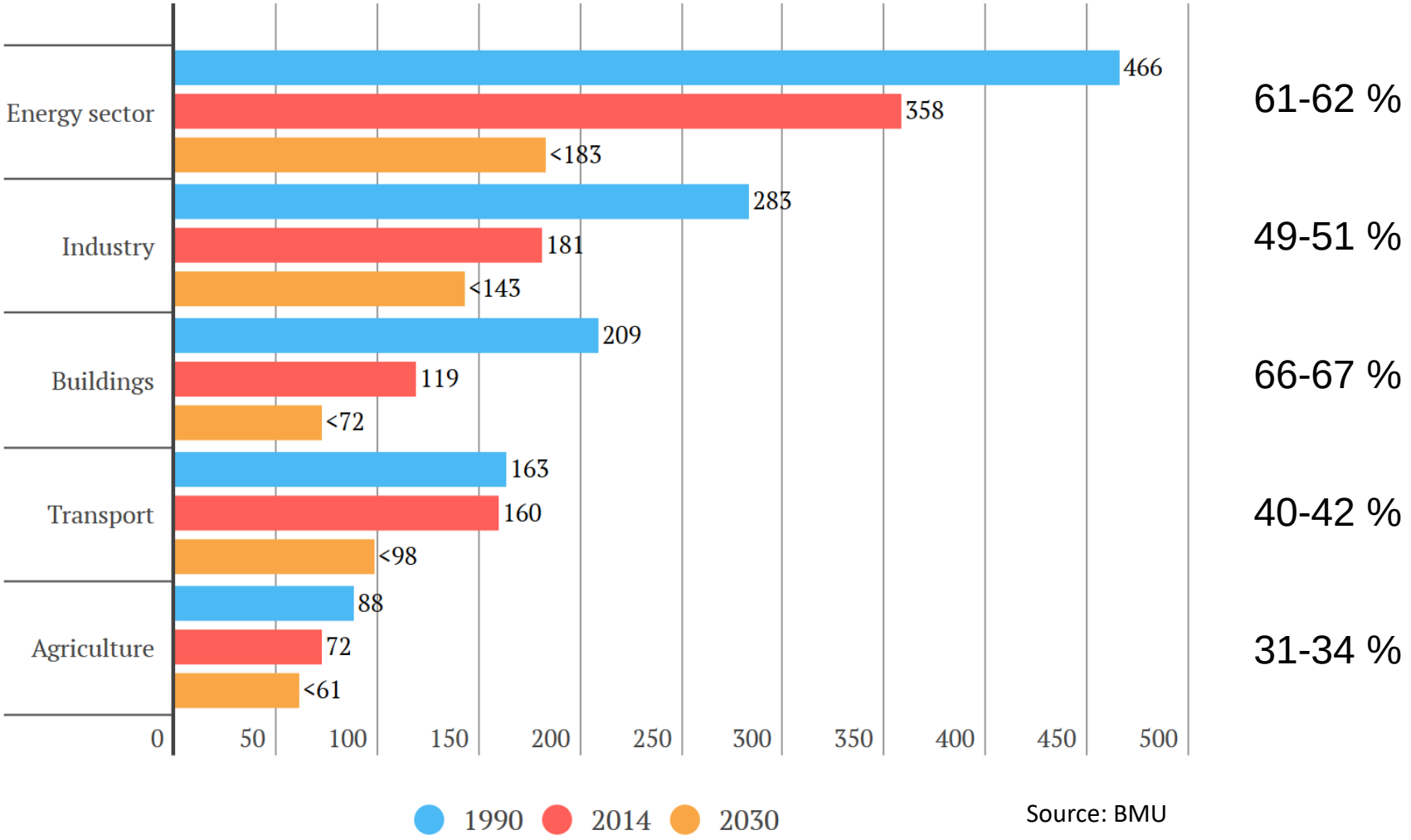
Status of the German energy transition

Dimension	Lead indicator
Mitigating climate change	Reduction in greenhouse gas emissions
Renewable energy	Increase in the share of renewable energy in gross final energy consumption
Energy efficiency	Reduction of primary energy consumption
Security of supply	Expansion of transmission grids
Affordability	End-user spending on electricity in terms of GDP
Public acceptance	General approval of goals of energy transition

Source: Löschel et al (2019)

