Energiewende

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Why Energiewende

- 'Laboratory' of the energy transition (Also – decarbonization as a new type of transition - forced politically, not technologically).
- Technological and ideological leadership.
- Largest energy sector, with direct and indirect impact on neighbouring countries.
- Germany as an economic and political (not military) leader of Europe and the EU.
- Germany's Energiewende has some serious geopolitical consequences (RES + natural gas from Russia).

Origins of EW

1st pillar: nuclear phase-out

- Long and successful tradition of nuclear industry in Germany – in the 1970s 17,000MW.
- German anti-nuclear movement – Außerparlamentarische Opposition in the 1960s (leftist students), environmental movements, local opposition.
- Three Mile Island in 1979, Chernobyl in 1986.
- 1998 Greens in the federal government (with SPD) – Germany's plan (2002) to gradually withdraw from nuclear.
- In 2010, the Atomic Energy Act was amended – NPPs' lifespan extended, production limits on nuclear electricity increased.
- 2011 Fukushima – phase-out by 2022.

Origins of EW

2nd pillar: climate and environment protection measures.

- In the 70s anti-nuclear sentiment, environmental consciousness and oil crisis raised the issue of RES.
- 1974 first RES subsidy program – PV parks. Strengthened in 1977 – 25% of investment costs reimbursed.
- 1990 – Act on the Supply of Electricity from RES into the Grid (StrEG).
- 2005 – Merkel´s great coalition (CDU/CSU + SPD) – ambitious climate plans, incl. RES and energy efficiency.
- 2010 – Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply -> Energiewende.

Germany's renewable energy targets and status 2020

Data: BMWi, 8th Monitoring Report on the Energy Transition (2021) / BMWi, AGEE-Stat (2021).

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	Status		Targets			
	2019	2020	2020	2030	2040	2050
Share of renewable energies						
Share in gross final energy consumption	17.7 %	19.6 %	18 %	30 %	45 %	60 %
Share in gross power consumption	42.0 %	45.4 %	min 35 %	65 %*		**
Share in heat consumption	15 %	15.2 %	14 %			
Share in transport sector	5.6 %	7.3 %	10 % (EU goal)			

*Target from Climate Action Programme 2030, EEG 2021

**The EEG 2021 stipulates that before 2050 all electricity generated or consumed in Germany is generated in a greenhouse gas-neutral manner

Germany's 2030 sector targets for greenhouse gas emission reduction and 2020 status

Data: UBA (2021) / Climate Action Law.

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Sector	2020 status (cut from 1990 levels)	2030 target (cut from 1990 levels)
Energy	52.7 %	76.8 %
Buildings	42.8 %	68.1 %
Transport	11.1 %	48.1 %
Industry	37.2 %	58.4 %
Agriculture	23.7 %	35.6 %
Other	76.7 %	89.5 %
Total	**40.8 %**	**65 %**

Note: Without emissions from land use, land use change and forestry (LULUCF), 2020 data preliminary.

Germany's energy efficiency and consumption targets, status 2020

Data: BMWi, 8th Monitoring Report on the Energy Transition (2021) / AGEB (2021).

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	Status		Targets			
	2019	2020	2020	2030	2040	2050
Energy efficiency and consumption						
Primary energy consumption (compared to 2008)	-11 %	-18.1 %	-20 %	-30 %		-50 %
Final energy productivity	1.4 % per year (2008-2050)	ND*	2.1 % per year (2008-2050)			
Gross electricity consumption (compared to 2008)	-7.1 %	-11.1 %	-10 %	→	→	-25 %
Primary energy demand buildings (compared to 2008)	-23.6 %	ND*	→	-55 %		
Heat demand buildings (compared to 2008)	-10.9 %	ND*	-20 %			
Final energy consumption transport (compared to 2005)	7.2 %	ND*	-10 %	→	→	-40 %

*No data

(Financial) costs and benefits of EW

Costs (in hundreds of billions of euros by the end of 2030s):

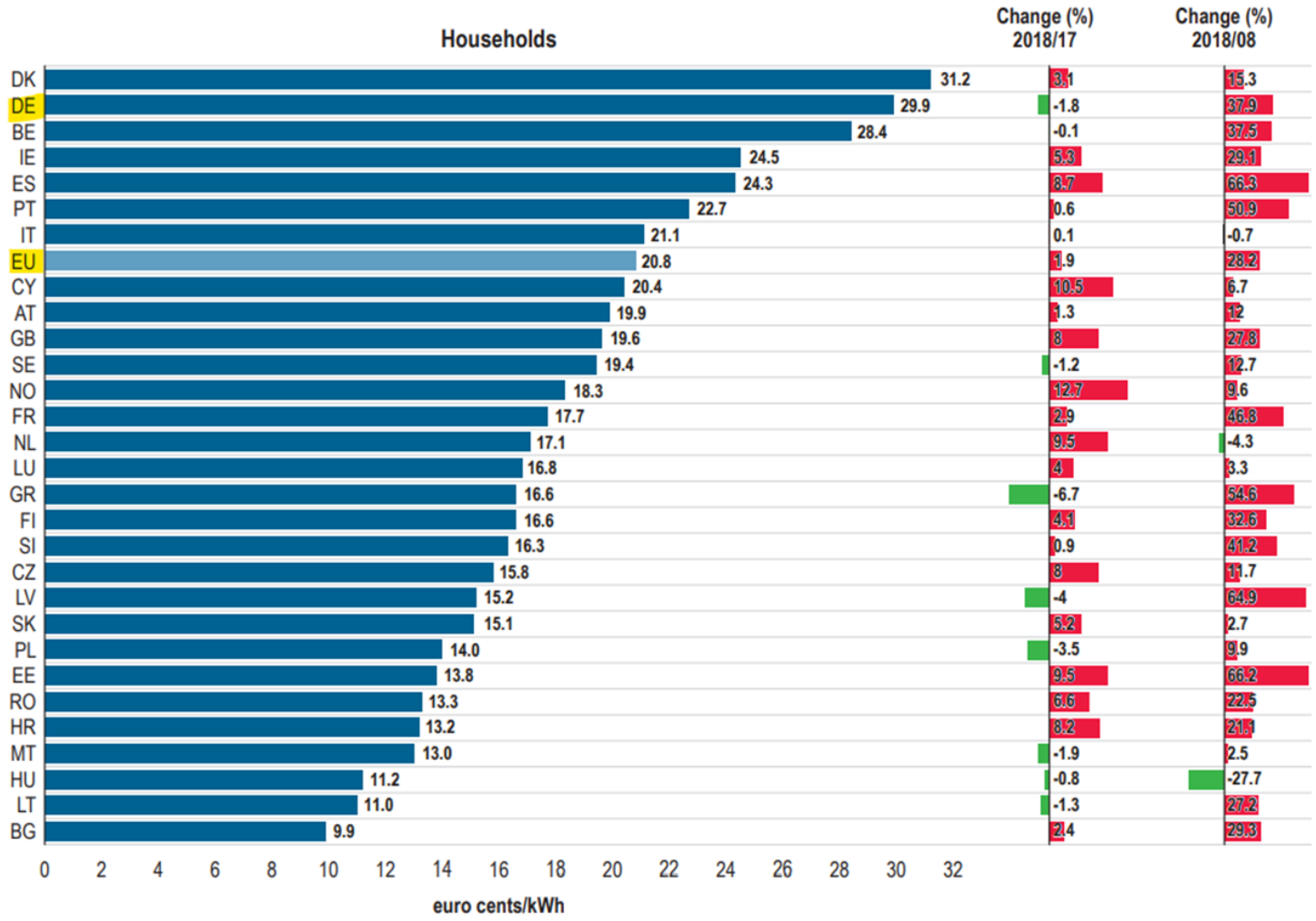
- Nuclear phase-out: Decommissioning expenses, company compensations, and potential job losses.
- RES surcharges: Subsidies for renewable energy development and integration.
- Grid management: Infrastructure upgrades for renewable source variability and smart technologies.
- Heat & transportation: Investments in electric charging stations, heat pumps, etc.

