

The Energiewende in the Power Sector: State of Affairs 2014

A Review of the Significant Developments and an Outlook for 2015

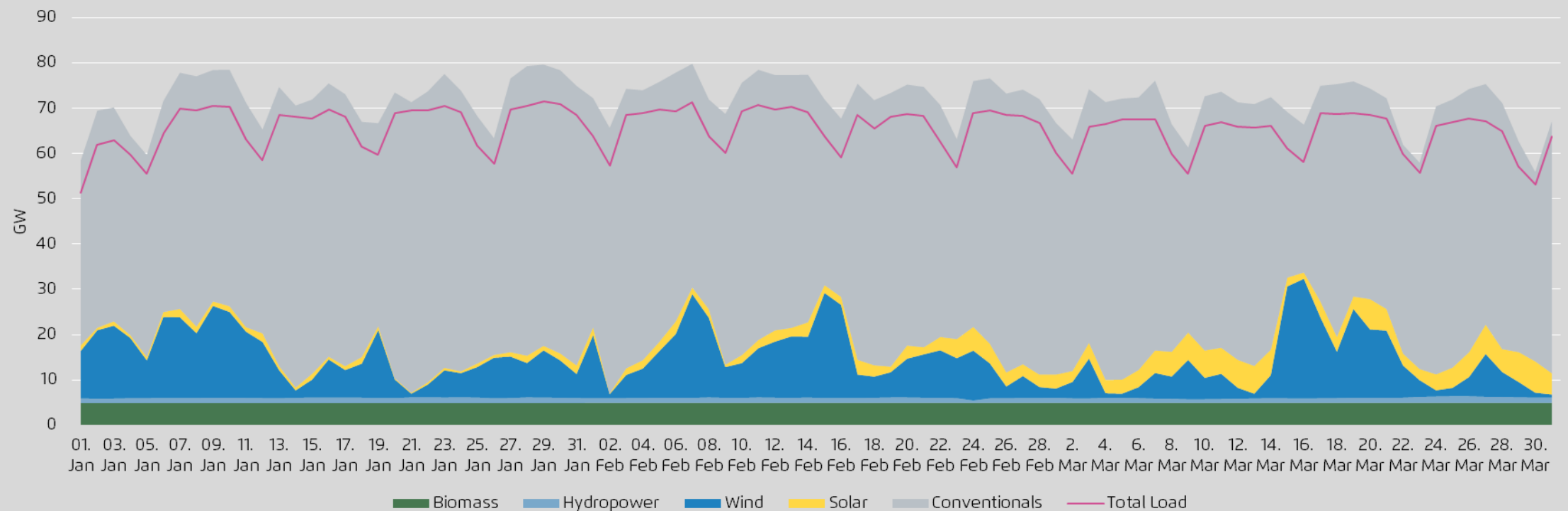
BERLIN, 07 JANUARY 2015

The most important developments in 2014 at a glance:

- 1. Renewable energies were the number 1 source of power production for the first time ever.** Renewables gained slightly in 2014 and now comprise 27.3 percent of domestic power consumption. They have now permanently displaced lignite as the top source of power in the electricity mix.
- 2. Power demand fell dramatically in 2014, by around 4 percent –** while at the same time the economy grew by around 1.4 percent. That continued the decline in power usage since 2007, while GDP grew simultaneously. The decoupling of growth from electricity usage appears to have been successful in recent years.
- 3. Hard coal and gas are the big losers in the power mix.** After gas-fired power production was reduced to the level that is taking place in combined heat-and-power plants, hard-coal plants are now also being squeezed out of the market as a result of the Energiewende. Lignite plants, however, continue to produce at high levels.
- 4. Greenhouse gas emissions have fallen considerably in 2014.** They are currently at their second-lowest level since 1990, due largely to the mild winter at the beginning of 2014 and the significant decrease in coal for power production.

Electricity generation 2014 at a sight (1st quarter): Due to a mild winter, electricity demand turned out to be quite low (60-70 GW)

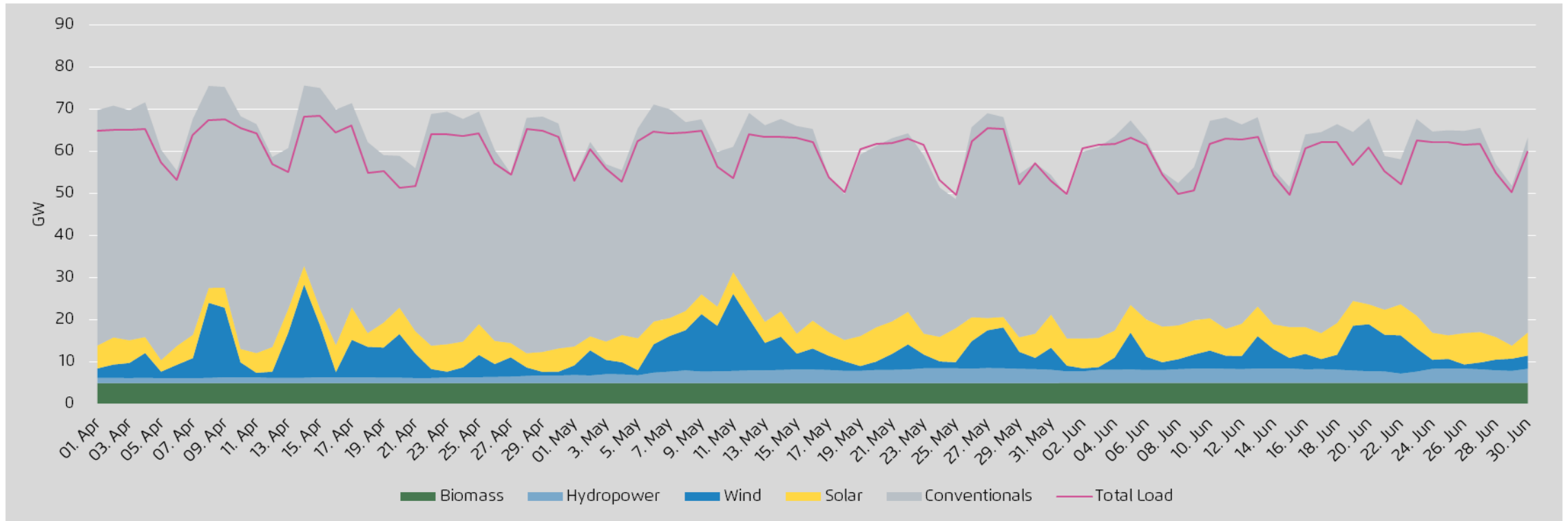
Net power production and demand in the first quarter of 2014



Own calculations based on EEX 2014 and ENTSO-E 2014, using average daily values

Electricity generation 2014 at a sight (2nd quarter): Wind and solar relatively strong during spring, with RES covering 28.5% of demand in the first half of 2014

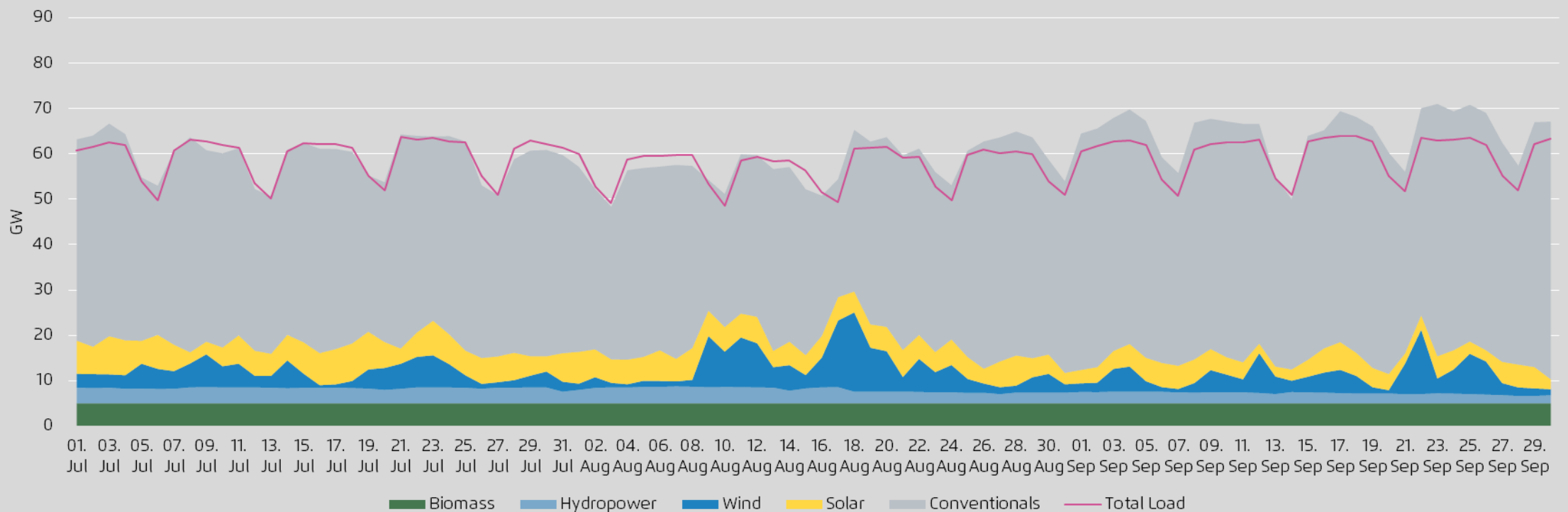
Net power production and demand in the second quarter of 2014



Own calculations based on EEX 2014 and ENTSO-E 2014, using average daily values

Electricity generation 2014 at a sight (3rd quarter): Sunny summer leads to relatively strong solar electricity production