Target attainment: likely uncertain unlikely

Climate Action Plan 2050 (2016) and 2030 targets

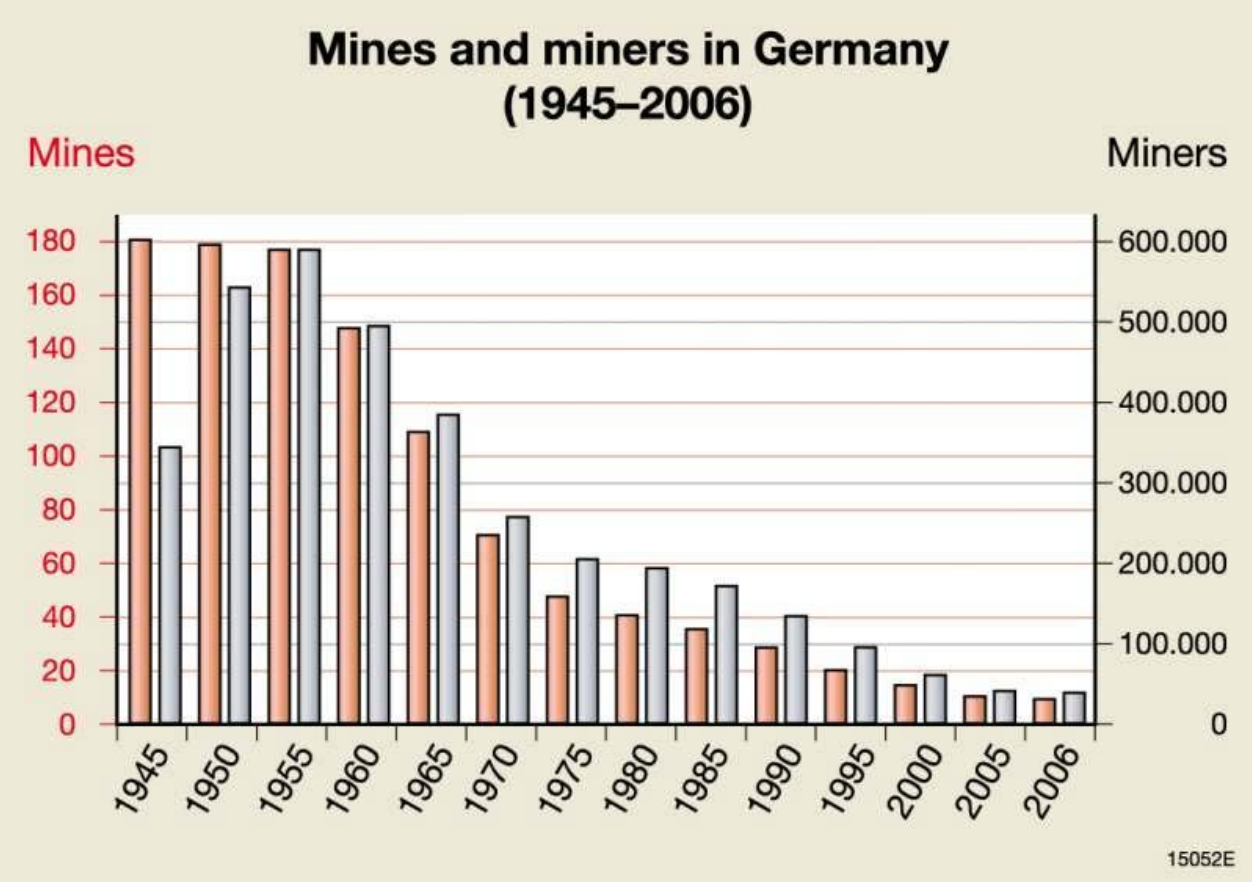


Source: BMU

Total ($MtCO_2eq.$)	1248	902	543-562	(55% in 2030 → 80-95% in 2050)