(Financial) costs and benefits of EW

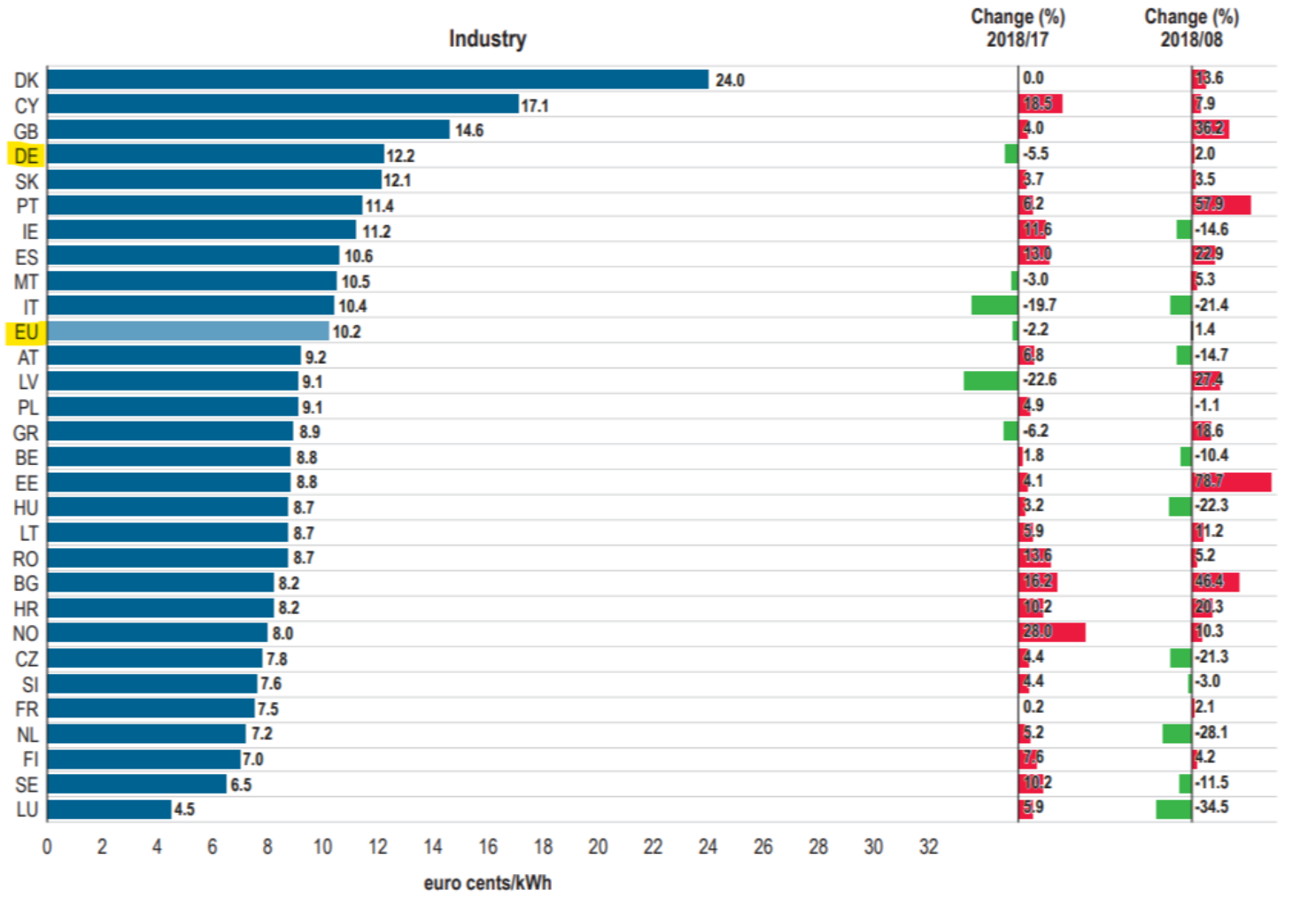
Avoided costs:

- Early transition may prevent losses from obsolete fossil fuel investments (stranded assets).
- Fewer energy imports enhance security and lower geopolitical risks.
- Reduced carbon emissions lead to fewer taxes or regulatory payments.
- Renewables can offer lower wholesale price of elektricity prices.(Note: Households face higher prices, but companies have exemptions for competitiveness. This incentivizes public discontent and raises questions about fairness of distribution, also at the EU level).

Electricity prices: Households (Eurocents/kWh)



Electricity prices: Industry (Eurocents/kWh)



Nuclear phase-out

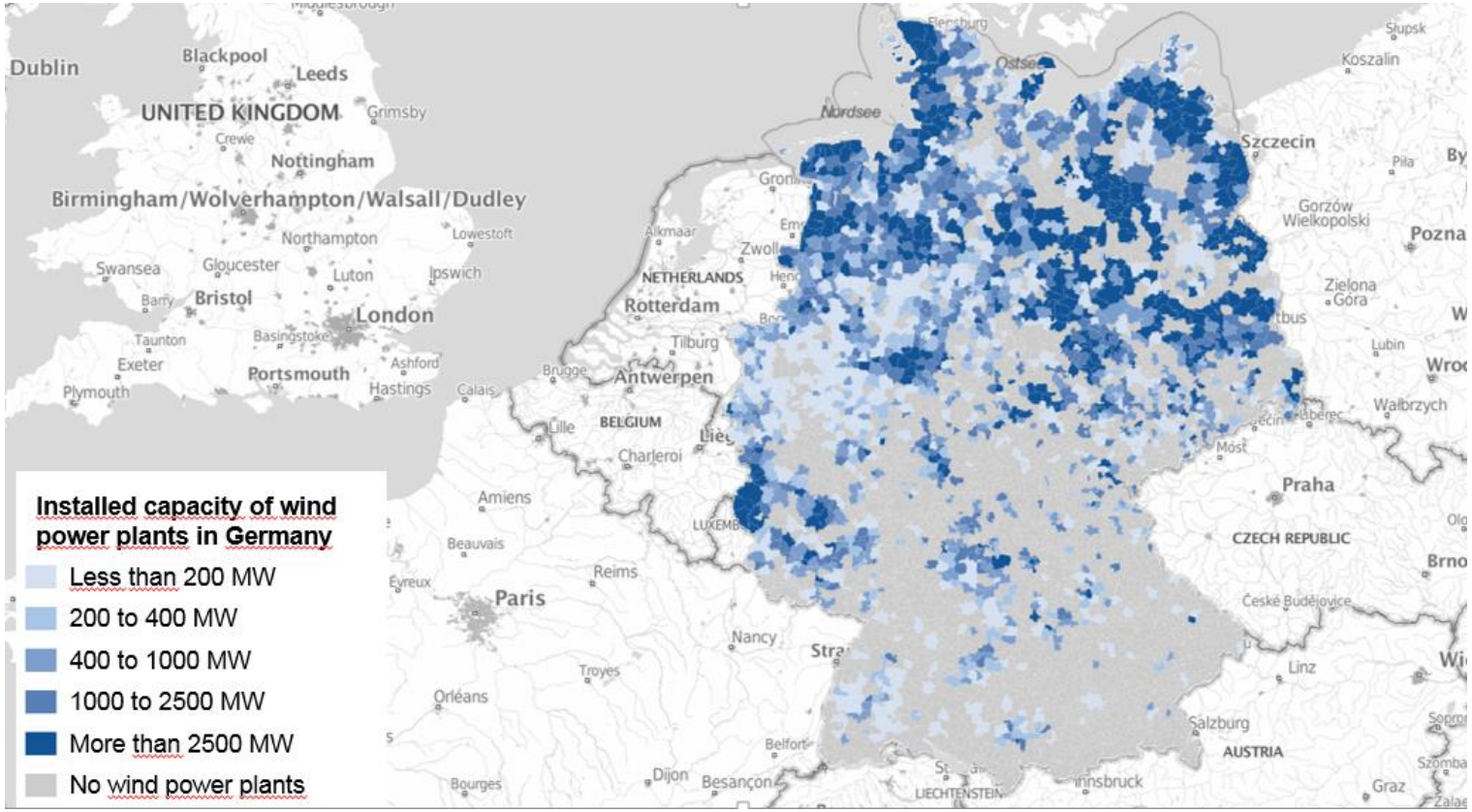
- 81% Germans support the phase-out (2015 poll).
- Decommissioning has a budget of EUR 38 billion, potentially insufficient.
- Company stability is at risk.
- Nuclear waste remains a concern.
- E.ON, RWE, EnBW, Vattenfall sought compensation. Over 30 legal cases settled in 2021 for EUR 2.5bn.

