

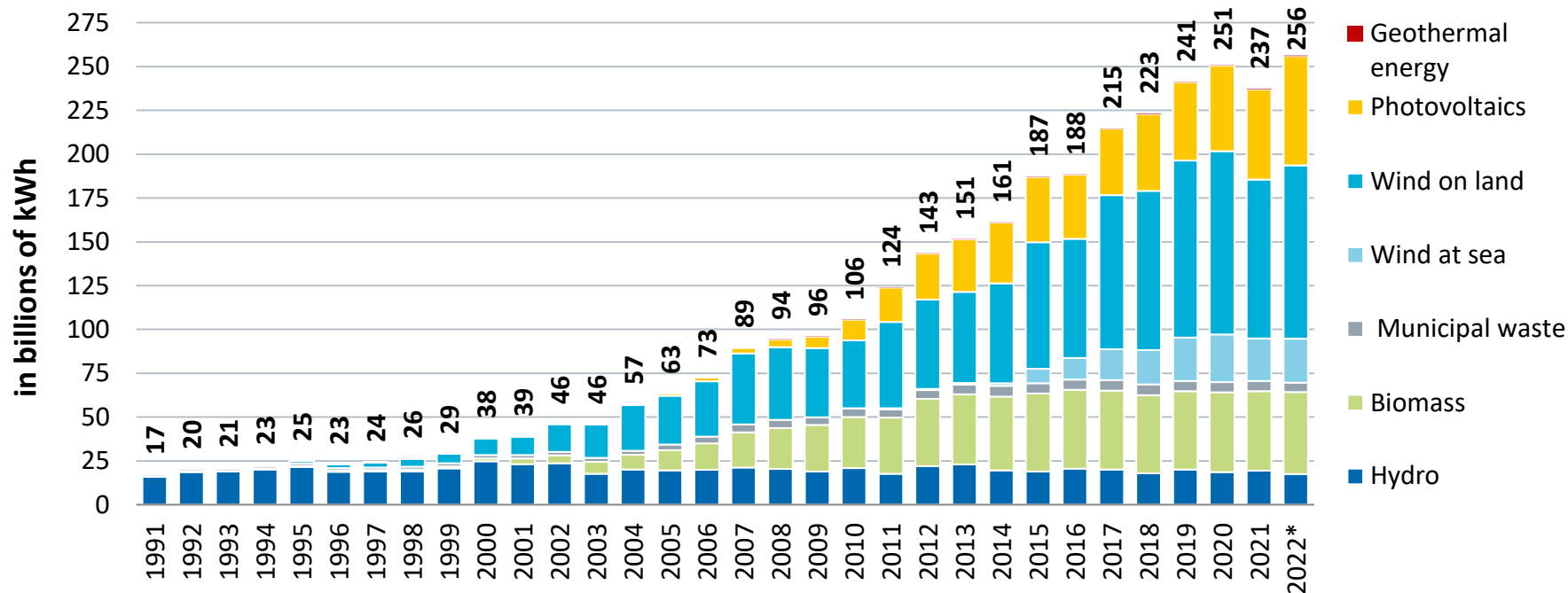
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Energie. Wasser. Leben.

Developing the renewable energy market in Germany – lessons learned and options for future market design refinement

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General Manager International Relations, BDEW