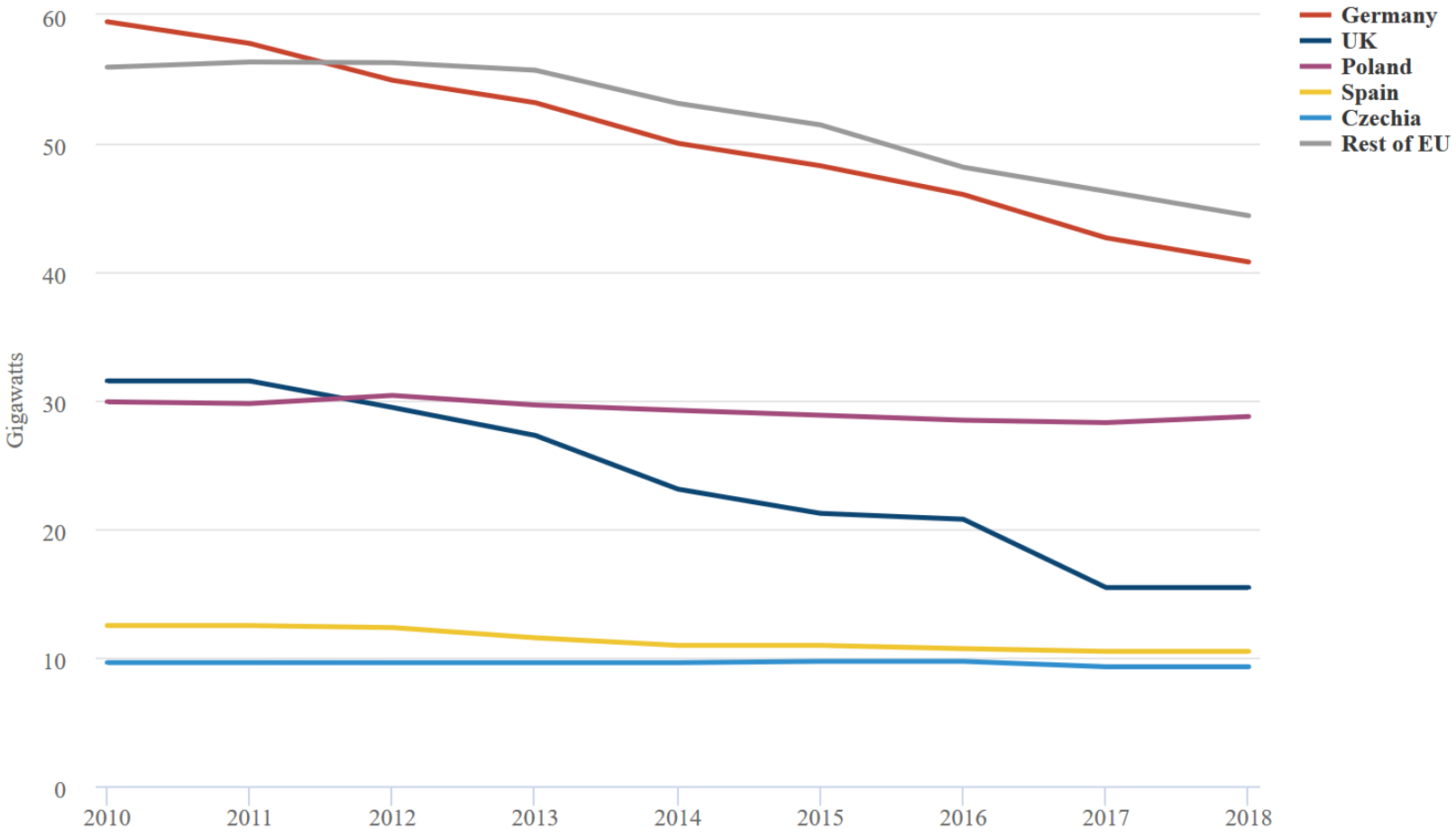
First Coal Phase Out: Hard coal mining

Number of employees in German hard coal mining districts, 1945-



Source: Dierke

Germany‘s coal fleet: largest in EU

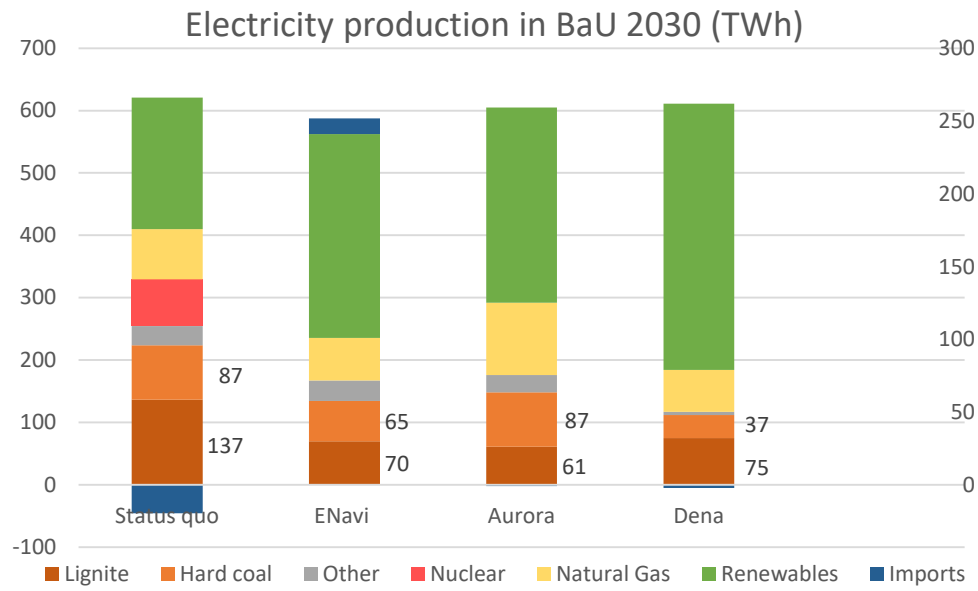


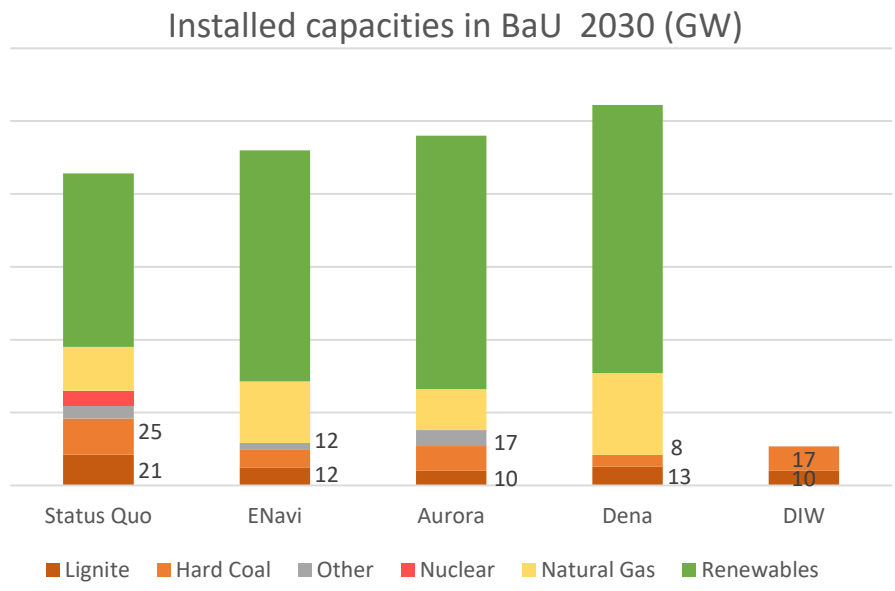
Carbon Brief (2019)

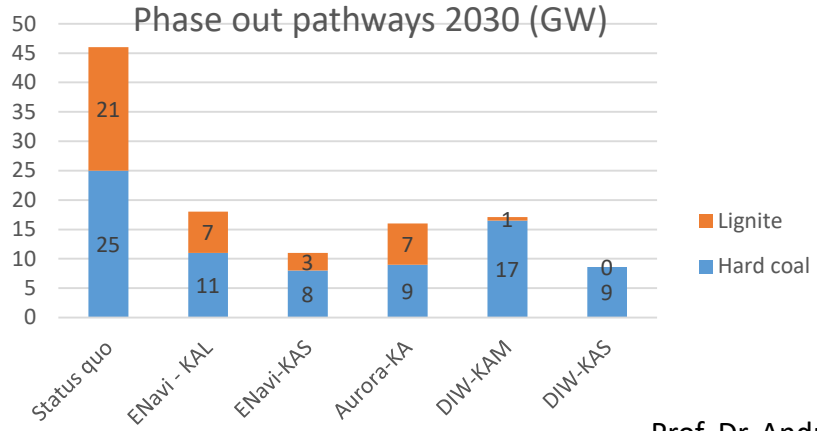
Commission on Growth, Structural Change and Employment

- Commission for growth, structural change and regional development appointed by the German government initiated in 2018
- consensus-oriented dialogue between stakeholders: representatives of utilities, electricity users, trade unions, local communities, NGOs, academics and state and federal governments
- Aims of the commission
  - "concrete prospects" and transition plans for lignite-mining regions → reconcile climate policy with economic growth
  - measures to ensure 2030 climate target in the energy sector (61 to 62 %)
  - roadmap and end date to phase out coal-fired power plants
- recommended that Germany phase out the use of coal for electricity by 2038 or perhaps 2035, starting with a rapid reduction in coal power plant capacity of about a third by 2022. By 2030, almost two-thirds of coal generation should have left the market.