The future of coal

- In 2018, Germany sourced 22.5% of its electricity from lignite and 12.8% from hard coal. Last hard-coal mine closed in 2018, but Germany still largest producer of lignite in the world.
- Multi-stakeholder coal commission – roadmap (1/2020) for shutting down the lignite-fired plants and on compensations (about EUR 4.35 billion + up to EUR 5 billion of social benefits by 2030).
- Auctions to shut-down hard-coal power plants by 2026, then forced closures. Ban on new coal plants with exception of Datteln plant (Uniper).
- No coal after 2038 (aiming at 2030).

Grid capacity

Grid is unable to accomodate 1 500 000 PV units and 23 000 wind turbines.



Share of energy sources in gross German power production in 2021.

Data: BDEW 2021, preliminary.

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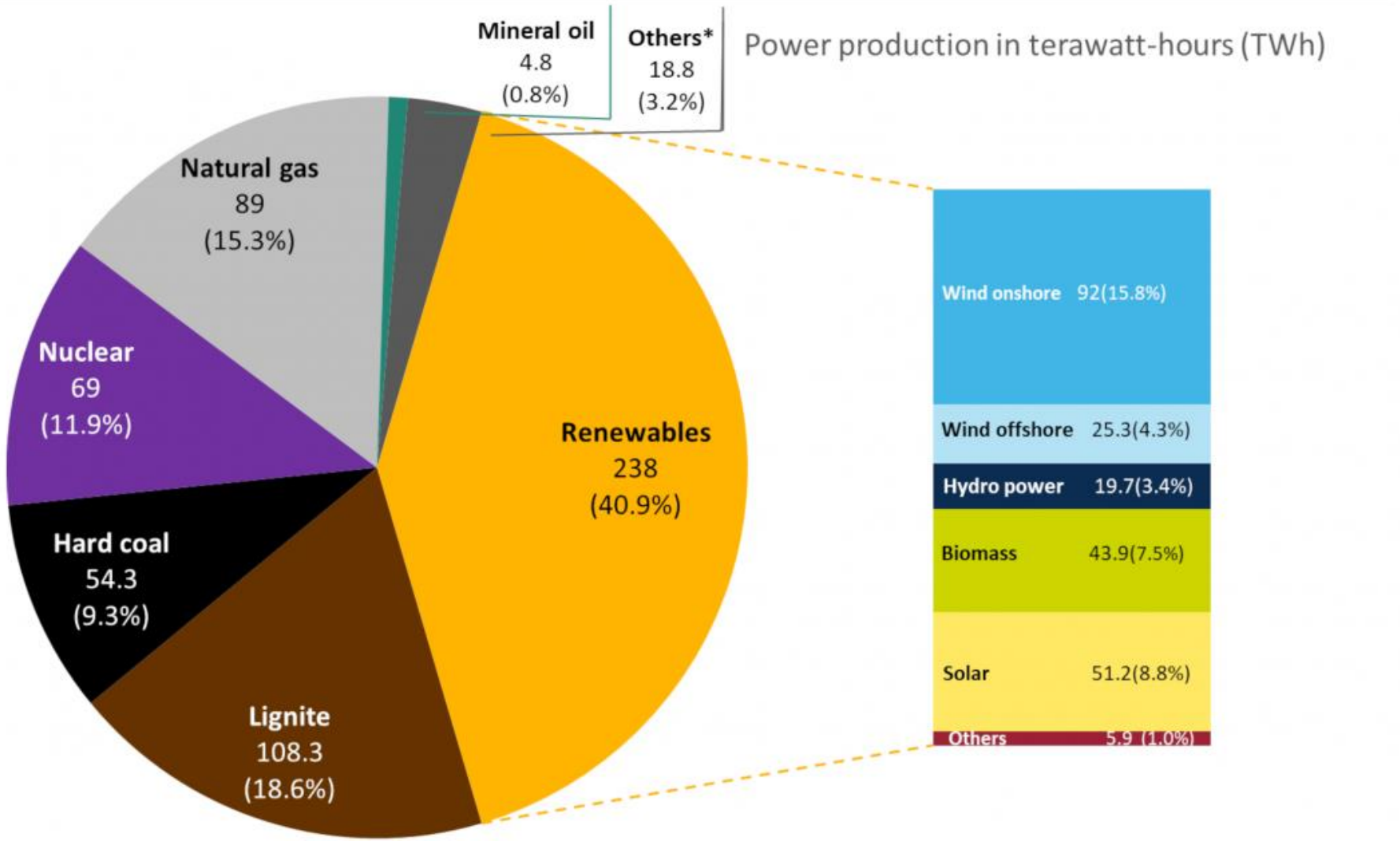
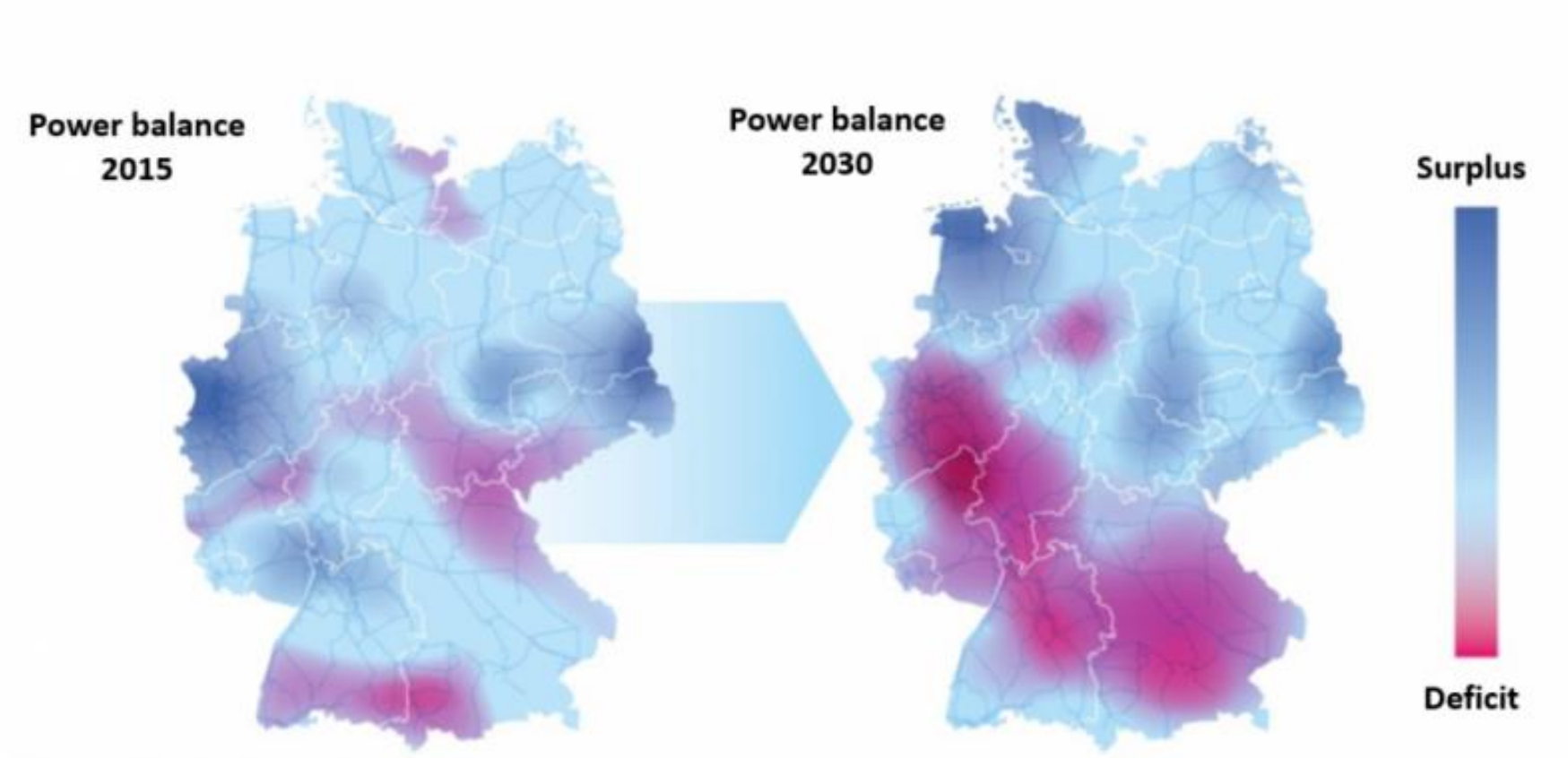