Development of electricity generation from Renewable energies in Germany

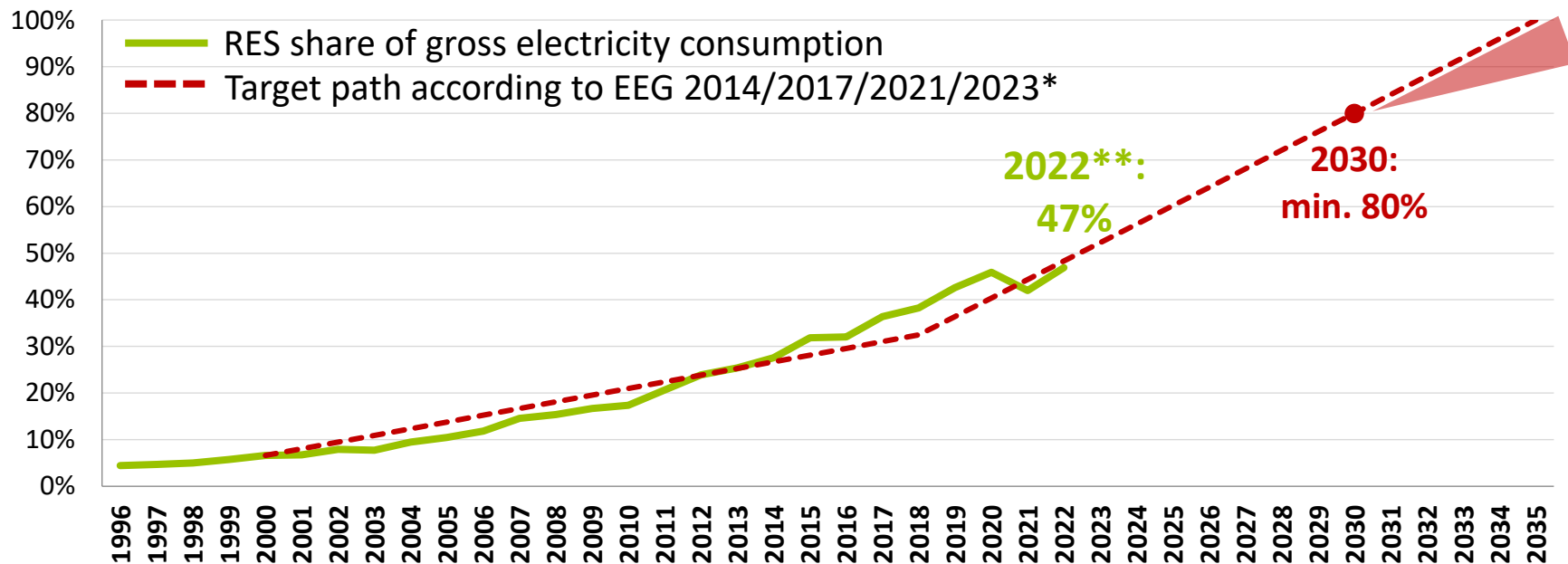


Sources: Destatis, ZSW, BDEW; as of 12/2022

* preliminary; partly estimated

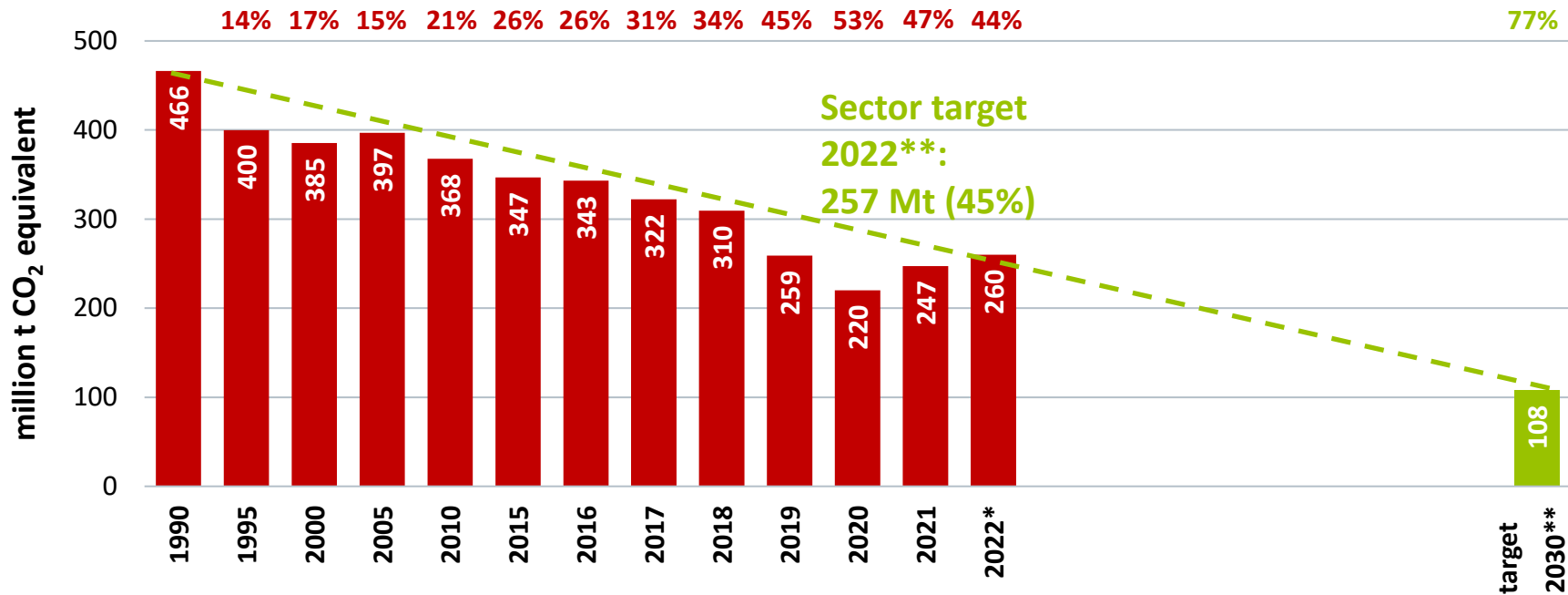
Renewable electricity quota

Share of electricity generation from renewable energies in gross electricity consumption