Electricity generation from coal







- substantial economic phase out
- additional reduction necessary
- pathways achieve 2030 target
- moderate effects on wholesale prices
- Germany to become net importer

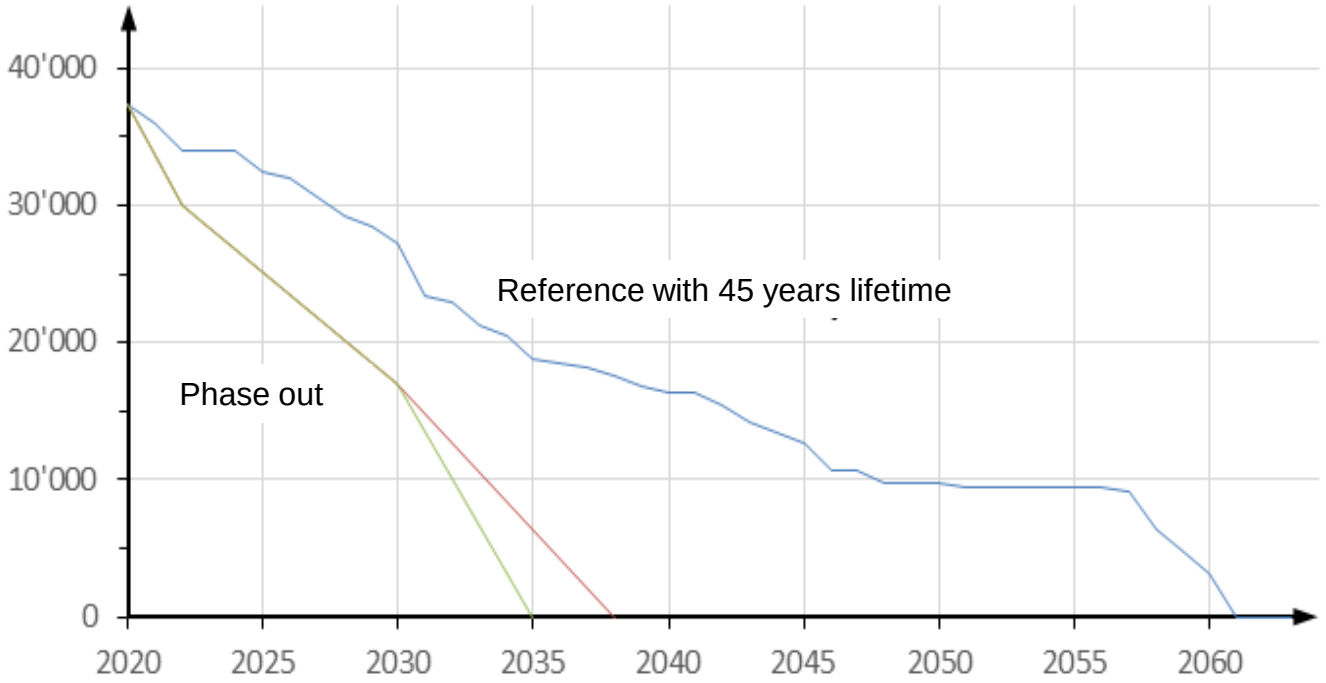
Prof. Dr. Andreas Löschel

Source: BDEW (2018), Enavi (2018), Aurora (2018), DENA (2018), DIW (2018)

Recommendation of the Coal Commission

- commission recommends a complete coal exit by 2038, with fixed reductions in power-plant capacity by 2022 (30 GW) and 2030 (17 GW)
- coal exit timeline and compensatory measures will be reviewed in 2023, 2026 and 2029
- latter two reviews look at end date, 2032 review will consider a 2035 phaseout

Capacities (hard coal, lignite in MW)