***Without power generation from pumped storage**

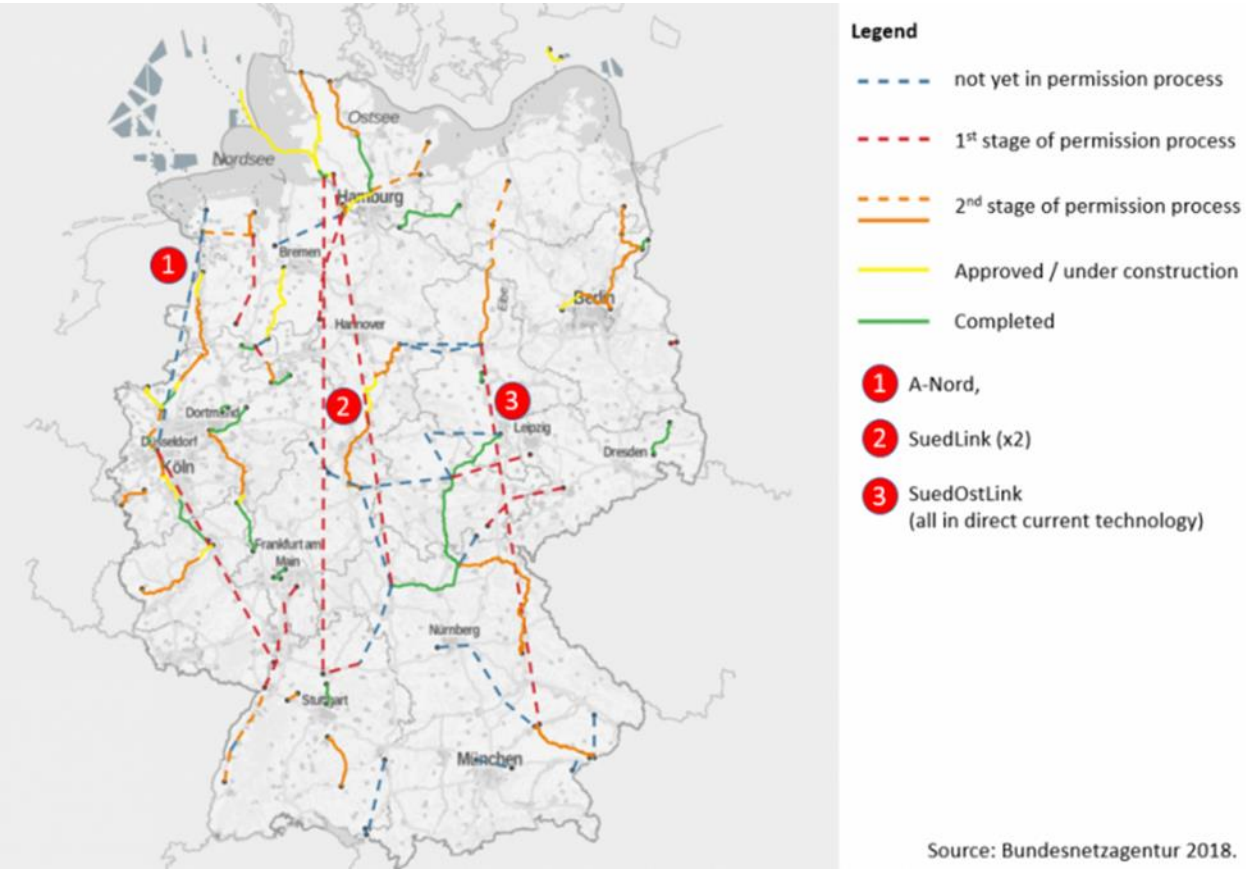
Note: Government renewables targets are in relation to total power consumption (561.8 TWh in 2021), not production. Renewables share in gross German power consumption 2021 (without pumped storage): 42.4%.

Building of the grid



Schematical overview

Source: Amprion.



Legend

- not yet in permission process
- 1st stage of permission process
- 2nd stage of permission process
- Approved / under construction
- Completed

1. A-Nord,
2. SuedLink (x2)
3. SuedOstLink
(all in direct current technology)

Source: Bundesnetzagentur 2018.

Suedlink – in 2028, instead of 2026.
SuedOstLink – 2027, instead of 2025.
Ultranet – 2027, instead of 2024.
A-Nord – 2027, instead of 2025.
3Q 2021 – only 1435km of about 11500km planned finished, another 1114 in construction.

Restructuralization of power production

RES development:

- Shift from traditional to renewable energy sources (RES).
- Need for tech: electricity storage, RES fluctuation management, integration, and backup.
- Rise of new energy companies; traditional firms decline.
- New regulations, trading, and financing mechanisms required…

= the same for other energy-related sectors (heat/cooling, transportation).

Is the EW a successful story of policy-driven transition?

- Increased share of RES in the energy (electricity) mix and a decrease in their costs.
- Decoupling of energy consumption from economic growth.
- Stable and reliable electricity supplies despite initial concerns.
- High but manageable costs.

VS

- Over-reliance on Russian natural gas.
- Premature (?) shutdown of nuclear power plants.
- Limited climate contribution (RES replacing nuclear).
- Increasing dependence on neighboring countries for grid stabilization.

Economic growth, power & energy consumption, GHG emissions 1990 - 2020.

Data: BMWi 2021, UBA 2021.