Greenhouse gas emissions of the energy sector

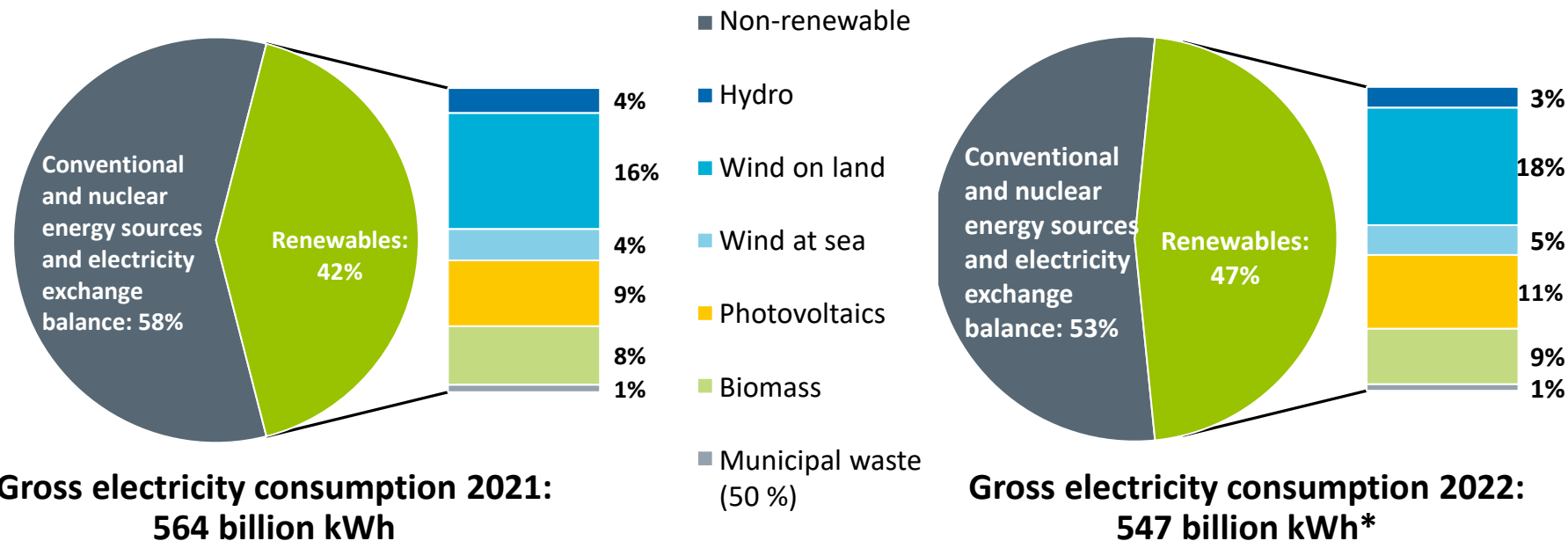
in million t CO₂ eq. and reduction compared to 1990 in %.



Sources: BDEW, UBA, Federal Climate Protection Act; status 12/2022

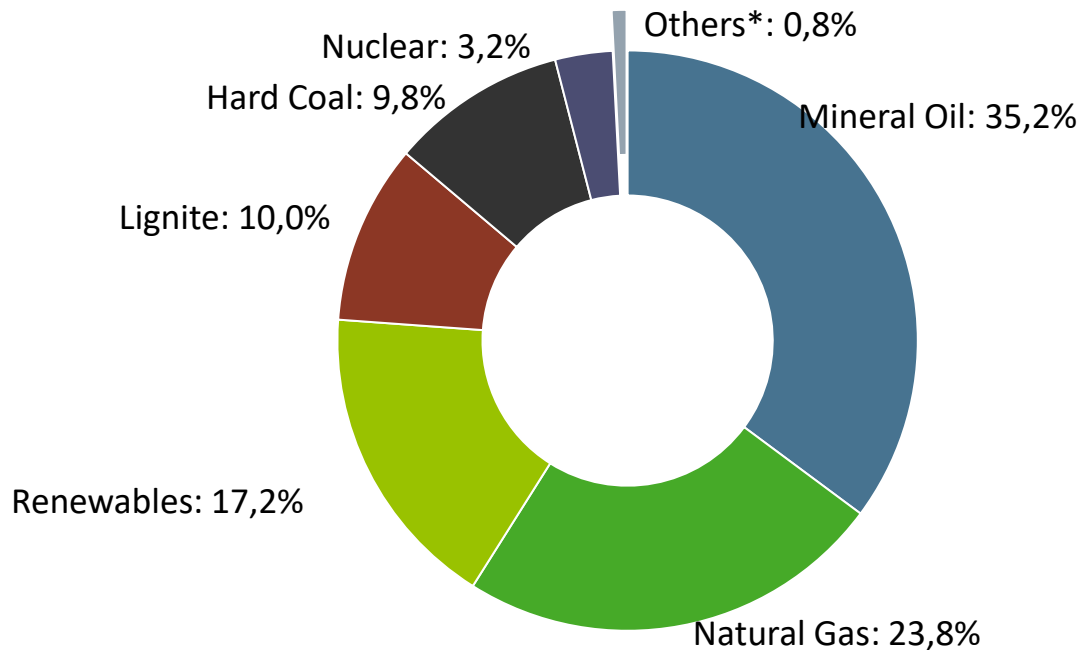
* preliminary ; partly estimated ** according to the Federal Climate Protection Act