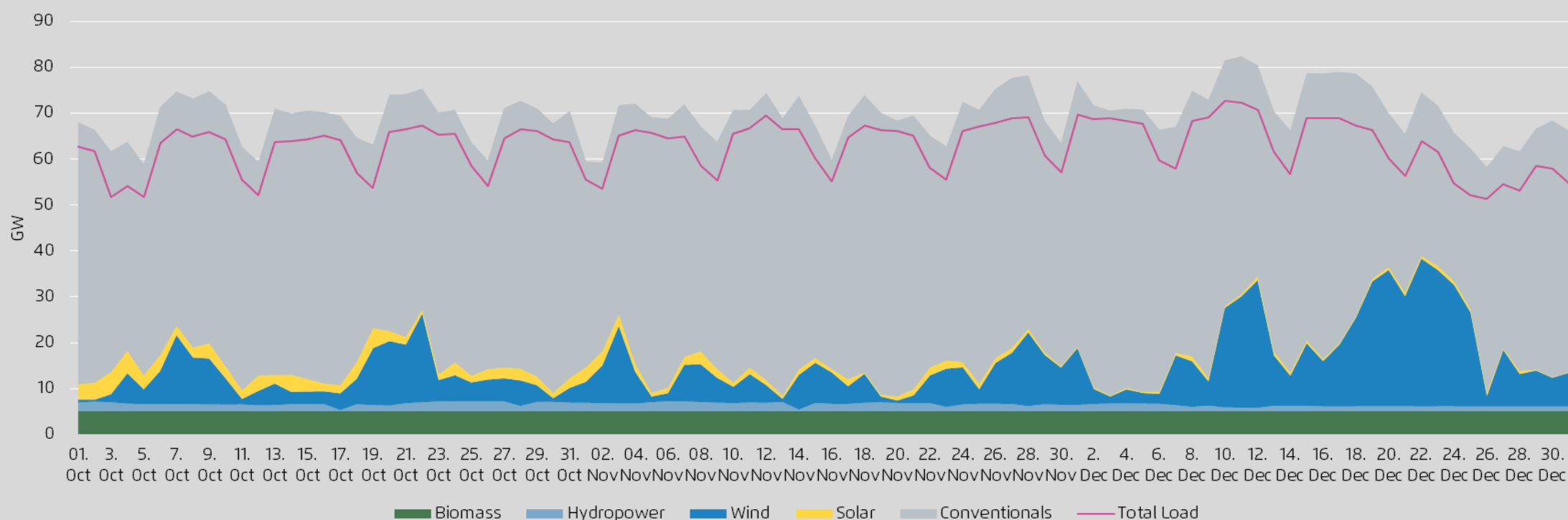
Net power production and demand in the third quarter of 2014



Own calculations based on EEX 2014 and ENTSO-E 2014, using average daily values

Electricity generation 2014 at a sight (4th quarter): While October and November were months with little wind, December yielded a new monthly wind electricity production record

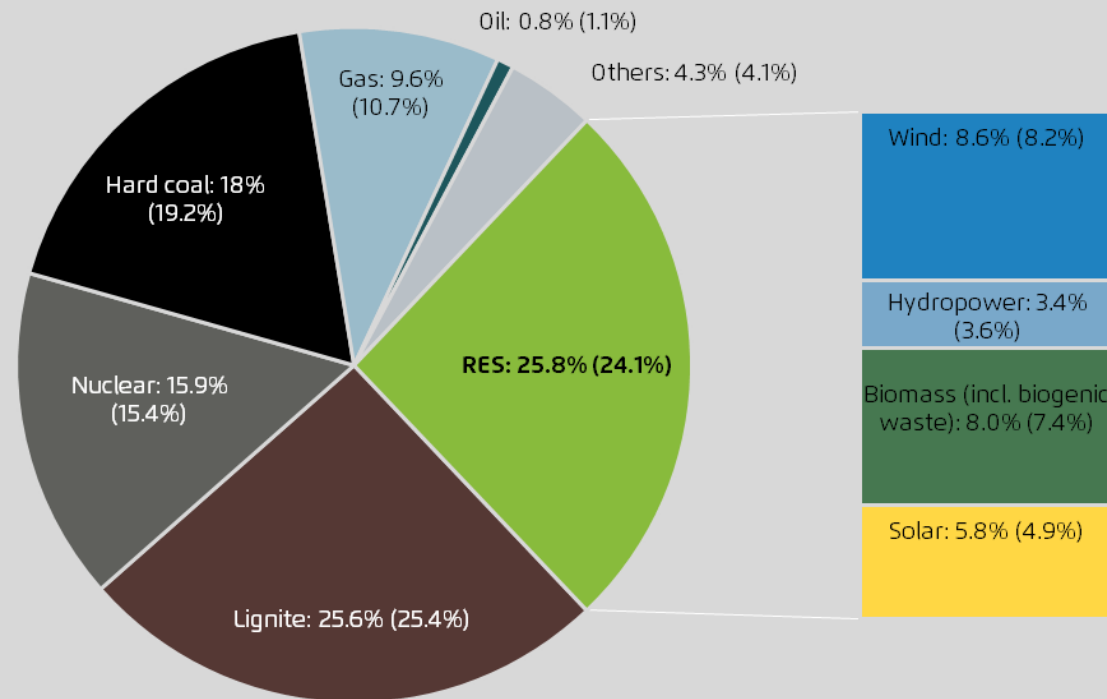
Net power production and demand in the fourth quarter of 2014



Own calculations based on EEX 2014 and ENTSO-E 2014, using average daily values

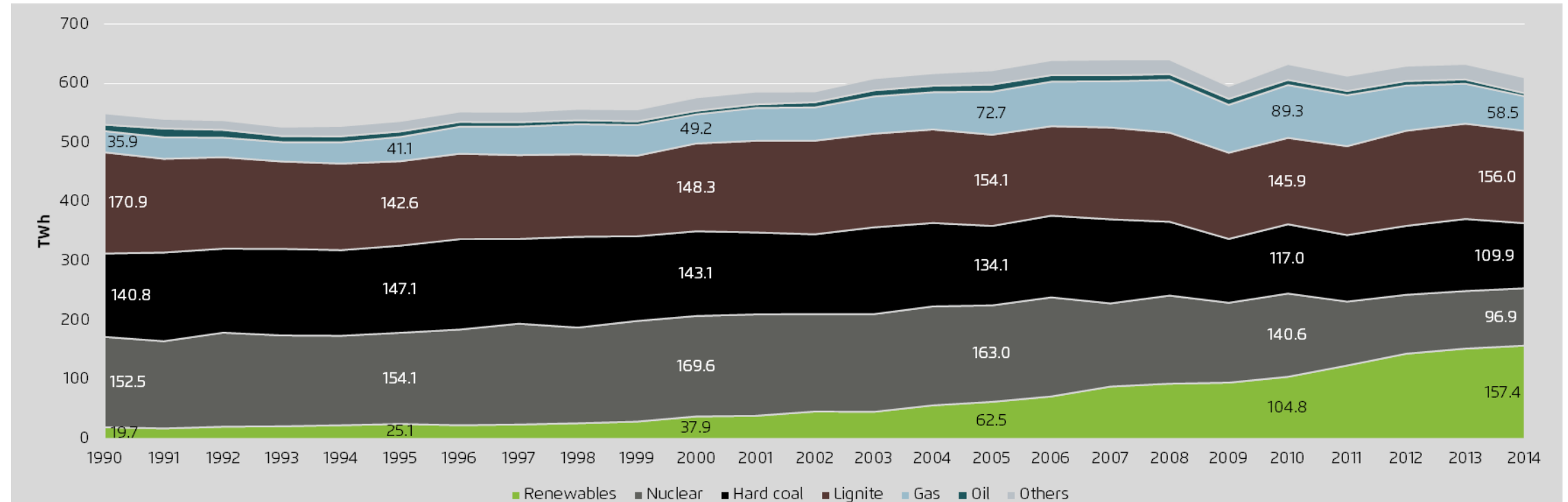
Renewables 2014 win first place in German electricity generation – just bevor lignite. Hard coal and gas are losers in the electricity mix 2014.

Share of energy sources in gross power production in 2014 (2013 values in parentheses)

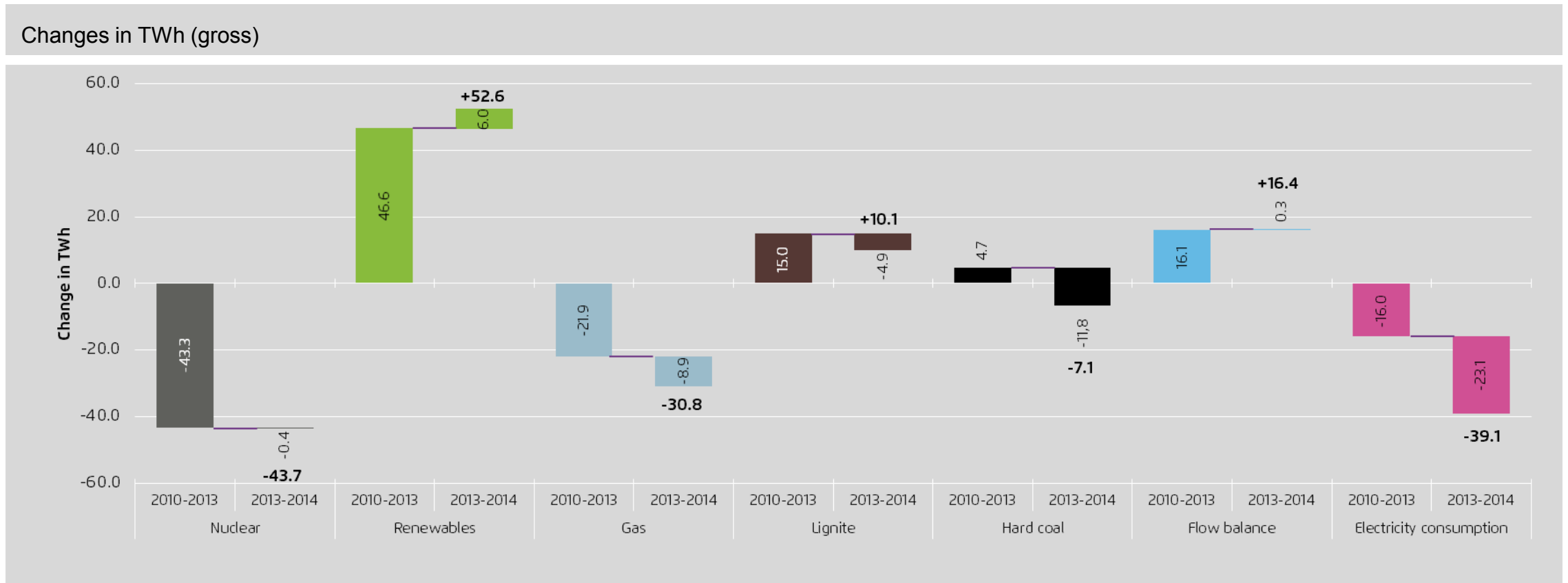


The key developments in Germany's power mix since 1990: Increase in renewables more than compensated for the decrease in nuclear, lignite and hard coal remain traditionally strong