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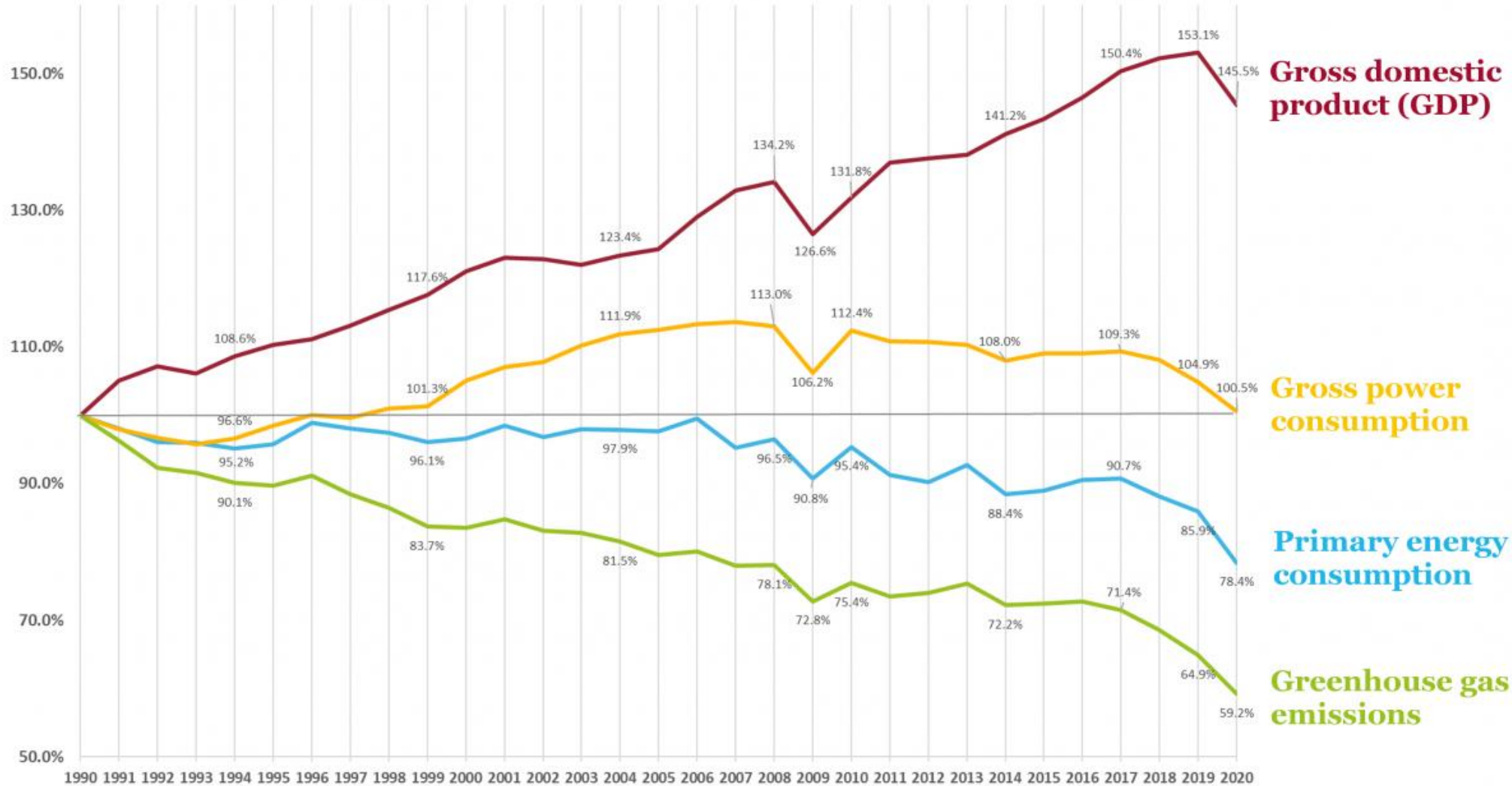
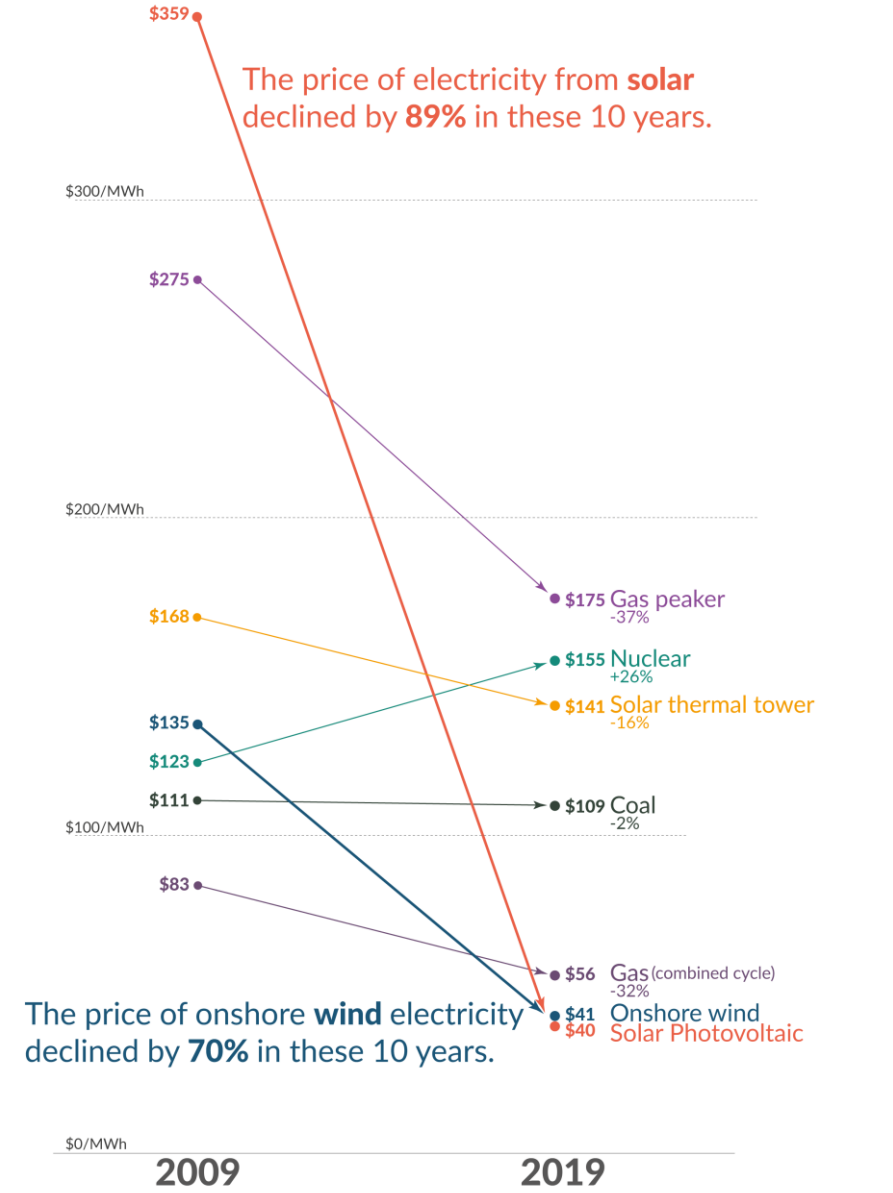


Note: As a general rule, emissions data for the last year shown can expected to be preliminary.

The price of electricity from new power plants

Electricity prices are expressed in 'levelized costs of energy' (LCOE).
LCOE captures the cost of building the power plant itself as well as the ongoing costs for fuel and operating the power plant over its lifetime.

