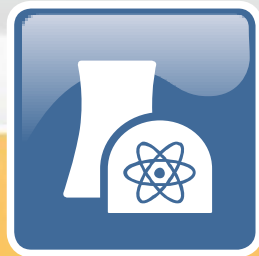


Flexibility in thermal power plants

30 April 2020

Dr. Claudia Weise





2030

min 40 %
Greenhouse
Gas Emission
Reduction
compared to 1990

min 32 %
Renewable
Energy
Consumption

32.5 %
Increase of
Energy
Efficiency

min 15%
Interconnection



Phase-out
of Nuclear
Power Plants in
2022

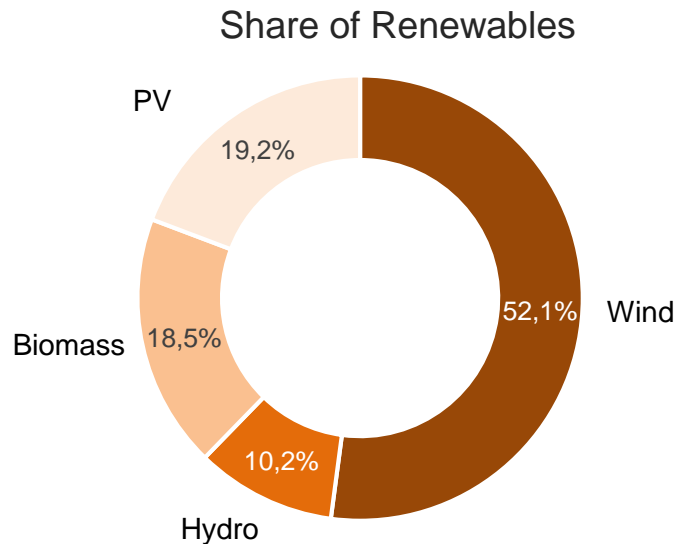
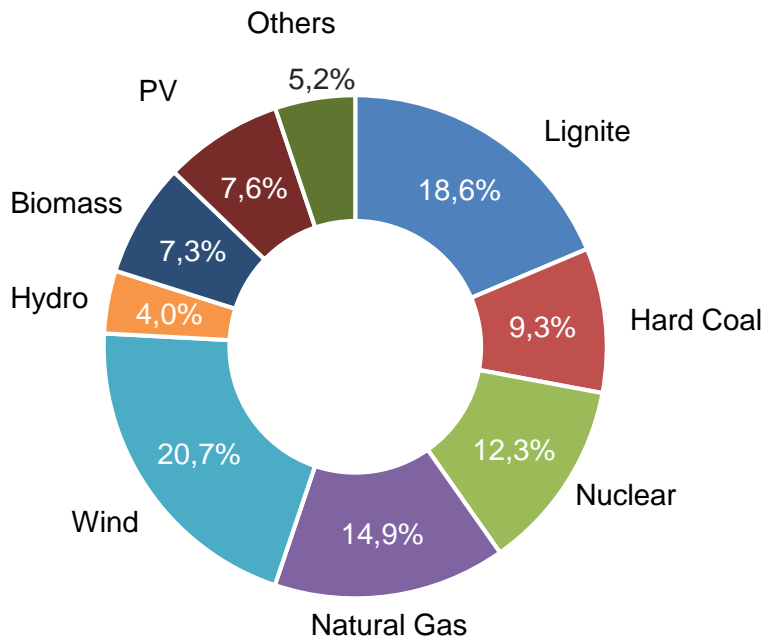
45 %
Share of
Renewables in
Electricity in
2025

40 %
Greenhouse
Gas Emission
Reduction until
2030 comp. to 1990

50 %
Less primary
energy con-
sumption until
2050 comp. to 2008

A 50% reduction of greenhouse gases by 2030 is under discussion in the EU and in different European countries. The EU Green Deal aims at climate neutrality in 2050.