Development of gross power production 1990-2014 in TWh



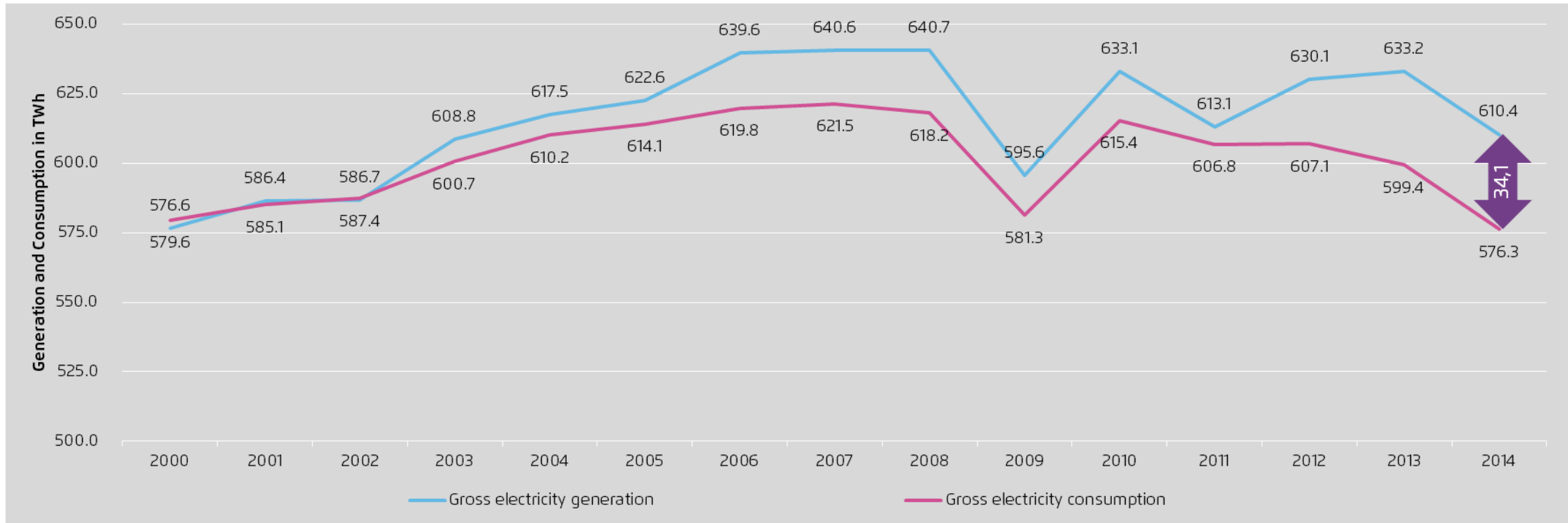
Electricity trends 2010-2014: Nuclear, gas, hard-coal and electricity demand decreased, renewables, lignite and power exports expanded



AG Energiebilanzen 2014, own calculations

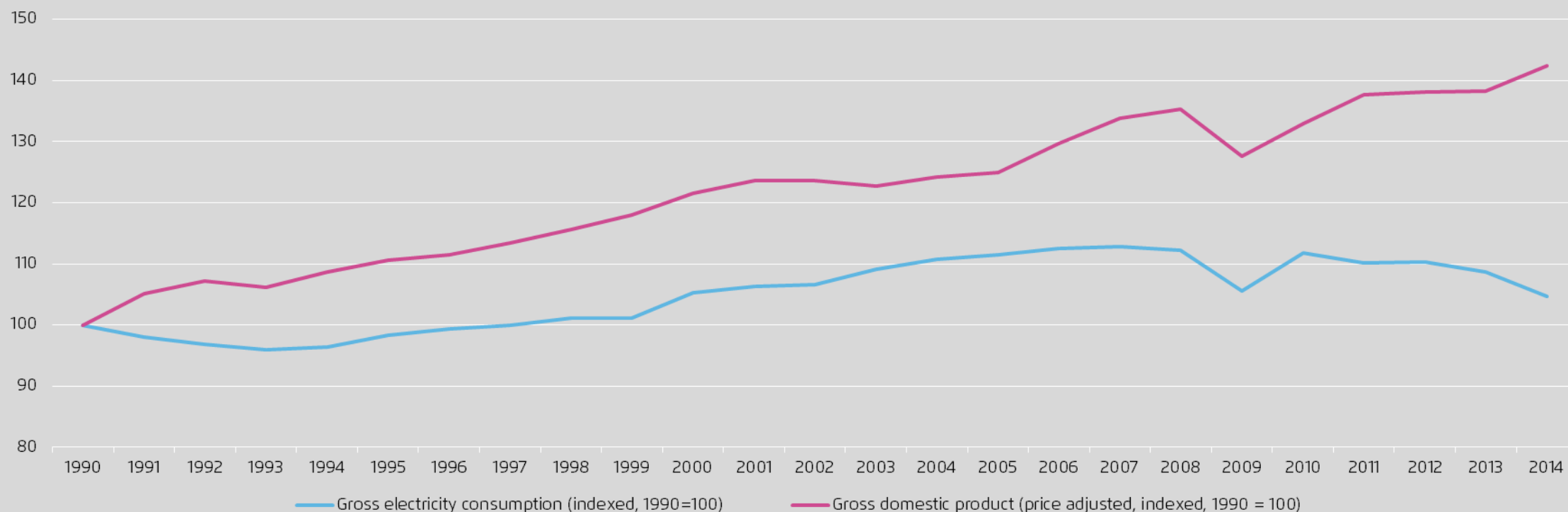
The gap between electricity generation and demand is widening since 2001: Germany is power export champion in Europe

Gross electricity generation and production in TWh



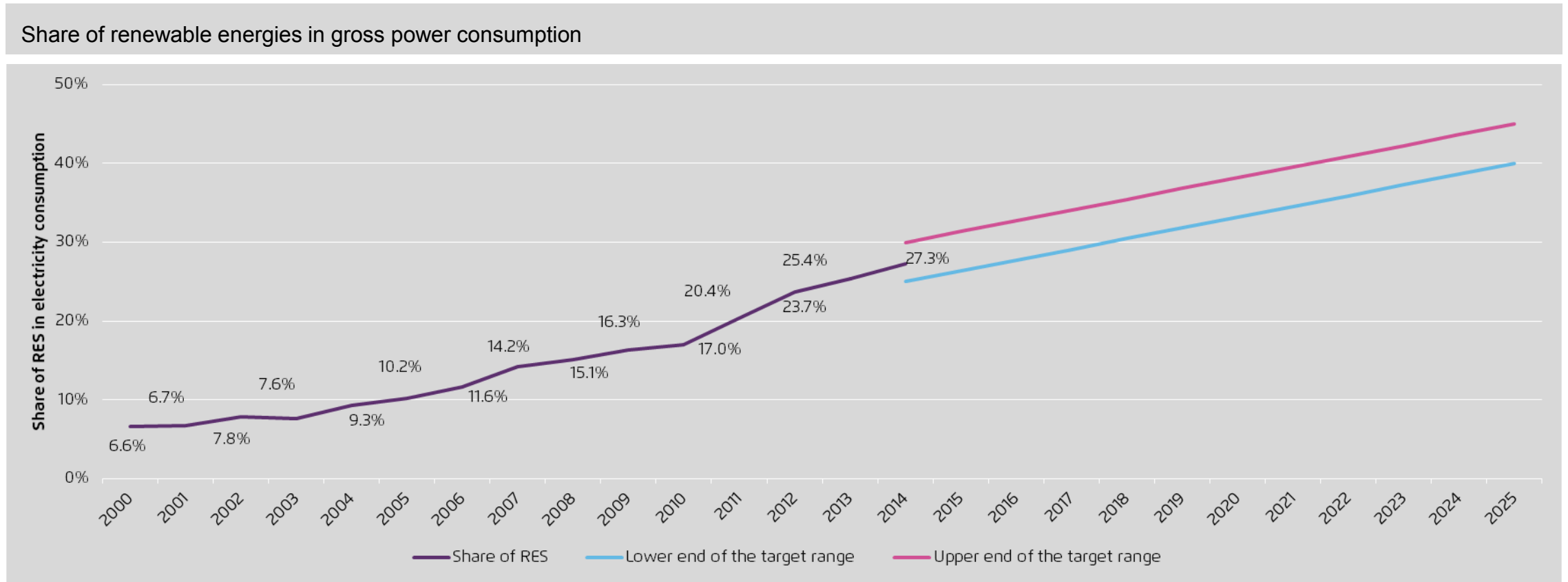
Economic growth and electricity demand are no longer correlated: While the economy has grown more than 40% since 1990, electricity demand has been decreasing significantly since 2007

Indexed economic growth and electricity usage (1990=100)



Statistisches Bundesamt 2014

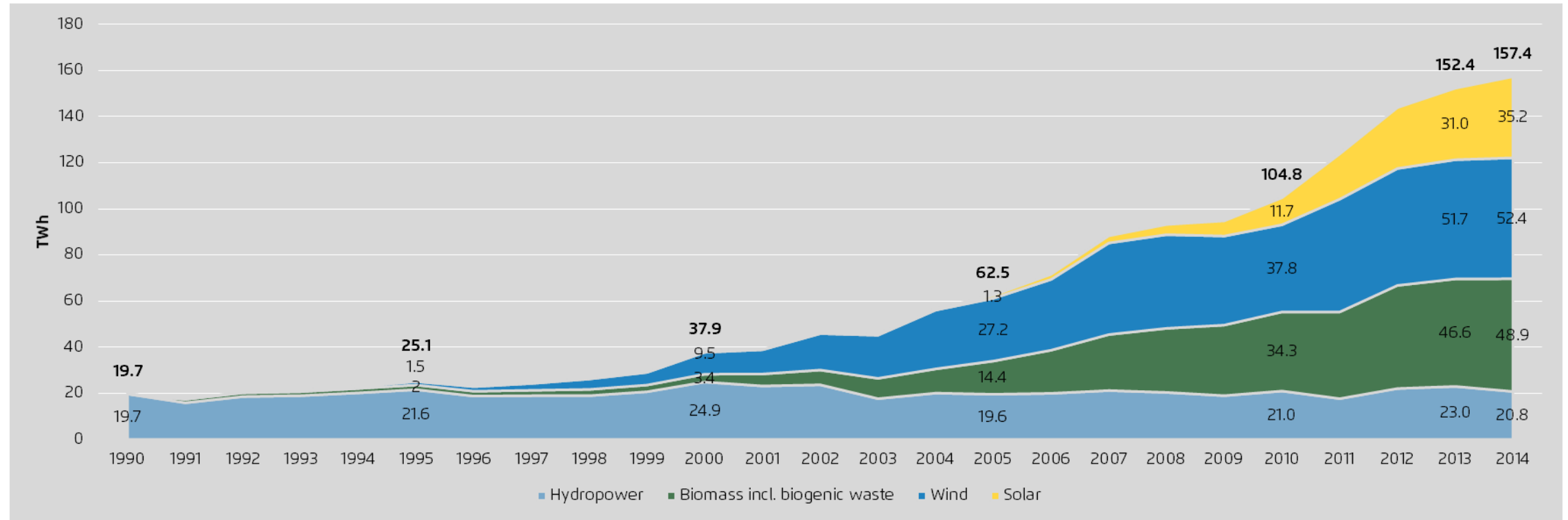
2014 growth of renewable energies fell exactly in the government's target corridor, which aims for a 40-45% renewables share by 2025.