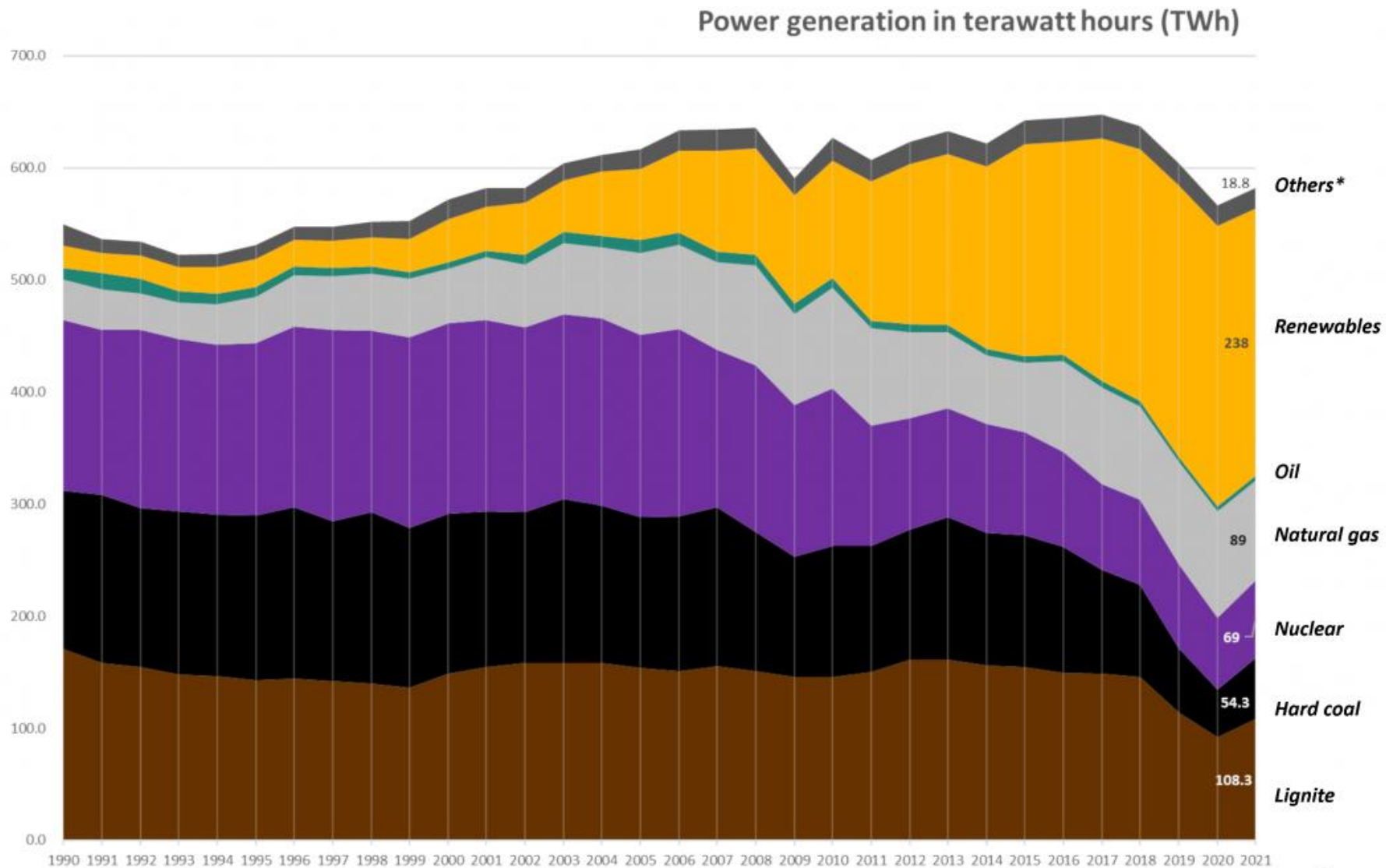
Our World in Data



Data: Lazard Levelized Cost of Energy Analysis, Version 13.0

Gross power production in Germany 1990 - 2021, by source.

Data: BDEW 2021, data preliminary.



*** Without power generation from pumped storage.**

Share of energy sources in gross German power production in 2021.

Data: BDEW 2021, preliminary.

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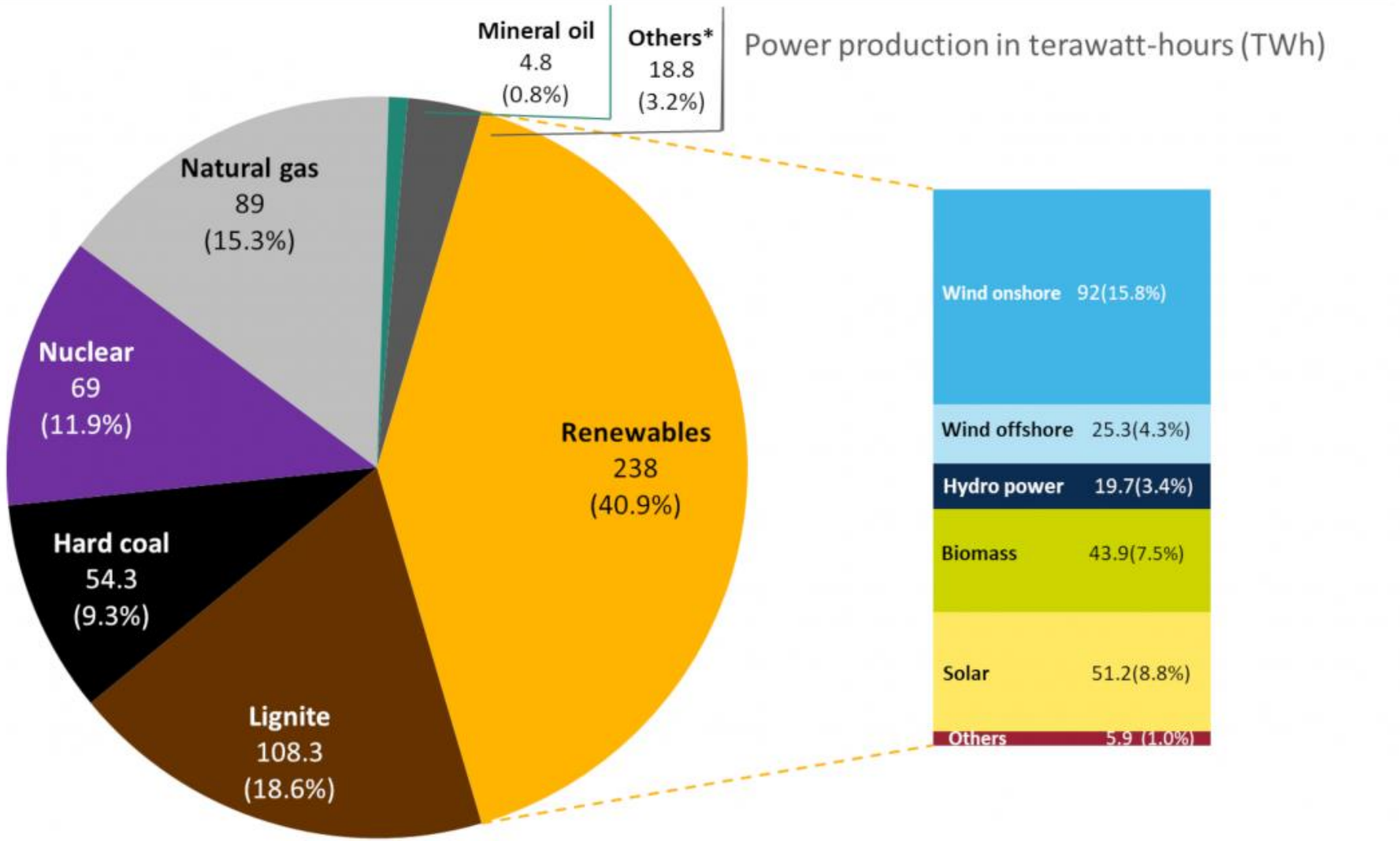

***Without power generation from pumped storage**

Note: Government renewables targets are in relation to total power consumption (561.8 TWh in 2021), not production. Renewables share in gross German power consumption 2021 (without pumped storage): 42.4%.

German energy sources' share in primary energy consumption 1990 - 2021.

Data: AG Energiebilanzen 2021, preliminary.