Contribution of renewable energies to covering electricity consumption in Germany - previous year comparison



Primary energy consumption in Germany

2022 total:
11,829 PJ (preliminary)



* including power exchange balance

Source: AG Energiebilanzen; Status 12/2022

The Renewable Energy Sources Act (EEG)

Measures adopted to boost development of renewables

- EEG: Implemented in 2000; extensively amended since then
- Important effect on the installation of wind turbines, photovoltaic and biomass plants, thanks to the following:
 - Priority grid access and transmission, independent of location and renewable energy source
 - If necessary, grid operators are obliged to enlarge grid capacity
 - Priority electricity feed-in
 - Remuneration
 - 2000: Guaranteed feed-in-tariffs (FIT), fixed for 20 years,
 - 2011: feed in premium (FIP)
 - 2014/2017: auctions to determine remuneration

The Renewable Energy Sources Act (EEG)

Grid operators (distribution grid and transmission grid)

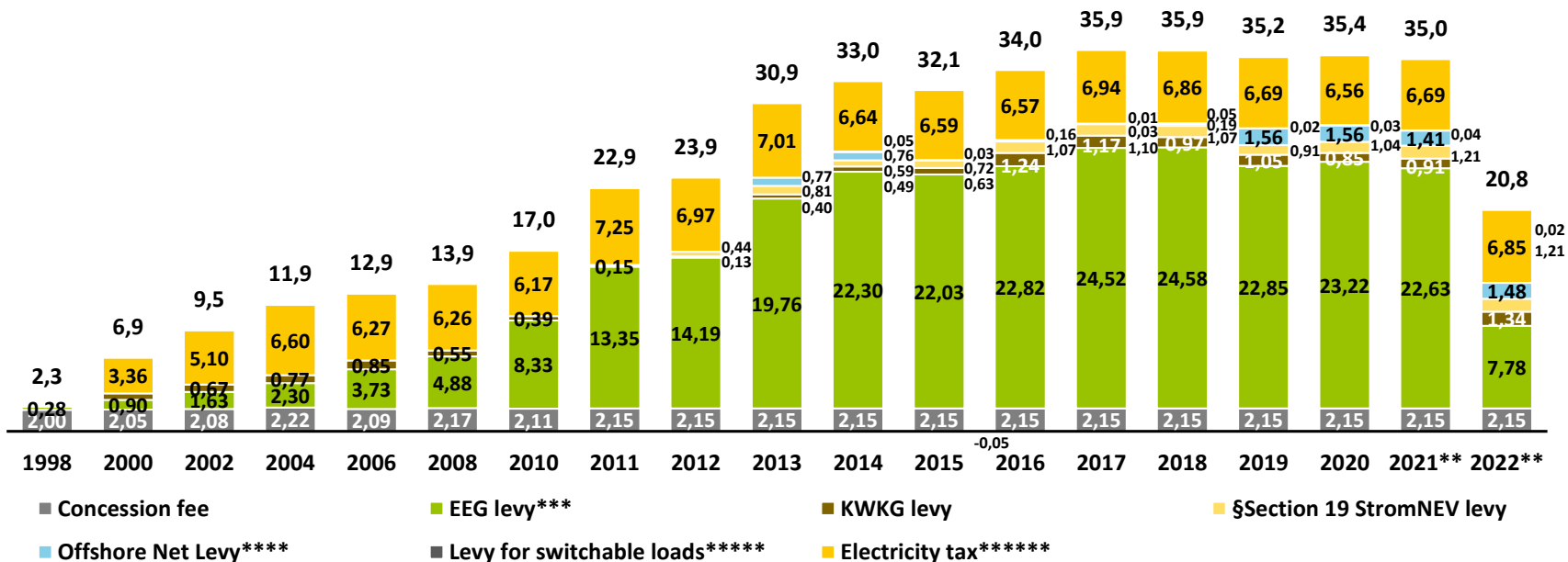
- take over and pay for the renewable electricity
- pass on the electricity to the wholesale market
- are in charge of the forecast, system balancing and services
- have to extend the grid to connect and transmit renewables power, or have to pay compensation otherwise (especially for wind).