AG Energiebilanzen 2014

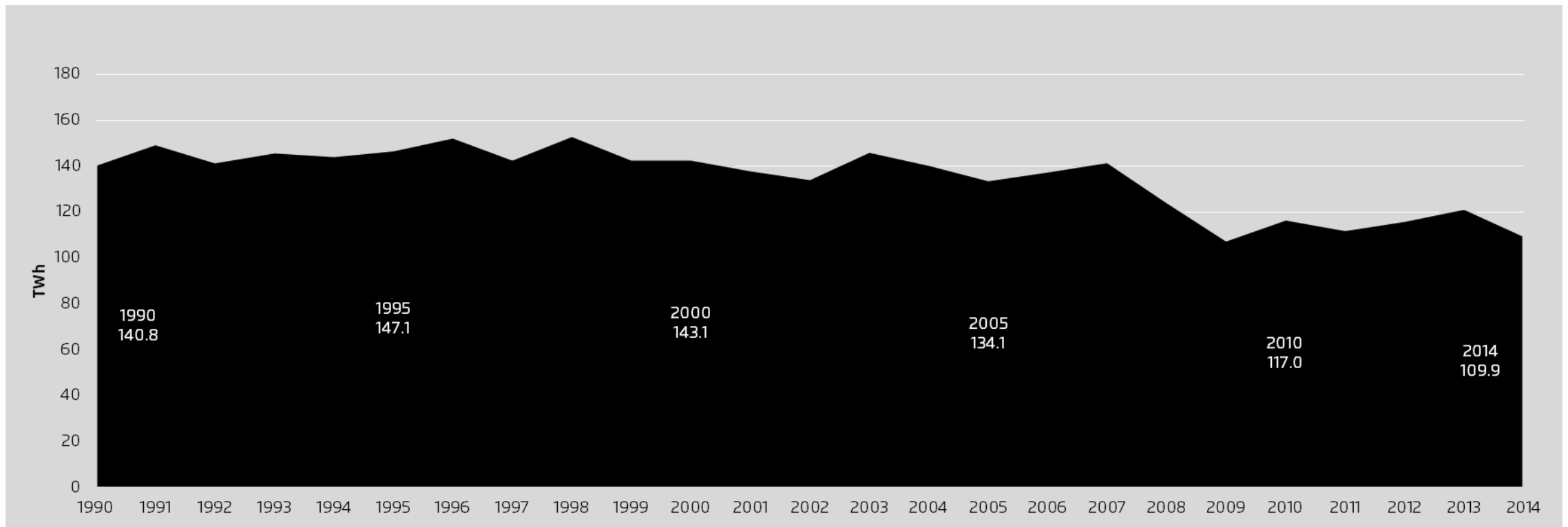
Renewables produced eight times more power in 2014 than in 1990. The key additions in the past years were new wind and solar installations

Gross power production from renewable energies in TWh



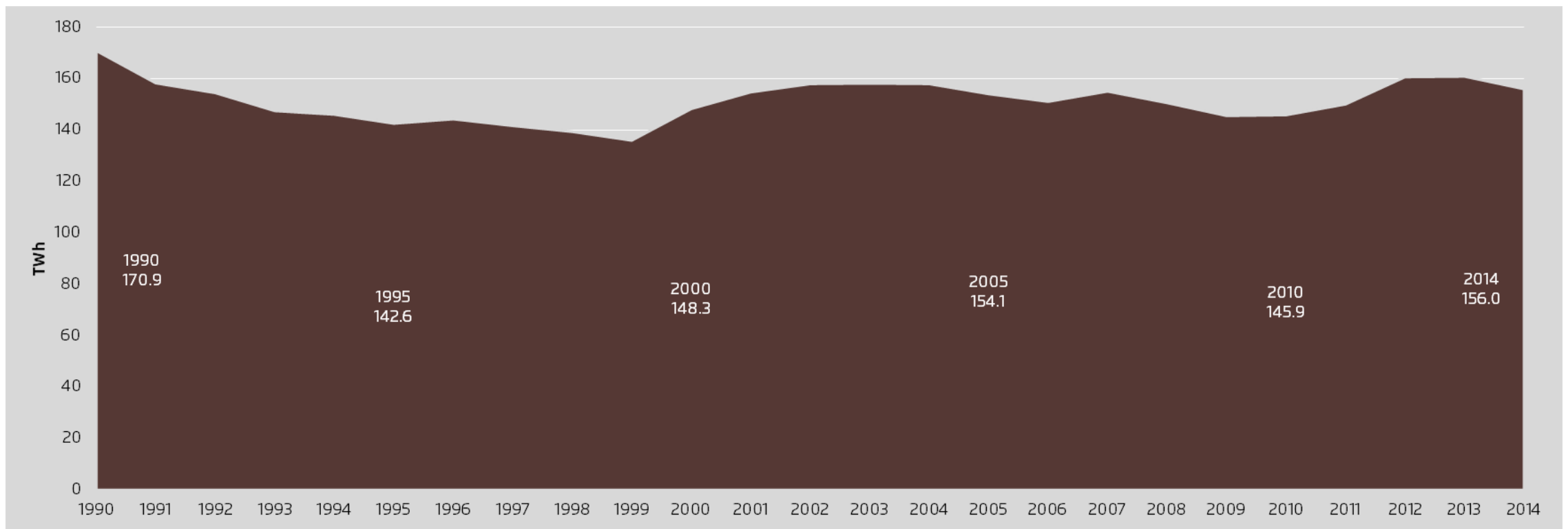
Power production from hard coal in 2014 was reduced to its second-lowest level since 1990 – only in 2009, the crisis year, less electricity was produced from hard coal

Gross power production from hard coal in TWh



Power production from lignite stayed constant in 2014 at a high level.

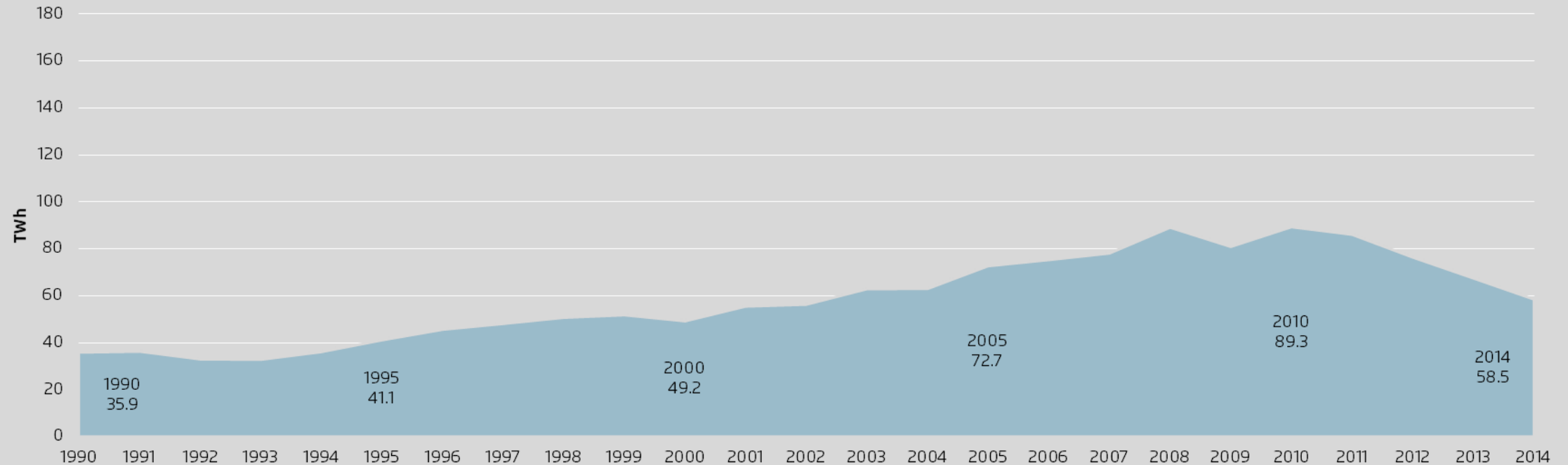
Gross power production from lignite in TWh



AG Energiebilanzen 2014

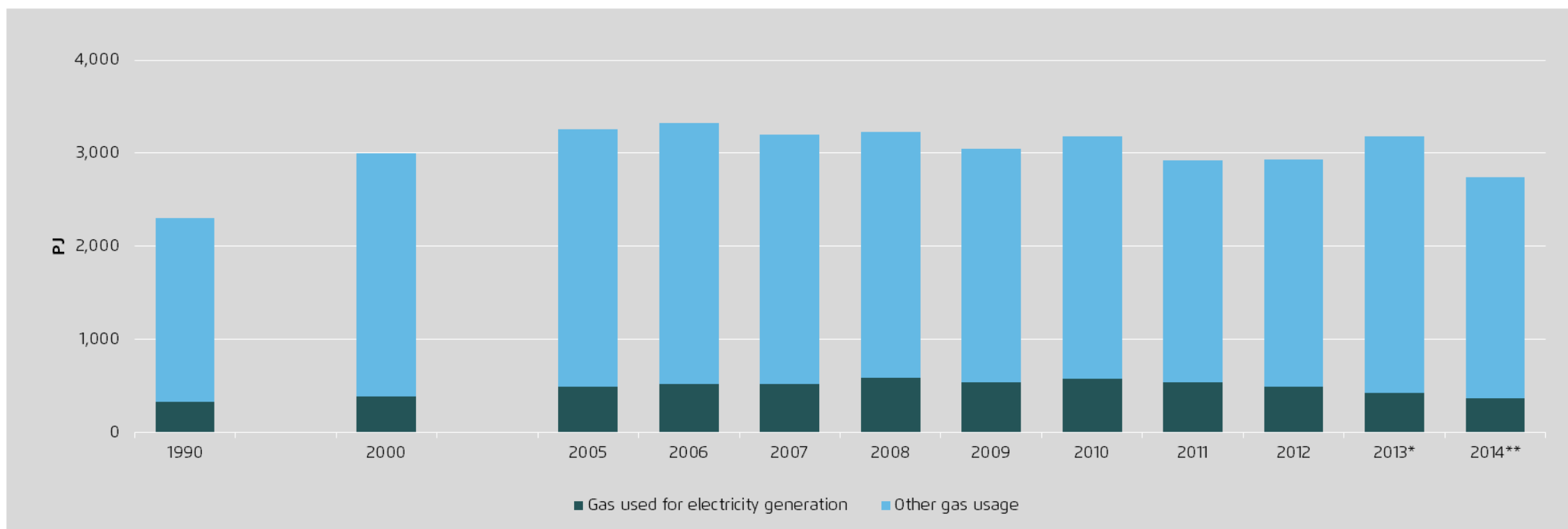
Power production from gas in 2014 decreased significantly. What is left stems mostly from combined heat-and-power plants, which have long-term heat supply contracts.