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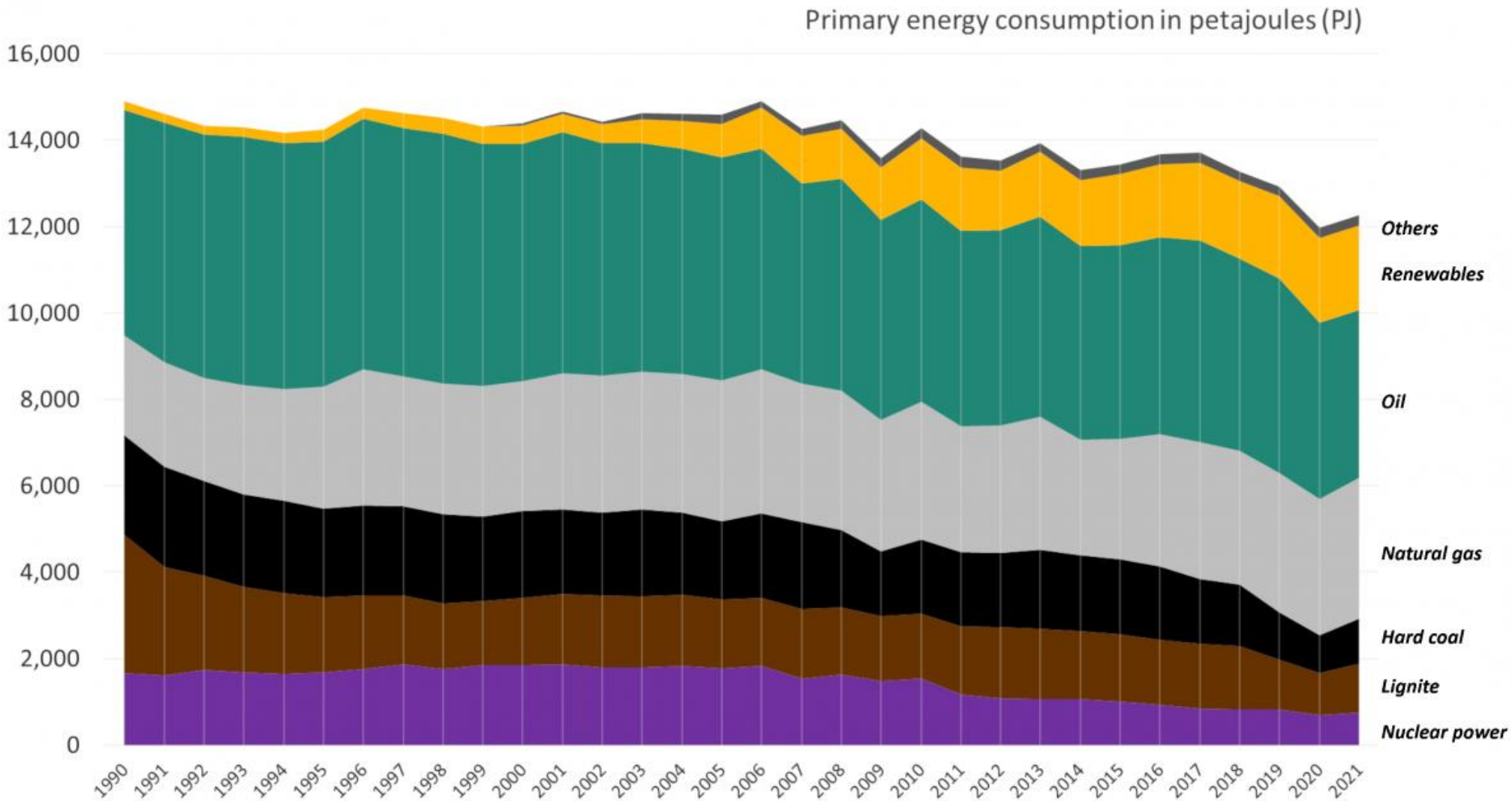

German power export balance 1990 - 2021.

Data: BDEW 2021 (2021 data preliminary).

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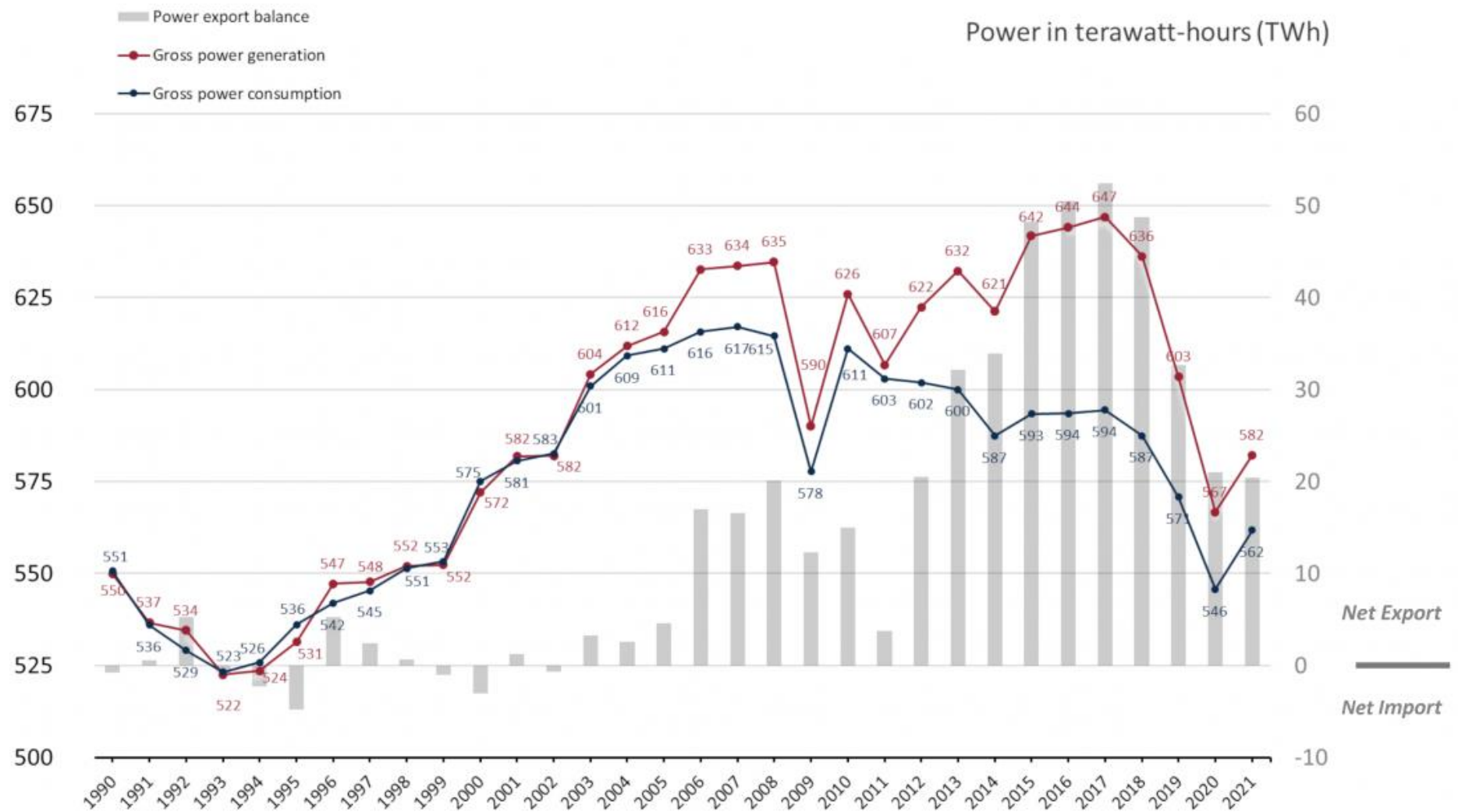
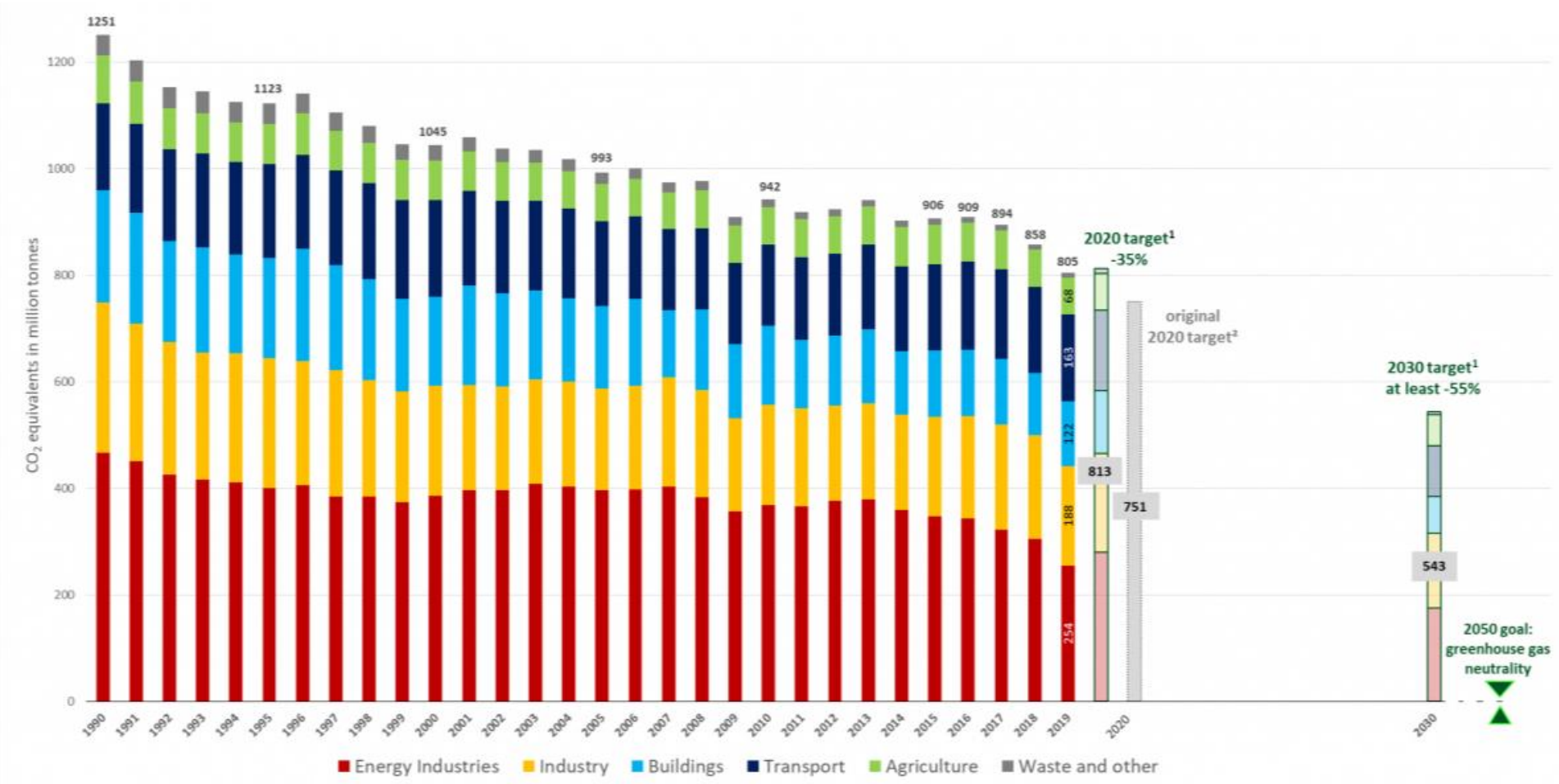