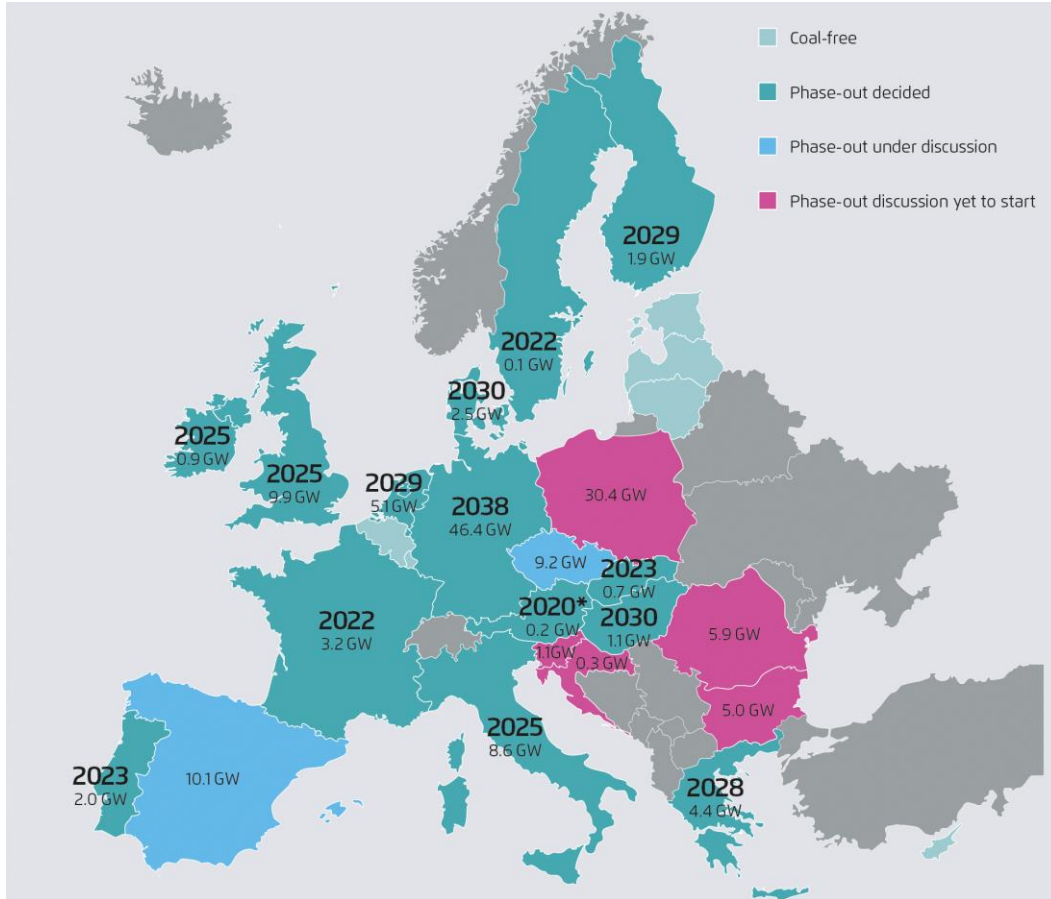
Gross electricity generation: 611,5 TWh
Installed capacity: 224 GW (120 GW Renewables)



Source: AG Energiebilanzen

The share of renewables accounted for almost 40 per cent in gross electricity generation – Wind has become the main energy source.