Gross power production from gas in TWh



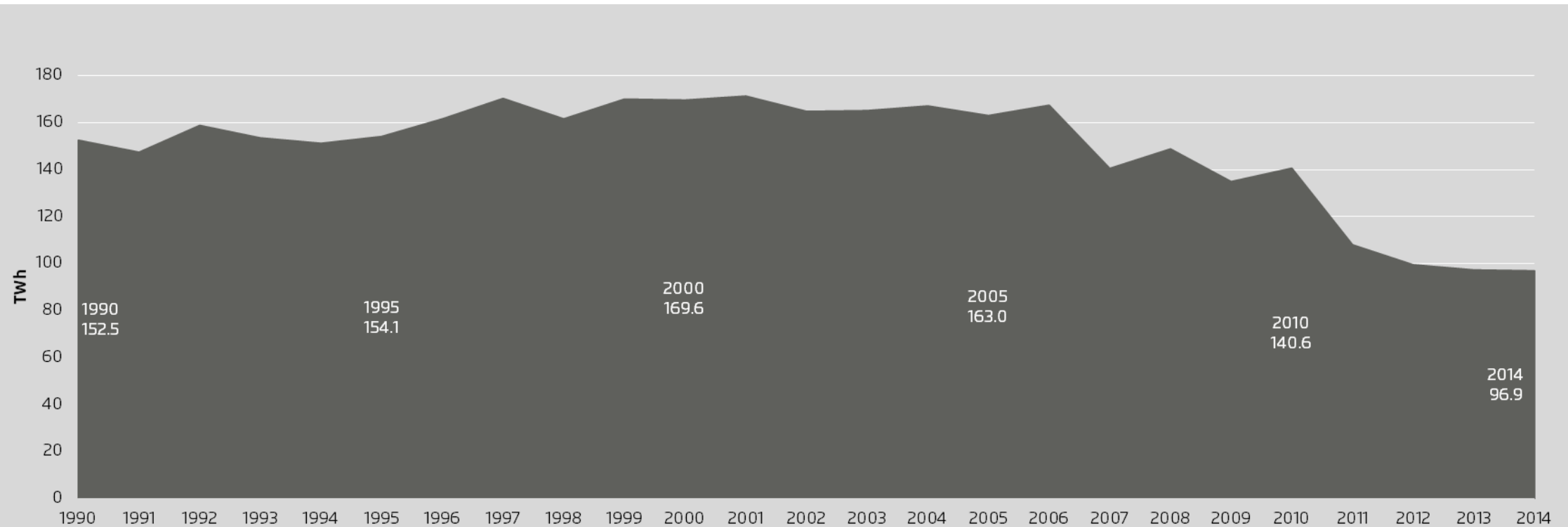
Only a small and shrinking share of gas usage in Germany is used for power production. Because of the mild winter gas usage in 2014 was reduced significantly.

Primary energy usage in PJ



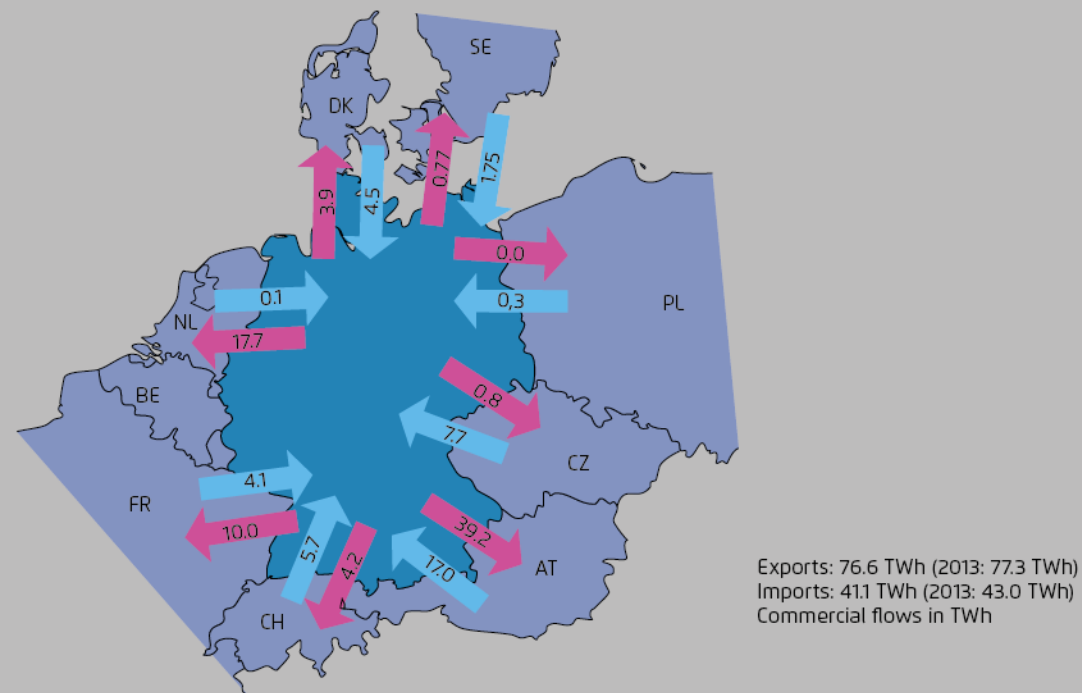
Electricity generation from nuclear energy remained steady in 2014. This will decline in 2015 as the nuclear power plant Grafenrheinfeld is due for shut down in spring.

Gross power production from nuclear energy in TWh



In 2014, Germany set a new record in net power exports – especially the Netherlands, Austria and France have been importing power due to lower German wholesale prices

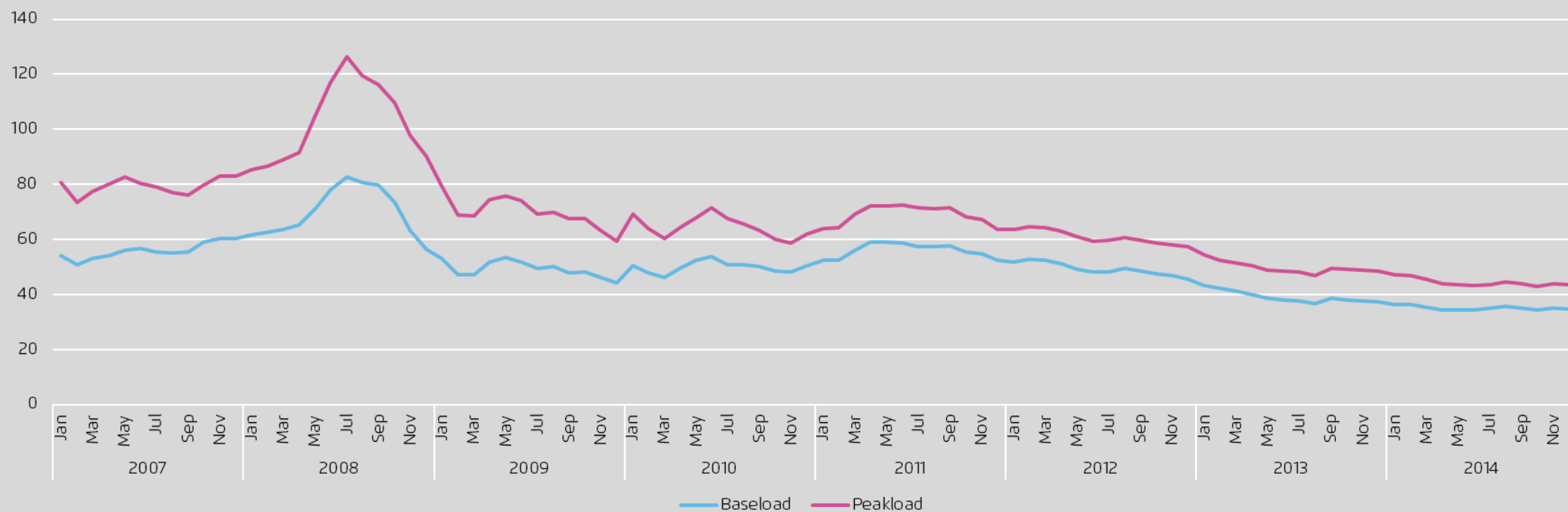
Cross-border power trades in TWh



Own calculations based on ENTSO-E 2014; commercial trade flows, not displaying physical power flows

The power price at the electricity exchange has been falling almost continuously since 2008 – on average, power could be bought in 2014 for less than 40 EUR/MWh.

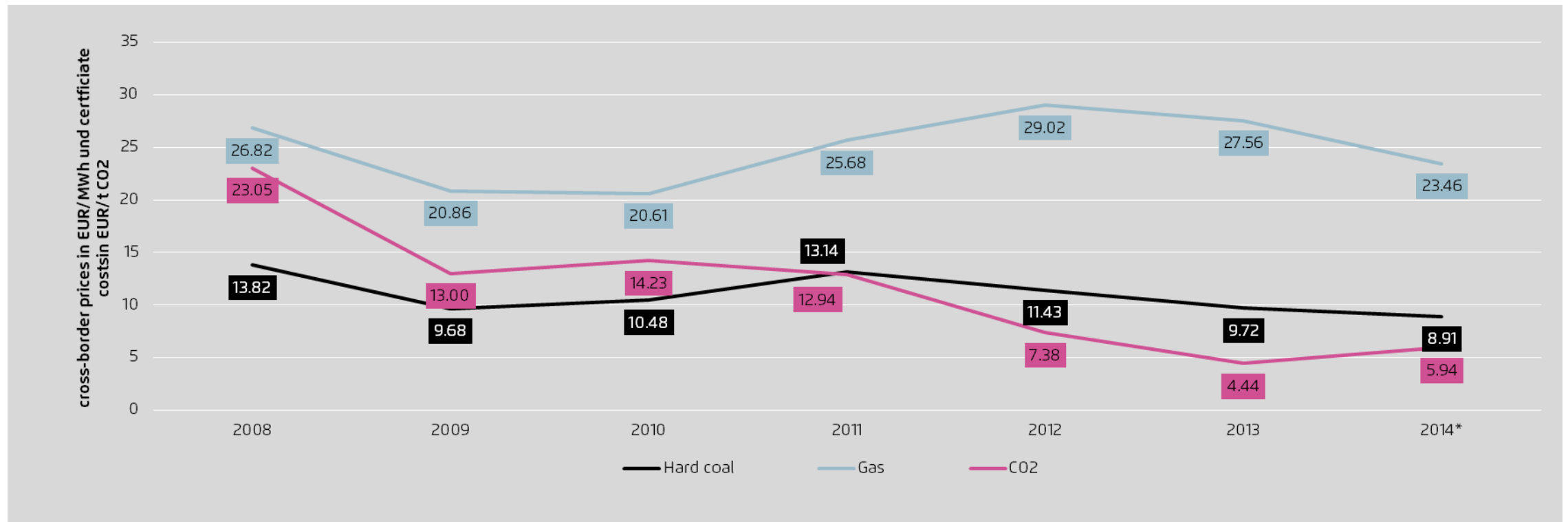
Annual Future for Power Delivery (roin Euro/MWh)



EEX 2014

The gap in the coal and gas price has widened dramatically since 2010 and only narrowed slightly in 2014. CO₂ prices remained steady at low levels.