Retail companies...

- Charged until mid 2022 an EEG-surcharge on the customers' bill and passed on this money to the grid operators
- As of mid-2022, the state assumed the additional costs.

Total burden of taxes and levies

Burden of electricity prices in € billion (without VAT*)



* VAT burden in 2022 approx. 11 billion euros

** partly provisional

*** until 2009 additional costs compared to exchange price; 2022: Jan.-Jun. 2022

Source: BDEW, as of 11/2022

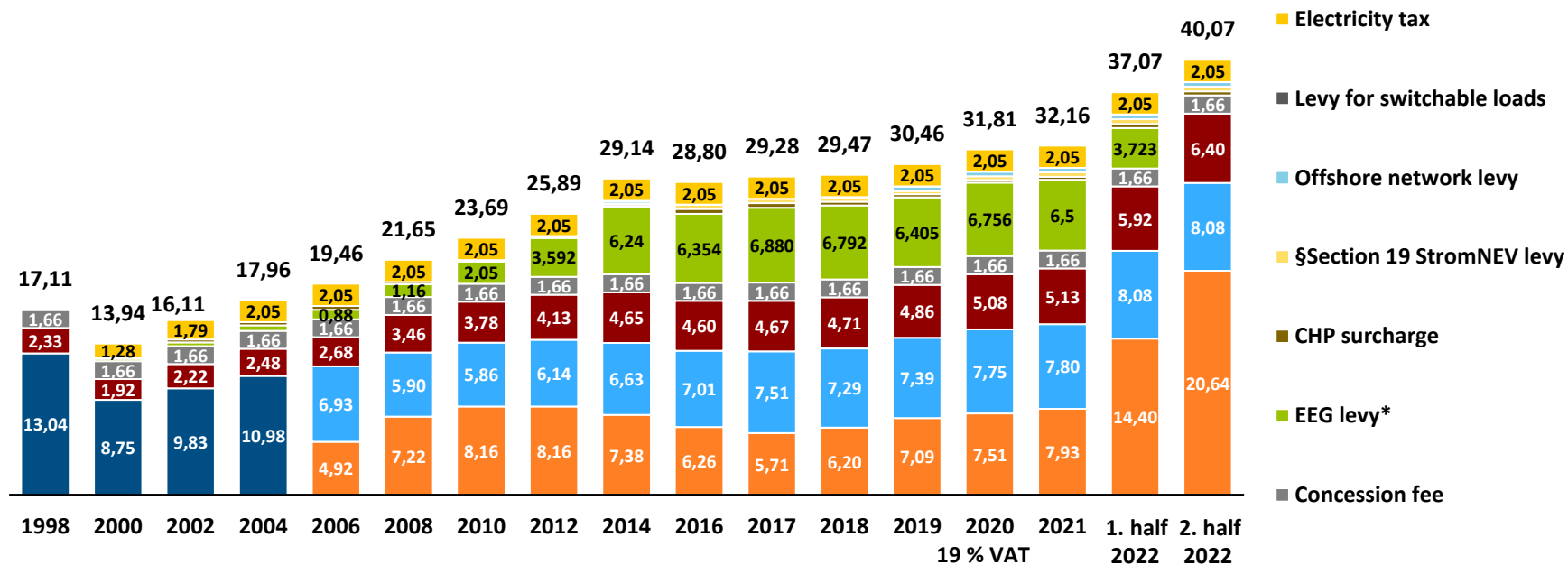
**** until 2018 Offshore liability levy; 2015 repayment

***** Levy for disconnectable loads suspended in 2016

***** 2021: according to AK "Steuerschätzung" of BMF, Oct. 2022

Electricity price for households

Average electricity price for a household in ct/kWh, annual consumption 3,500 kWh, basic price included pro rata, tariff products and basic supply tariffs incl. new customer tariffs included, not volume-weighted