Löschel et al. (2019), Monitoring

Implementation determines impacts

- Negotiated phase out – or regulatory phase out w/o agreement; probably auctions for closure in the 2020s → inefficient from an economic perspective
- CO_2 pricing the most economically sensible approach for achieving climate protection targets: market-based exit via energy pricing minimises system costs
- regulatory coal phase-out without accompanying measures problematic
  - new construction/extension of gas-fired power plants and higher emissions from gas utilisation
  - utilization of remaining coal-fired power plants increases (coal rebound; Aurora: can even lead to higher emissions if hard coal is closed before lignite)
  - emissions abroad increase (EU waterbed: Aurora 40% of German reduction)

  → minimum price in EU ETS or national CO2 price

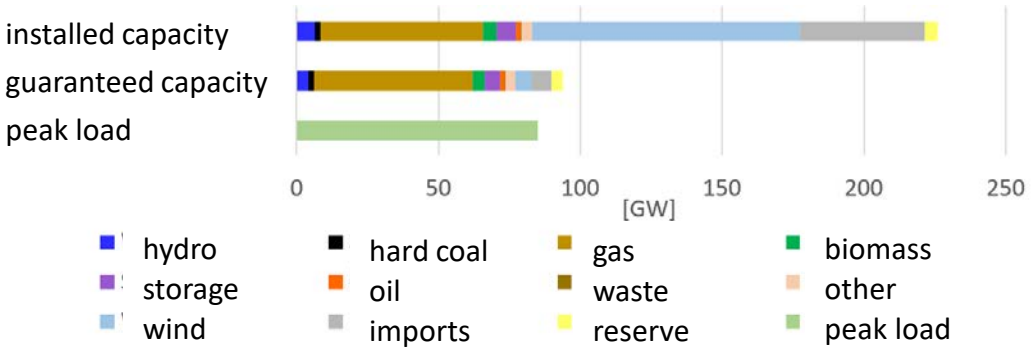
  → certificate cancellation and market stabilisation reserve (ENavi 1300 Mt CO2)

Impacts on electricity costs and plant owners

- electricity prices rise in all scenarios due to nuclear phase-out and reduction of overcapacities D/EU, CO_2 prices, resource prices, especially natural gas prices (ENavi 60 EUR/MWh, Aurora 57 EUR/MWh from 40 EUR/MWh)
- coal exit increases wholesale electricity price slightly compared to reference (coal price -, natural gas price +, CO2 price -) (ENavi 2 EUR/MWh, Aurora 4 EUR/MWh)
- margins for power plant operators change due to phase-out:
  i) higher utilization of power plants + , ii) lower CO2 price reduces variable costs + ,
  iii) higher electricity price + , iv) shutdown shortens power plant lifetime -
  - ➢ the longer a power plant remains in the market, the more it benefits from coal phase-out (particularly modern coal-fired and gas-fired power plants)
- undiscounted cumulative additional costs of the rapid phase-out of coal (without possible compensation payments) amount to EUR 41-106 billion in the energy system over 30 years (ENavi)

Security of Supply / Energy Security

- reduction of electricity exports and transition to net electricity imports by 2030 at the latest in all ENavi scenarios → to what extent is this tolerable (stochastic balancing effects, systemic possibilities, political agreements)?
- security of supply determined by annual peak load and Dunkelflaute (dark lull, 14 days): annual peak load rises due to increased electrification (Dena 94-160 GW) and thus demand for secured power, fewer options to cover the Dunkelflaute
- replacement of coal and nuclear energy by renewables and especially gas: by 2050 at least doubling of installed capacities necessary (ENavi 46-67 GW by 2050, DENA 55-117 GW by 2050), electricity generation from gas-fired power plants increases (ENavi 53-136 TWh, Dena 69-250 TWh incl. climate-neutral green gases)
- Example: System stability
  ENavi - KAS 2035



Energy Transition - Status quo and challenges

- substantial gaps in 2020/2030: climate target and efficiency
- climate policy options
  - coal phase out as a relatively cheap option, but implementation costly
  - CO_2 pricing and energy tax reform (electricity tax, FIT, …)
- renewable policies to be developed further (tech, grid, market price risk)
  → increase in renewable alone not sufficient to achieve CO_2 targets
- sector coupling necessary in long run (electricity, heat, transport): electrification and Power to X (hydrogen, green gas, synthetic fuels)
- grid extension as a bottleneck (also in EU): grid charges, market splitting
- comprehensive review of the coal exit measures and their implementation in 2023, 2026 and 2029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Thank you.