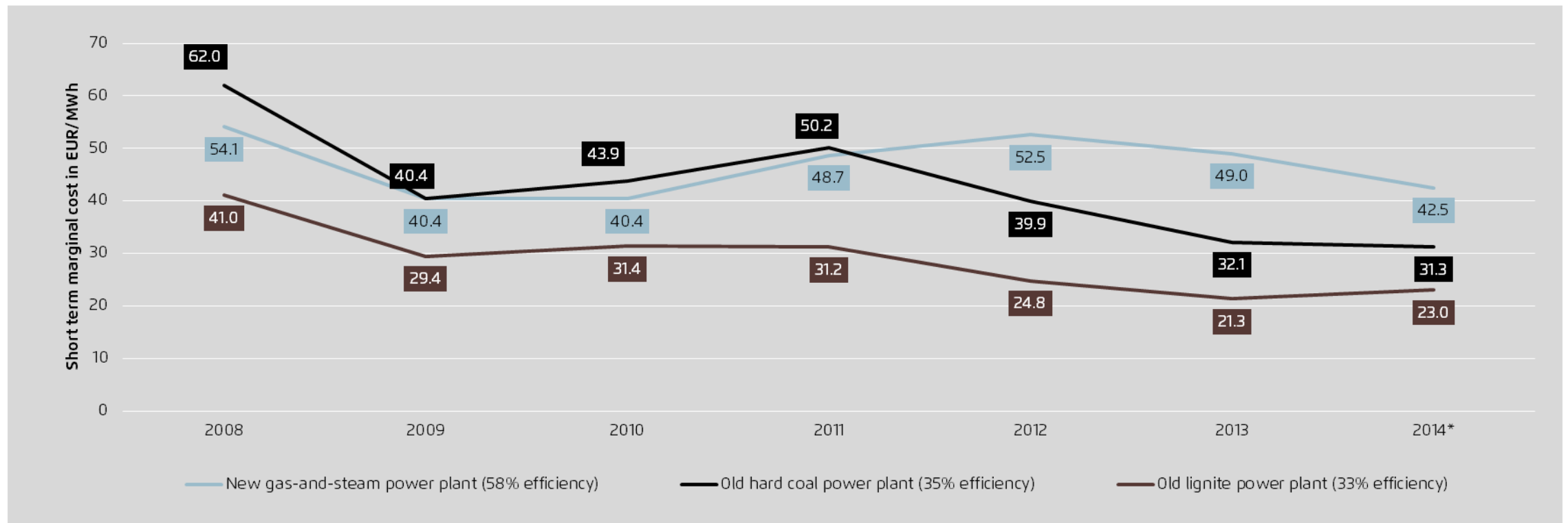
Cross-border prices for gas and hard coal in euros/MWh and certificate prices in euros/t CO₂



BAFA 2014, EEX 2014, own calculations; *preliminary estimate

Because of the price relations between coal, gas and CO₂, since 2011 electricity from old hard-coal plants has been cheaper than power from new gas-fired plants.

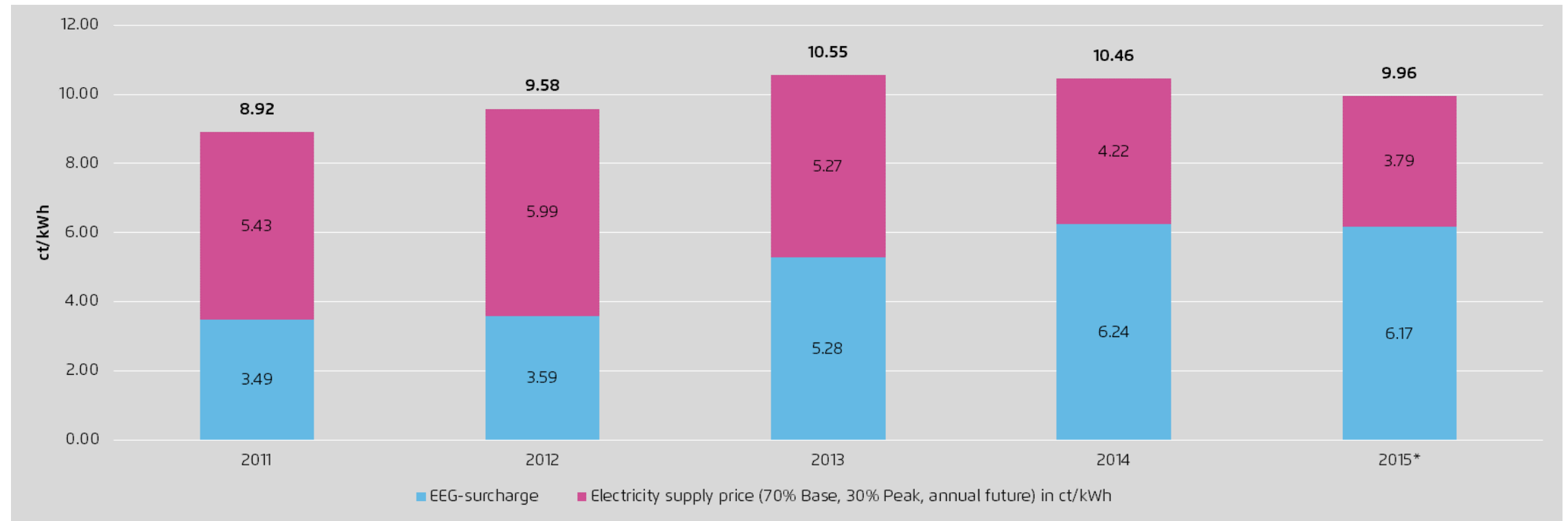
Marginal costs of old hard-coal power plants, old lignite power plants and new gas-fired power plants in EUR/MWh



BAFA 2014, EEX 2014, own calculations; *preliminary estimate

Electricity supplier can reduce their tariffs: The electricity supply price, together with the renewable energy surcharge, will sink by 5 percent in 2015 over 2014.

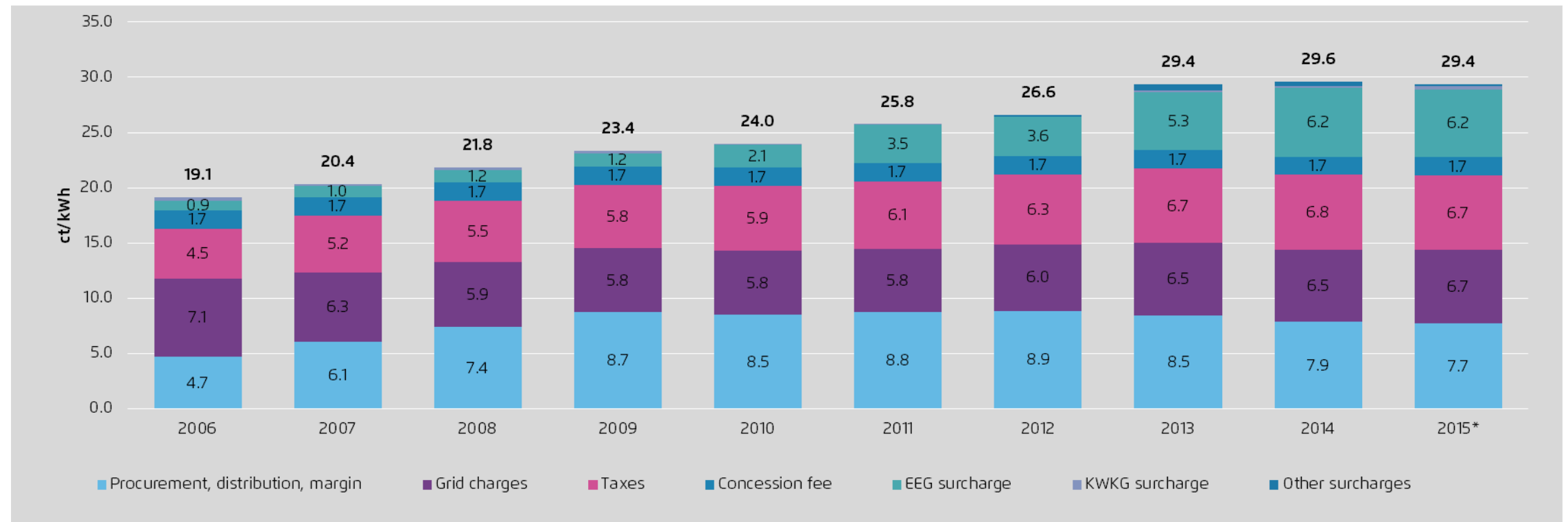
Renewable energy surcharge and electricity supply price (70% Base, 30% Peak, both annual futures) in ct/kWh



Grid operators 2014, EEX 2014; *preliminary estimate for 2015

In 2015, the rise in household electricity prices will be suspended – on average, they should even slightly decline.

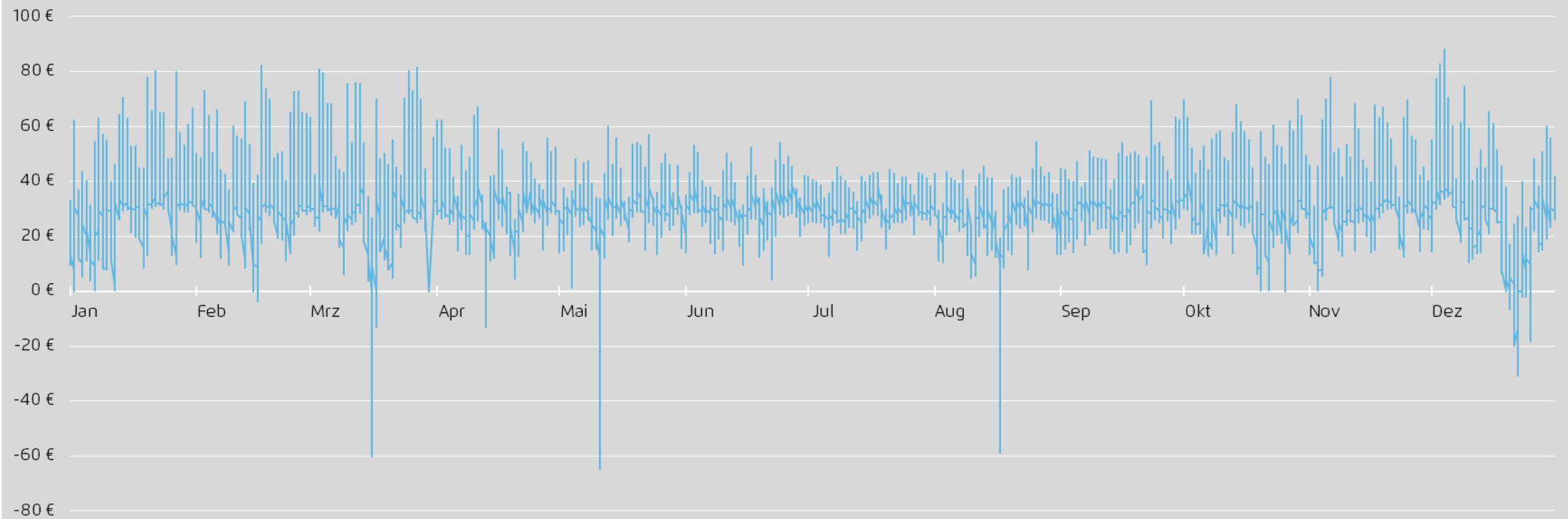
Composition of household electricity prices 2006-2015



BDEW 2014, BNetzA 2014, own calculations; *Prognosis for 2015

Spot market 2014: Lower prices and smaller fluctuations in summer, negative prices at Christmas.