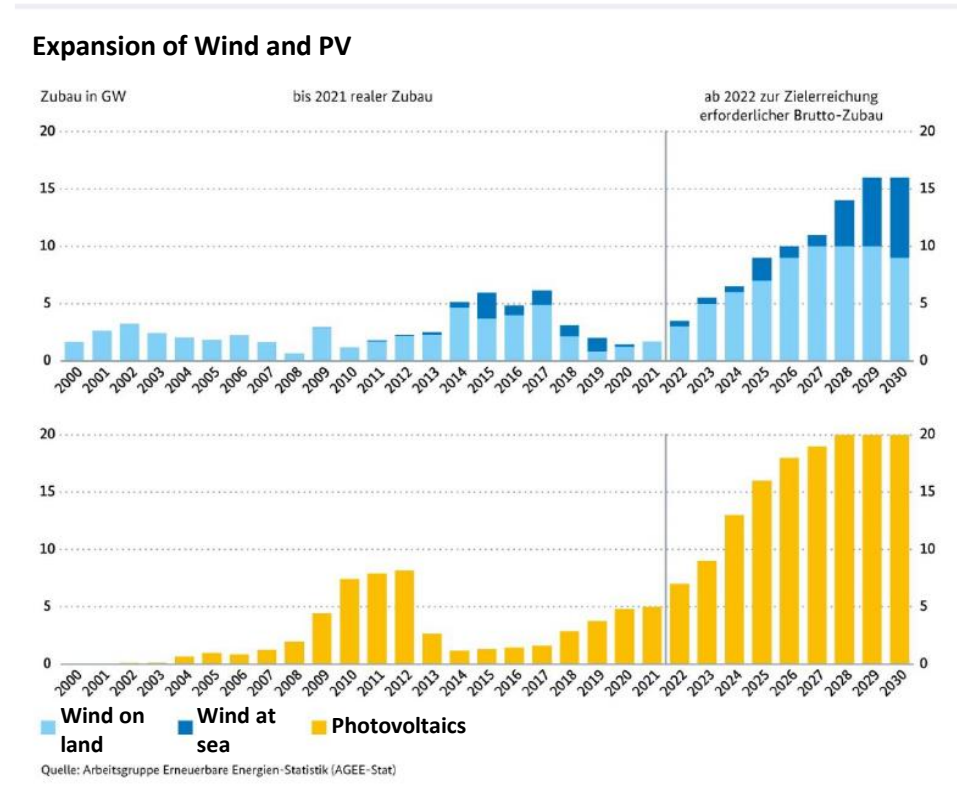


Source: BDEW; Status: 11/2022

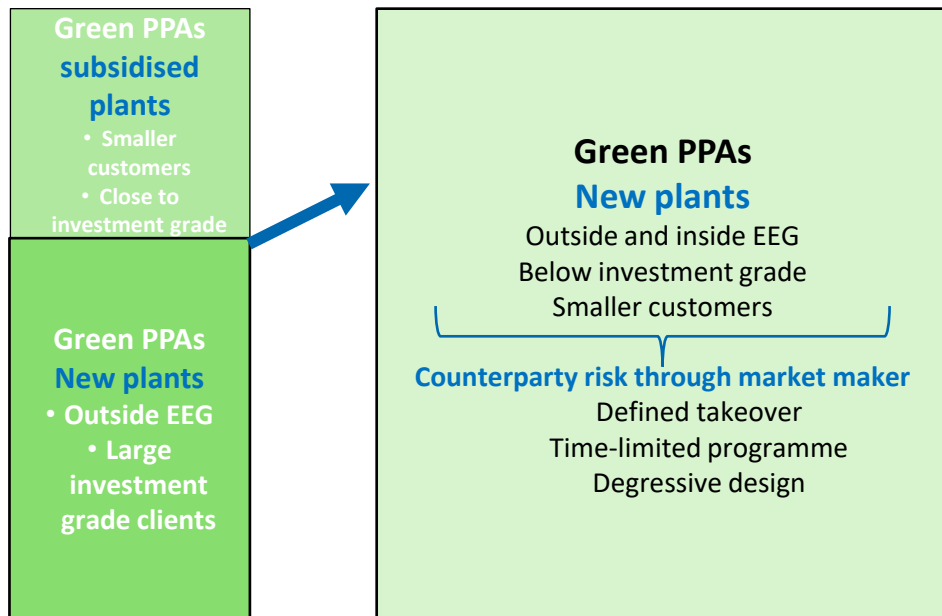
*EEG levy will not apply as of 01.07.2022

Expansion targets by 2030 for renewable energies by sector

- The highest increase in renewable generation capacity is to be provided by photovoltaics: 200 GW by 2030
- This is followed by onshore wind energy with 100 GW by 2030.
- Wind offshore is expected to grow to 30 GW of installed capacity by 2030, then to 40 GW by 2035.
- The chart shows the annual additions of wind and PV planned by the federal government.
- Only a small contribution to the expansion target is expected for bioenergy, hydropower and geothermal energy - wrongly in BDEW's view.



Strengthening Green PPAs - How?



Increase projects

- Acceleration of planning and approval
- Restoring market confidence
- Learning effects

Strengthening of value through **Green GOOs**

Timeline

How do renewable energies enter the market?