Prof. Dr. Andreas Löschel
Chair of Energy and Resource Economics
University of Münster
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We Chat: AndreasLoeschel
Twitter: @andreasloeschel

Upcoming seminars

Date/Location	Presenter	Topic
Wed 17 July, 7-9pm Climate & Energy College	Jeremy McLeod & Nadine Samaha (Breathe Architecture)	Renew Branch Meeting: Sustainable Architecture
Wed 24 July, 11am Climate & Energy College	Ellycia Harrould-Kolieb (University of Melbourne)	Governing Ocean Acidification: Framing an Emergent Issue Across Existing Multilateral Environmental Agreements

climatecollege.unimelb.edu.au/seminars

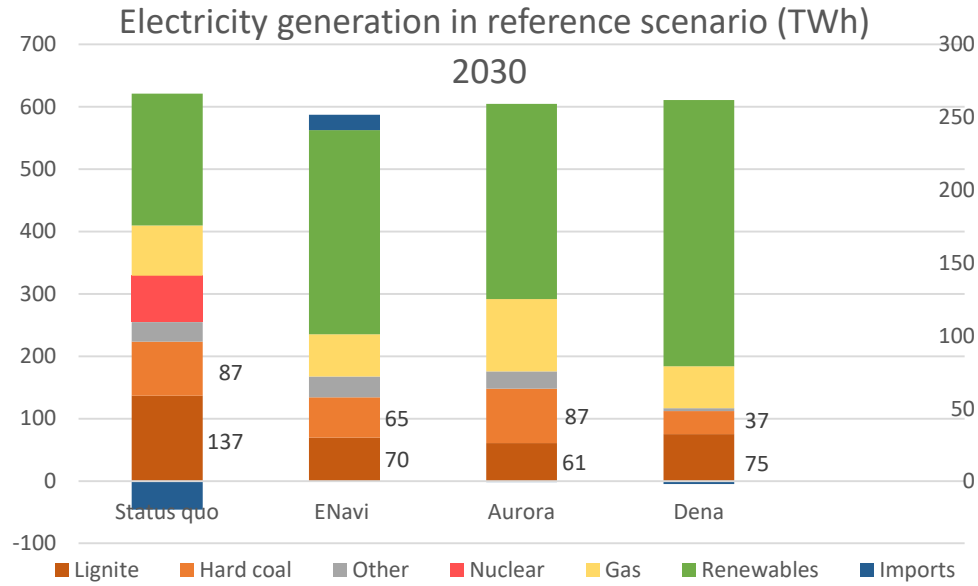

@climatecollege

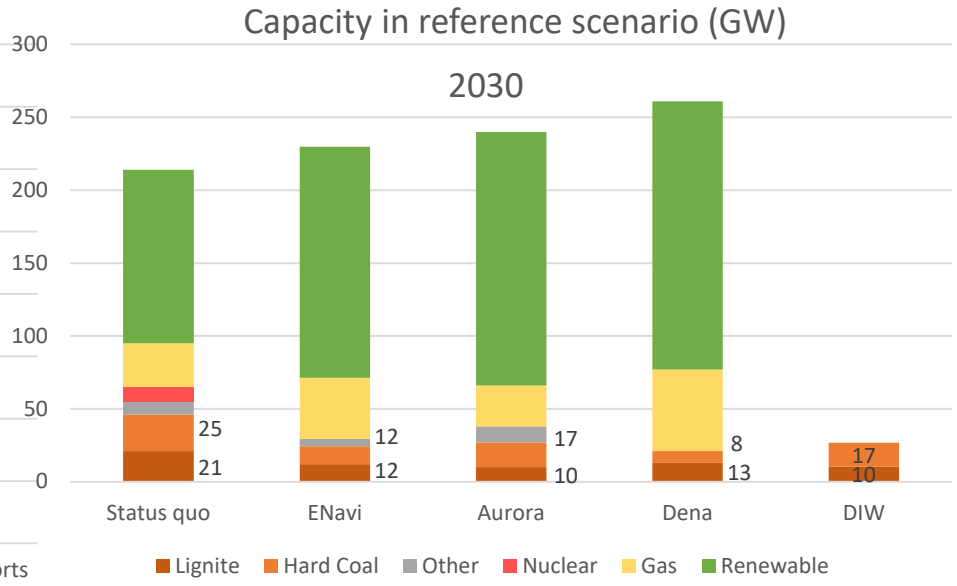
Framework for Energy Sector Target

- Commission for growth, structural change and regional development appointed by the German government
- various studies on the impact of climate targets on coal-fired power generation and power generation (e.g. Agora 2016, Aurora 2018, BDI 2018, BUND 2018, DENA 2018, DIW 2018, Enavi 2018, Öko-Institut 2017/2018)
- achievement of the sectoral objective depends on different framework conditions:
  - renewables expansion: stronger expansion of renewable energies capacities +
  - CO_2-prices: higher national or ETS-prices +
  - fuel prices: higher coal price/lower gas price +
  - power Consumption/Efficiency: Higher Power Consumption -
  - European integration (goals, instruments), interactions, balance - / +

    → determine the development of coal capacities without further intervention given economically driven closure and modernisation decisions and provide a framework for the investigation of various coal phase-out scenarios

Different Reference Scenarios

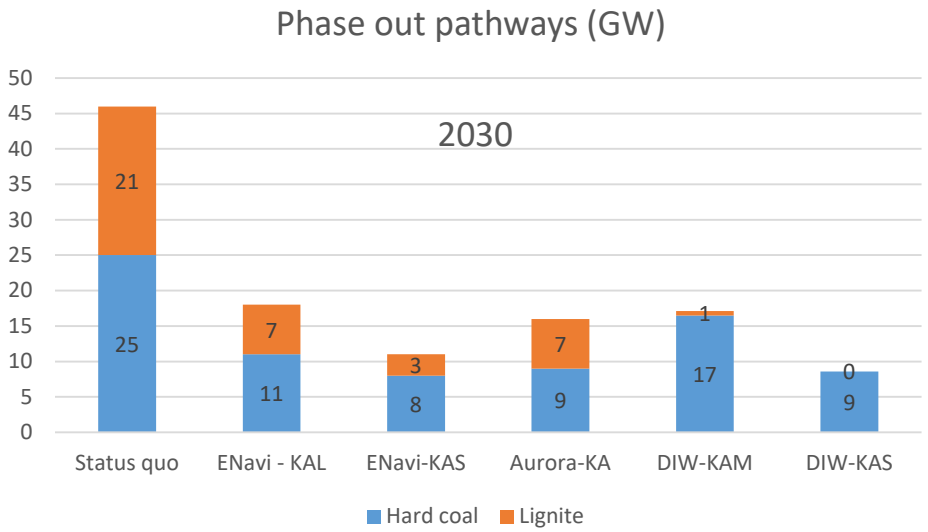