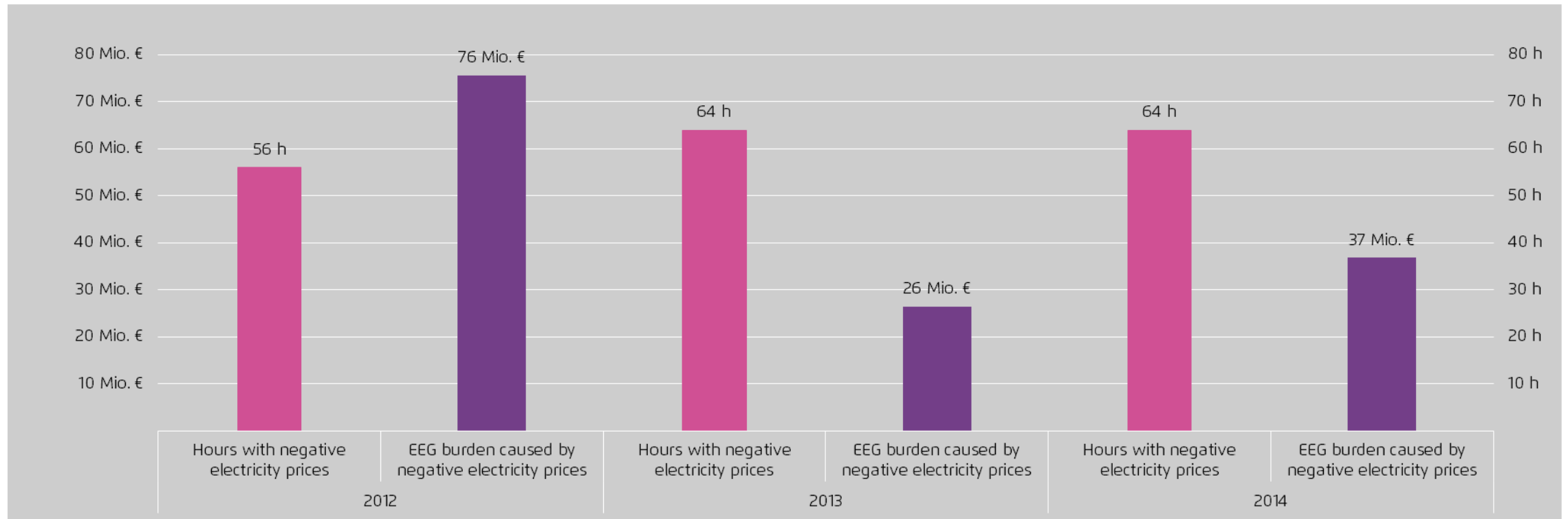
Electricity price in the Day-Ahead-Auction in euros/MWh



EEX 2014

The flexibility of the power system is increasing: Same number of hours of negative power prices as 2013 despite higher share of renewable energies

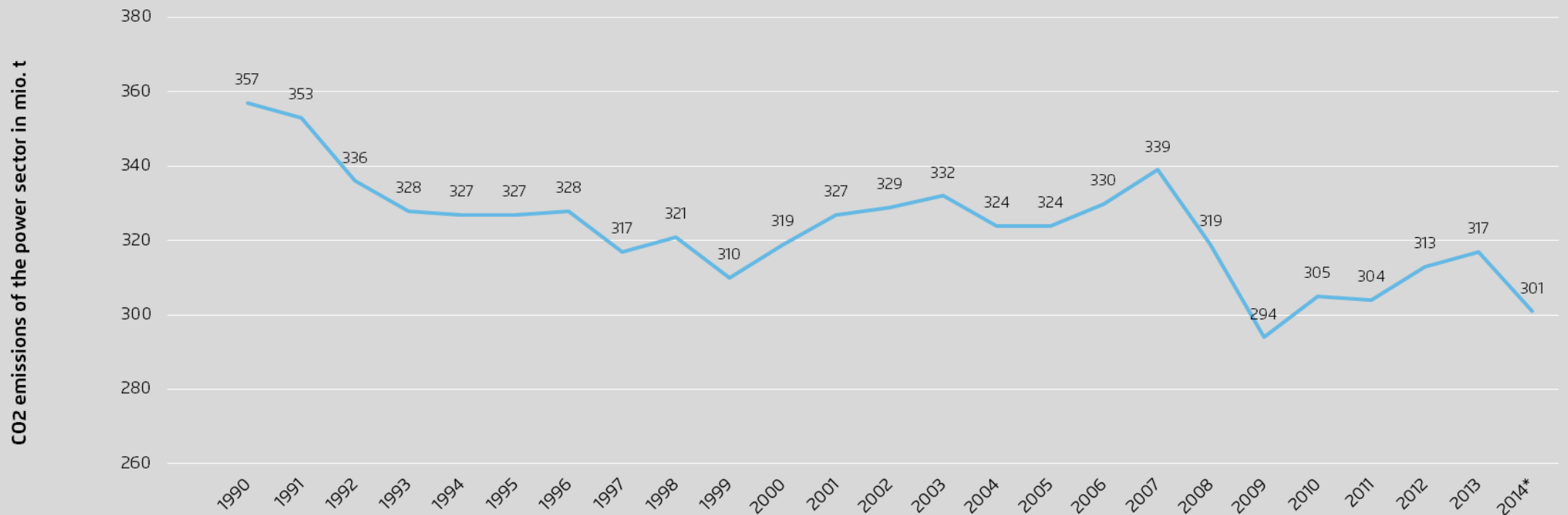
Hours with negative prices and burden for the EEG through negative electricity prices



Own calculations on the basis of EEX 2014

Because of the drop in coal power production, CO₂ emissions in the power sector decreased in 2014 significantly. They are now on the second lowest level since 1990.

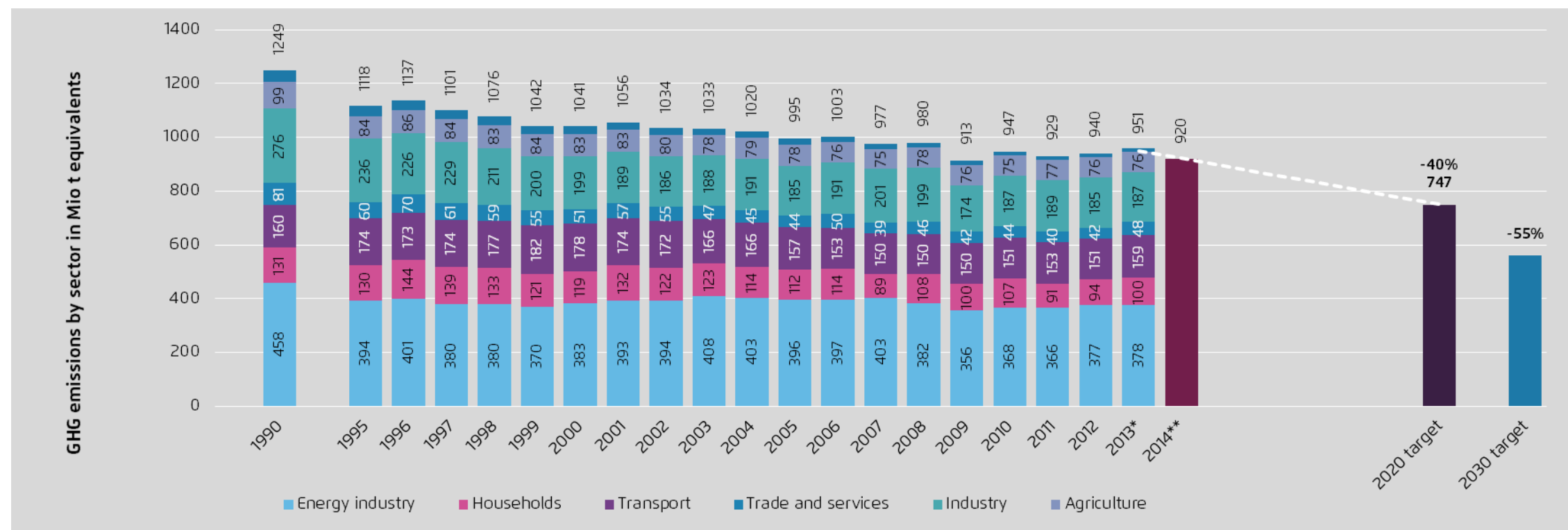
CO₂-emissions in the power sector 1990-2014



UBA 2014 and own calculations; *preliminary estimate

Reduced emissions by the energy industry and the mild winter lead to a major decline in greenhouse gas emissions 2014. However, there is still a lot to do in order to reach the 2020 climate target.