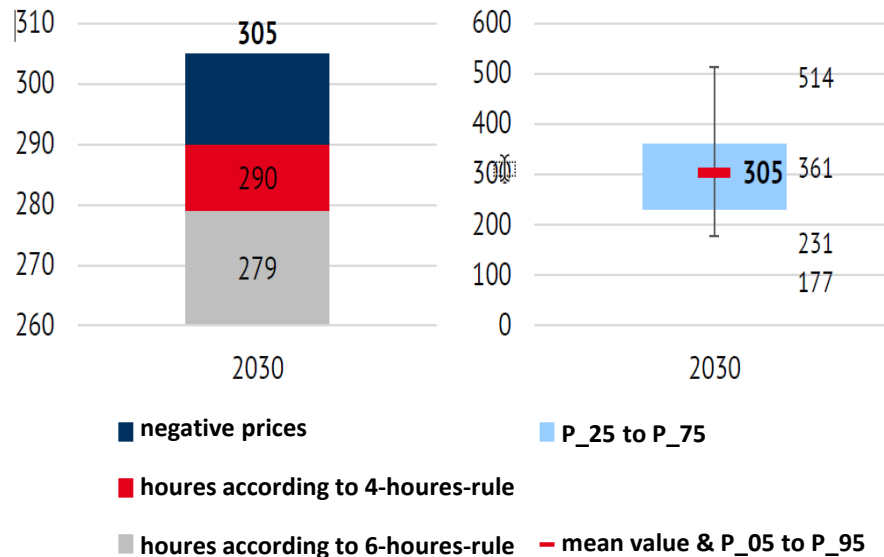
Opportunities and limits of PPAs

- However, the EEG is not rendered superfluous by PPAs, as only marketable renewables can finance themselves via such direct supply contracts
- The ambitious expansion targets for renewable energies can only be achieved if renewable energies, which are currently and possibly even in the long term more expensive, also make a significant contribution.

Sources: PNP, Deutschlandfunk,
Orsted, Enpal, UBA,



Future need for funding? - Need because of "cannibalisation"



- Different studies determine a different, but always considerable increase in periods of negative electricity prices when no remuneration is paid.
- Examples:
 - BEE study "New electricity market design" (2021)
 - Energy Brainpool (2020)
 - Agora Energiewende (2014)