Source: BDEW (2018), Enavi (2018), Aurora (2018), DENA (2018), DIW (2018)

- sectoral target not met in reference case (gap 65 Mt according to Aurora)
- even without regulatory intervention, coal-fired power plants are shut down for economic reasons (15 GW Aurora, 20 GW DIW, 22 GW ENavi, 25 GW Dena).
- renewables expansion important: in the reference (before KOAV) renewables are expanded less strongly (52% according to Aurora) (not in DENA)
- stronger expansion of renewables (65%) partially closes gap (15 Mt in Aurora)

Different Coal Phase Out Paths



- Studies on coal exit with different paths:
  - Enavi-KAL (-6 GW): exit 2050 and sector target 2030 achieved
  - Enavi-KAS (-13 GW): ambitious phase-out 2035 (Agora Energiewende, 2016)
  - Aurora-KA (-11 GW): exit 2040 and close 2 GW per year by age
  - DIW-KAM (-10 GW): 3 GW by 2020, mainly brown coal, hard coal after 2030
  - DIW-KAS (-18 GW): 7 GW by 2020, hard coal and lignite by 2030

  → in all scenarios, target achievement in 2030
  (for Aurora-KA only with 65% renewable energy expansion)

Implementation determines impacts

- Climate protection effect depends on cumulative emissions: less important endpoint of coal phase-out than closures in the next decade (e.g. 50% more emissions with 33 GW 2025 / phase-out 2035 than 18 GW 2025 / phase-out 2050)
- determine budget, optimal phase-out non-linear (ENavi: early and strong coal reduction economically advantageous compared to reduction after 2030)
- CO_2 pricing the most economically sensible approach for achieving climate protection targets: market-based exit via energy pricing minimises system costs
- regulatory coal phase-out without accompanying measures problematic
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