Greenhouse gas emissions by sector in mio. t CO₂-equivalents, as well as German government targets for 2020 und 2030



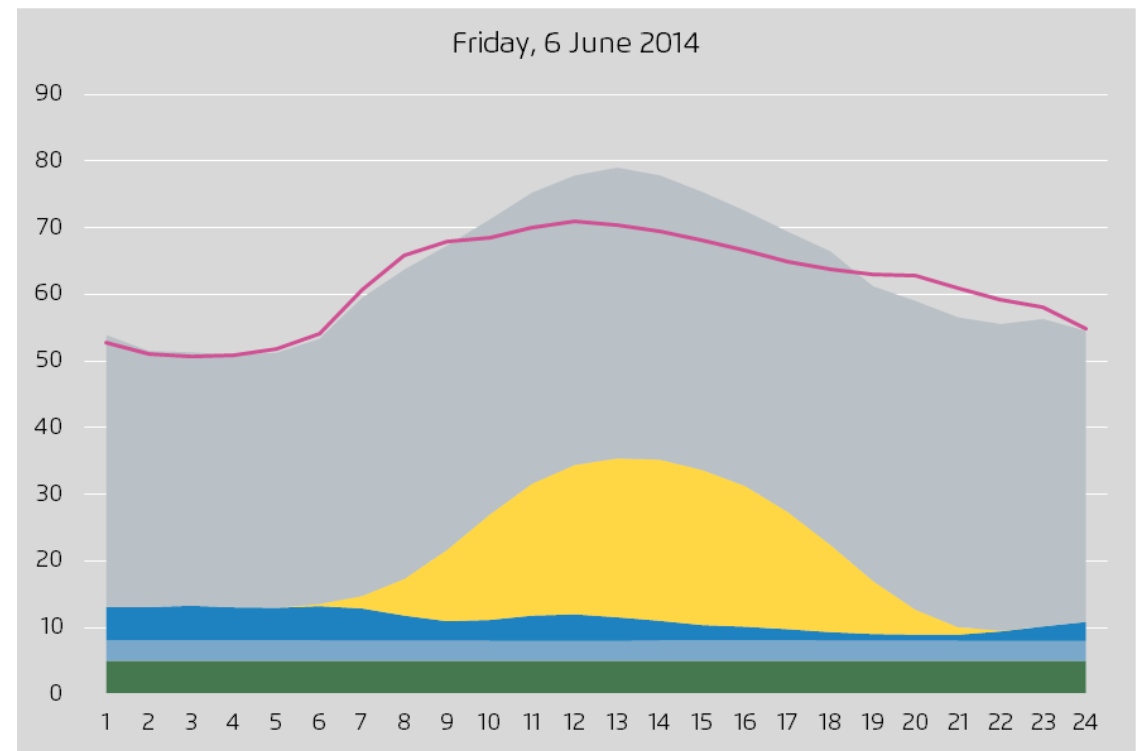
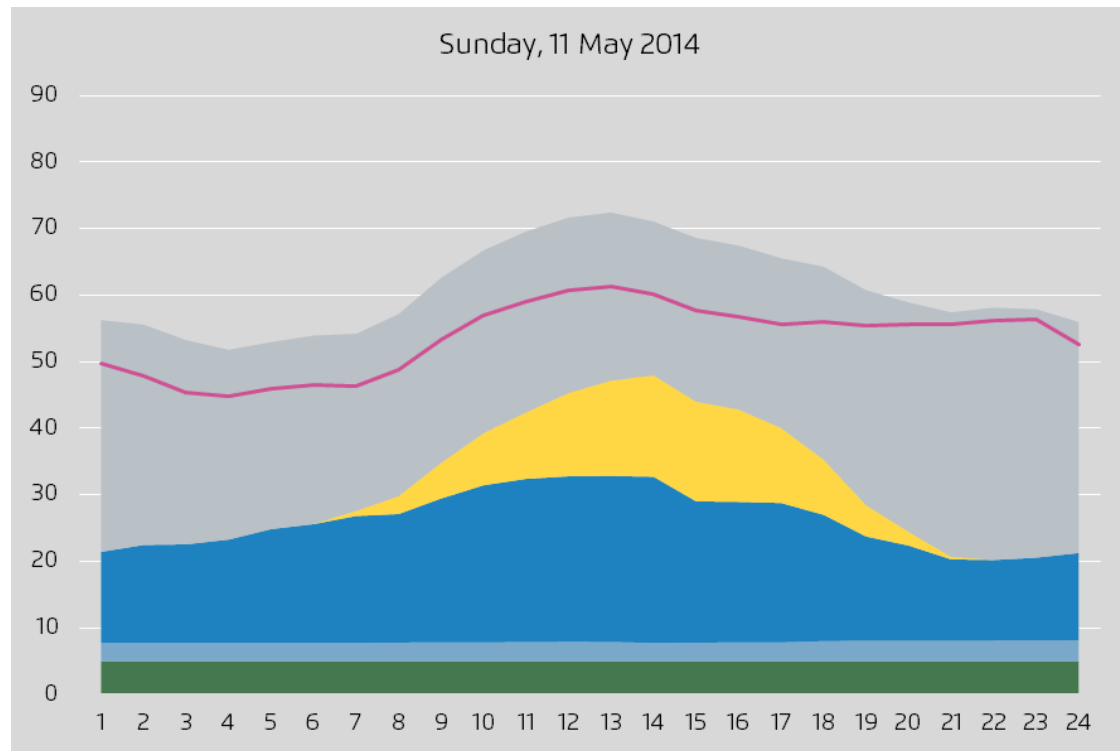
UBA 2014, own calculations, *preliminary, **own estimates

Record days in the power sector 2014:

Sunday, 11 May 2014: 80% of power demand is met by renewables

Friday, 6 Juni 2014: Maximum production from solar energy (24 GW)

Net electricity production and usage



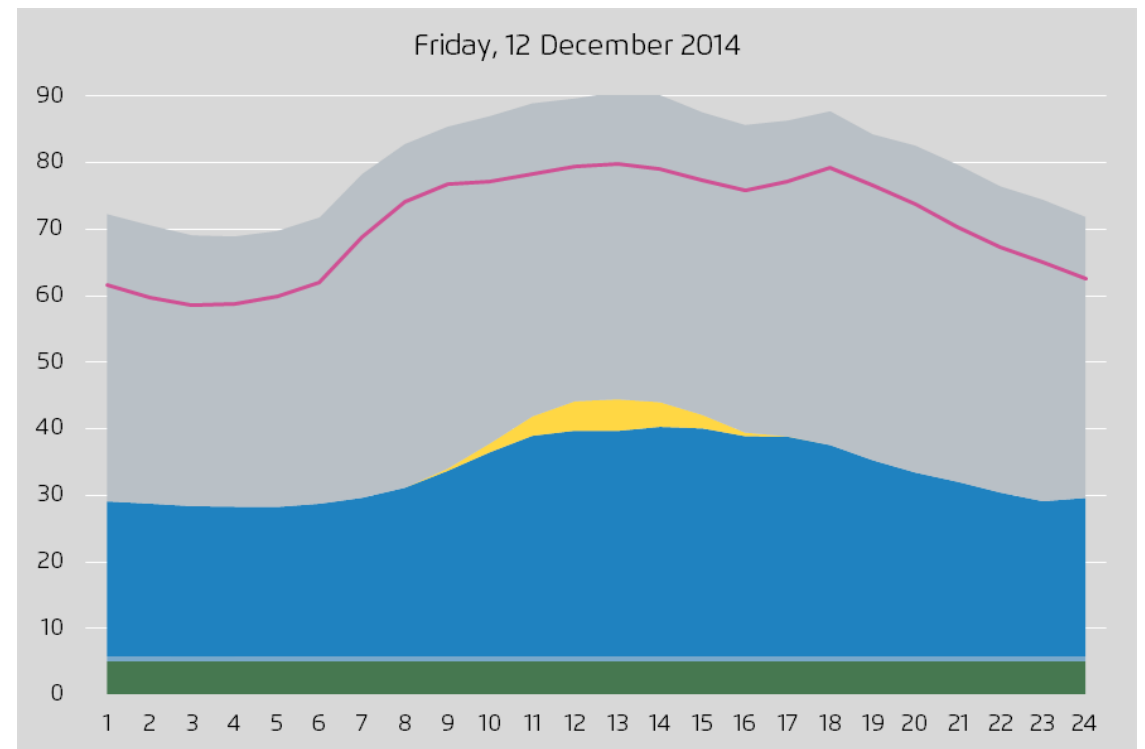
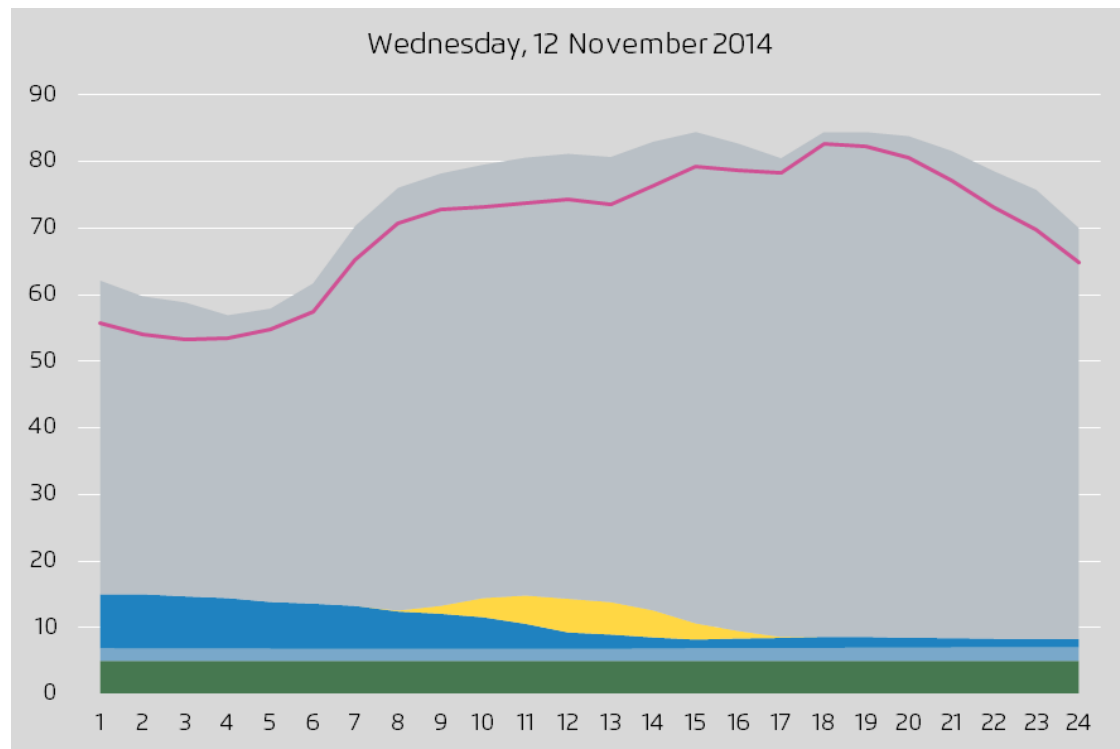
Own calculations based on EEX 2014 and ENTSO-E 2014

Record days in the power sector 2014:

Sunday, 12 November 2014: Maximum load and only 10% RES

Friday, 12 December 2014: Maximum production from wind energy (35 GW)

Net power production and usage



Own calculations based on EEX 2014 und ENTSO-E 2014

Outlook 2015

- Power production from nuclear sources will decline by 7-8% due to the shutdown of the nuclear plant at Grafenrheinfeld in spring 2015.
- Electricity generation from wind power will rise considerably in 2015, as a result of
 - new offshore windparks are expected with a total capacity of around 2,400 megawatts, and
 - in 2014 there was a record net increase of 3,400 megawatts of onshore wind power, which will be fully incorporated into the system in 2015.
- Power production from lignite will remain at a high level in 2015, while the development of hard coal and gas depends on power demand and the net export balance.
- Electricity prices for households and manufacturing will decline slightly over 2014.

**Find more information and analyses at
www.agora-energiewende.de**

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