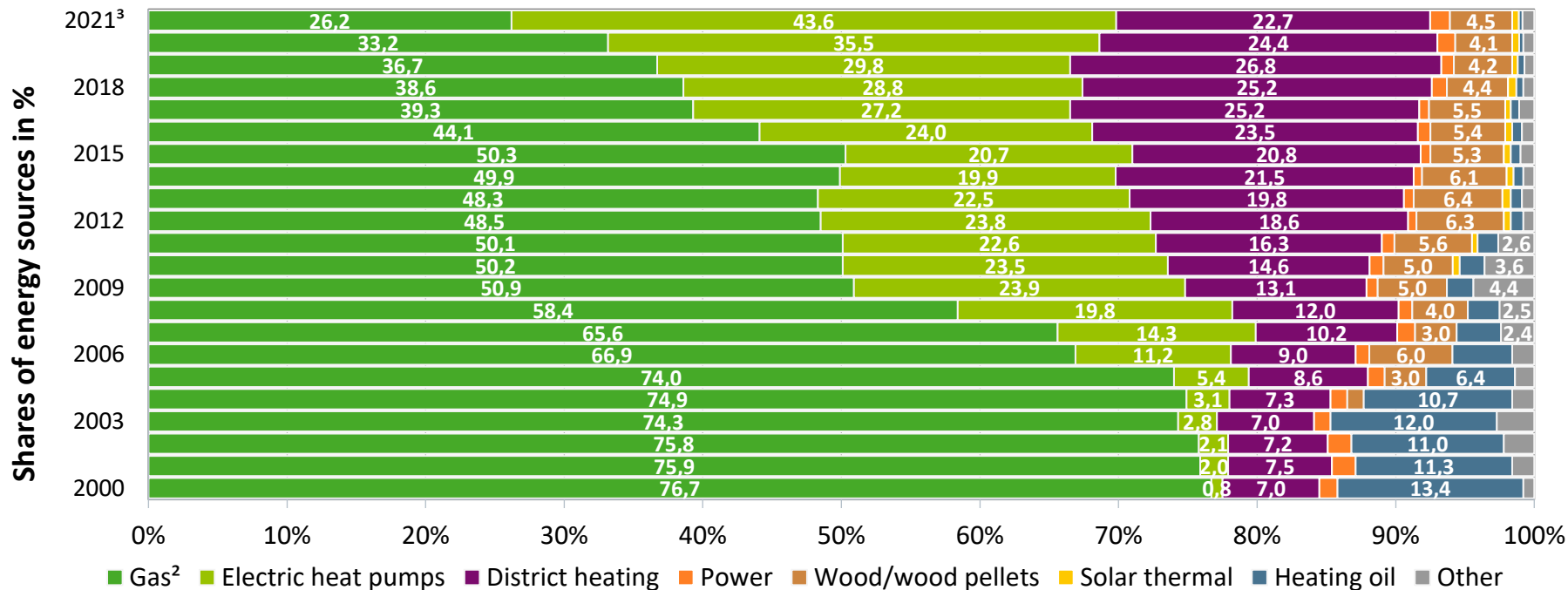
Source: Energy Brainpool

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Back-up

Development of Sources of Heating in new houses in Germany

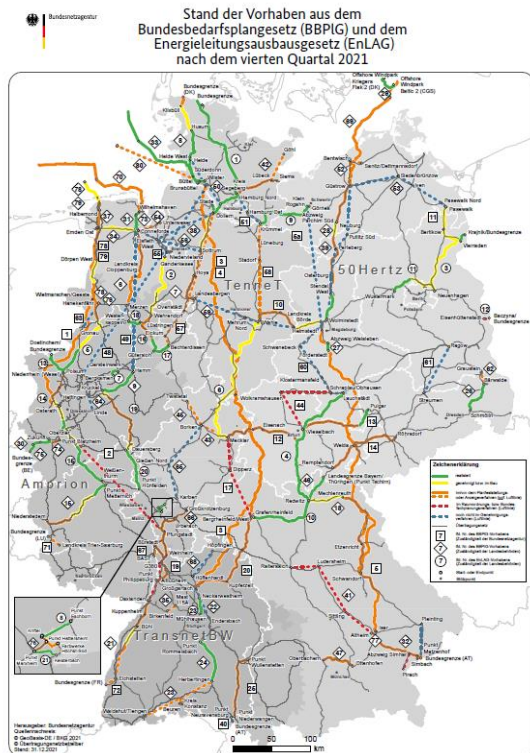


Sources: State Statistical Offices, BDEW; as of 03/2022

¹ New residential units approved for construction; primary heating energy;

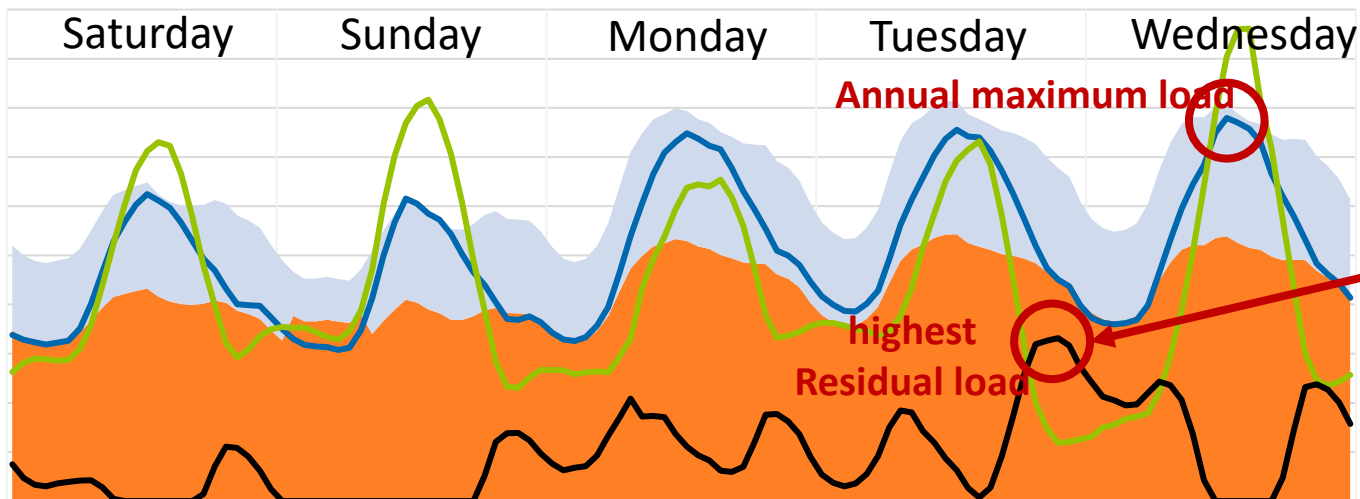
² including biomethane; ³ preliminary

Fluctuating generation needs grid expansion



- The expansion of renewable electricity generation also needs an expansion of the electricity grid - therefore measures to accelerate planning procedures have to be extended to grid construction procedures.
- "Prosuming" and further local flexibilities contribute to a stable electricity system - but do not replace grid extension
- Security of supply grows with grid extension all over Europe. Therefore the construction of border connection points to link the national electricity systems is elementary.

Future highest residual load and annual maximum load (schematic representation)



Future coverage of the highest residual load will be a decisive criterion for the assessment of security of supply!

- Bandwidth flexible power consumption
- Realised power consumption
- Residual load (electricity consumption minus RE generation)
- inflexible power consumption
- Supply-dependent RE generation