Note: Without power generation from pumped storage.

GHG trends by sector



1) 2020 and 2030 targets as stated in the Climate Action Law.
2) The German government abandoned its original 2020 target with the introduction of the Climate Action Law in 2019.

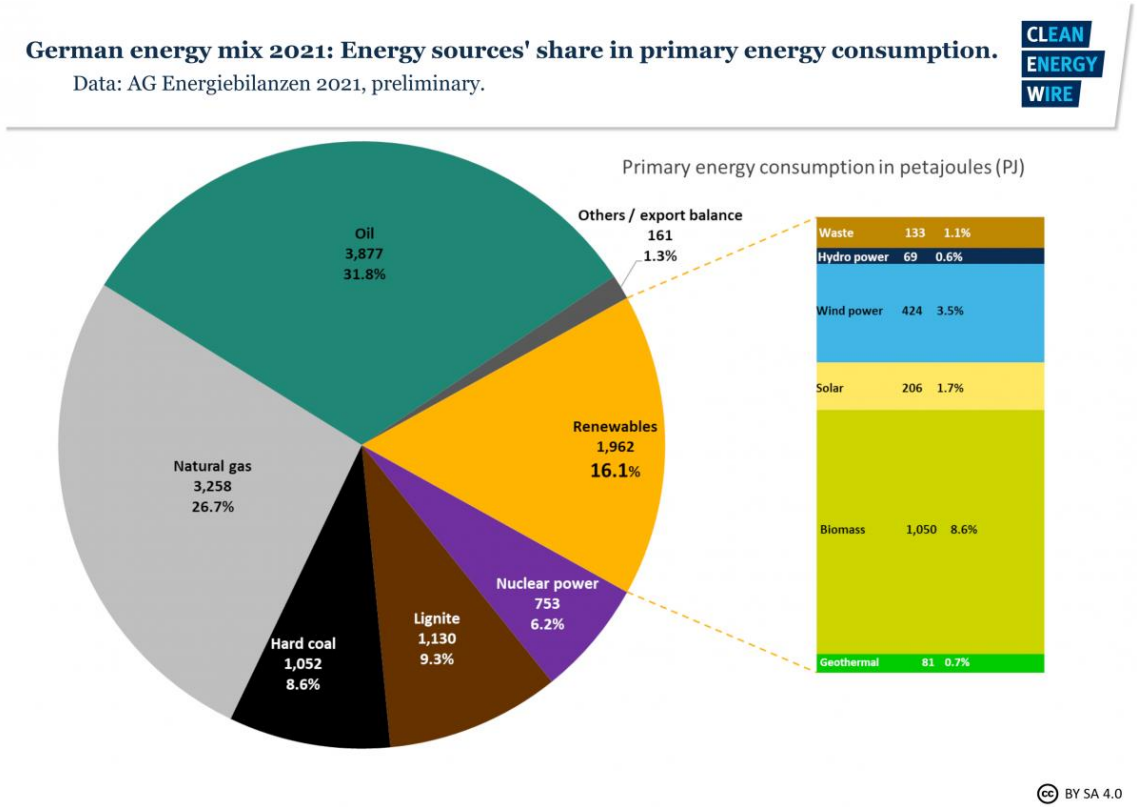
German – RF relationship

- From the collapse of the Soviet Union to 2014 – special relationship (Sonderbeziehungen).
- „European security is impossible to achieve without Russia“.
- „There can be no military solution, any crisis must be solved politically.“

- Slowly deteriorating due to Georgia (South Ossetia, Abkhazia) and other aggressions of Russia. (Russia as a revisionist power).
- The same applies to German public opinion.
- 2012 German parliament: „since … Putin has reassumed office, …measures are taken aimed at widening control over active citizens, criminalizing critical engagement…“ (demonstration in protest against Duma election 2011).
- After Crimea strong backing of sanctions.

German – RF relationship

34% of oil, 53% of hard coal, 32% of natural gas (15% of electricity, 41,5 million households and industry) from Russia.



Germany's Geopolitical Pivot

Olaf Scholz, 2/24/2022:

- Support for Ukraine is essential.
- Deter Putin with Swift disconnection, reserve currencies, tech export restrictions...
- Firm NATO defense commitment: troops to Lithuania, Romania, Slovakia; navy to North Sea, Baltic Sea.
- Military budget: Short-term EUR 100 billion; 2% of GDP by 2024.
- Energy security: Faster RES adoption, carbon neutrality, coal/gas reserves, two LNG terminals, review NPP decommissioning.
- Diplomacy is key, but avoid naivety.

Current challenges

- (Russian) gas as bridge fuel, the transition from Russia to Qatar and others (Also Nord Stream sabotage).
- Taking control of Russian energy assets.
- RES as a solution to that crisis, trying to encourage their (slowing) development.
- Fear of deindustrialization, energy subsidies.
- New technologies for households.
- Hydrogen.
- Chinese impact on the German RES sector.

Also

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Samuel Bailey

Sources

- BMWi (2015): Making a success of the energy transition.
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- Černoch et.al.(2017): Energiewende and the Energy Security of the Czech Republic and Poland
- IEA (2019): World Energy Investment 2019
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- Clean Energy Wire (2019): Germany´s energy consumption and power mix in charts