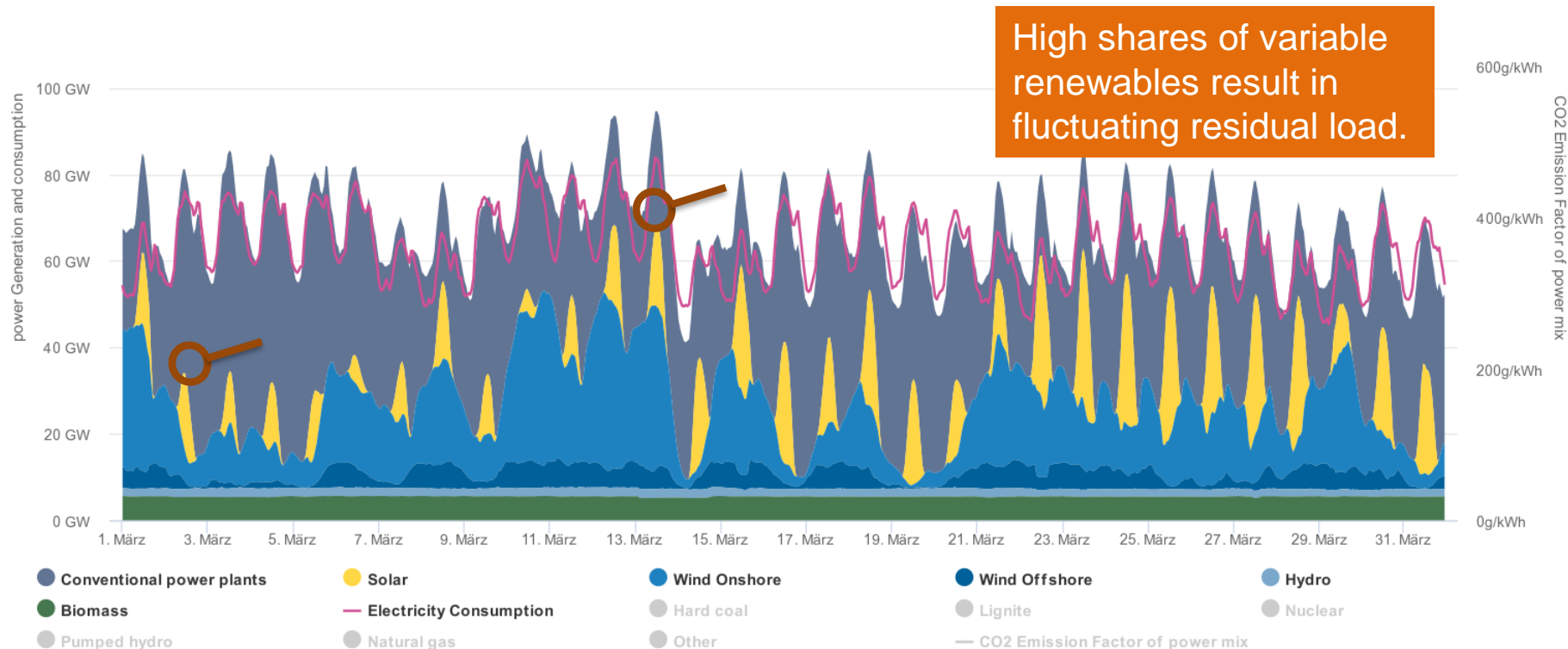
Coal phase-out in Europe has started



Political acceptance of coal based generation is falling rapidly. Pressure to change to gas and energy storage; push for sector coupling technologies.

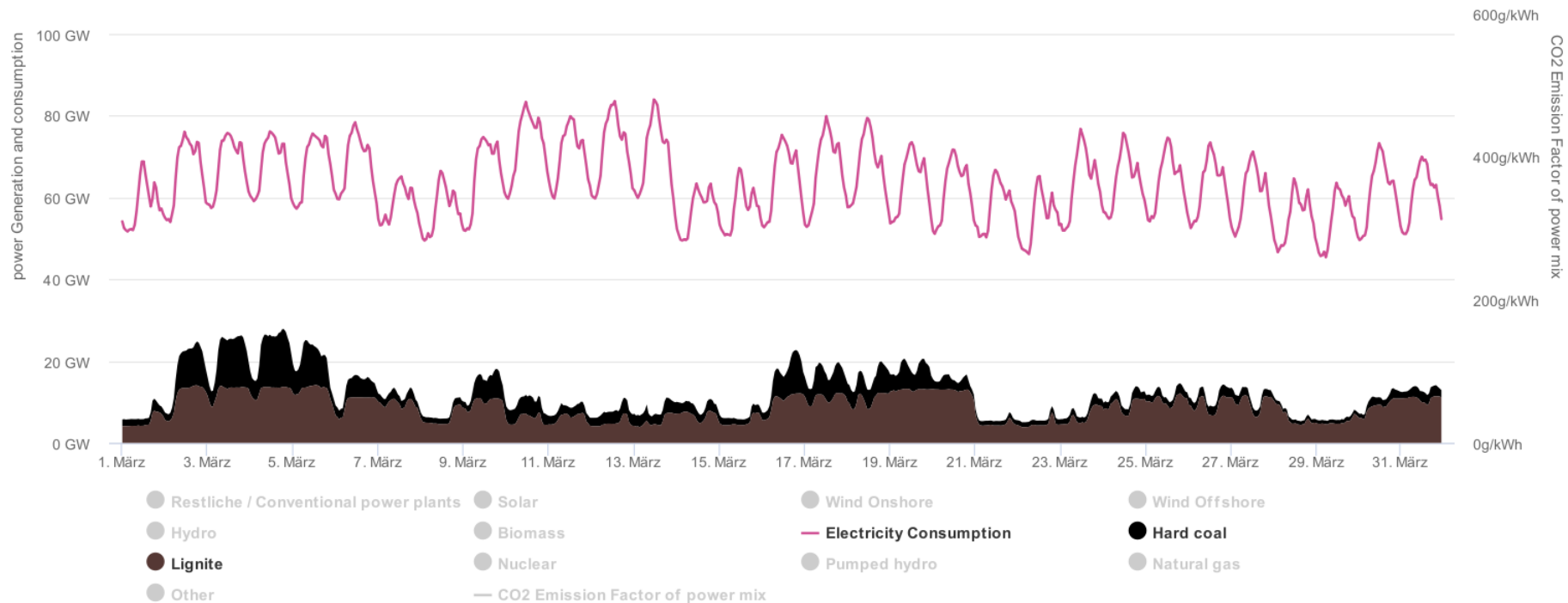
Source: Agora Energiewende and Sandbag (2019)

Power Generation in Germany

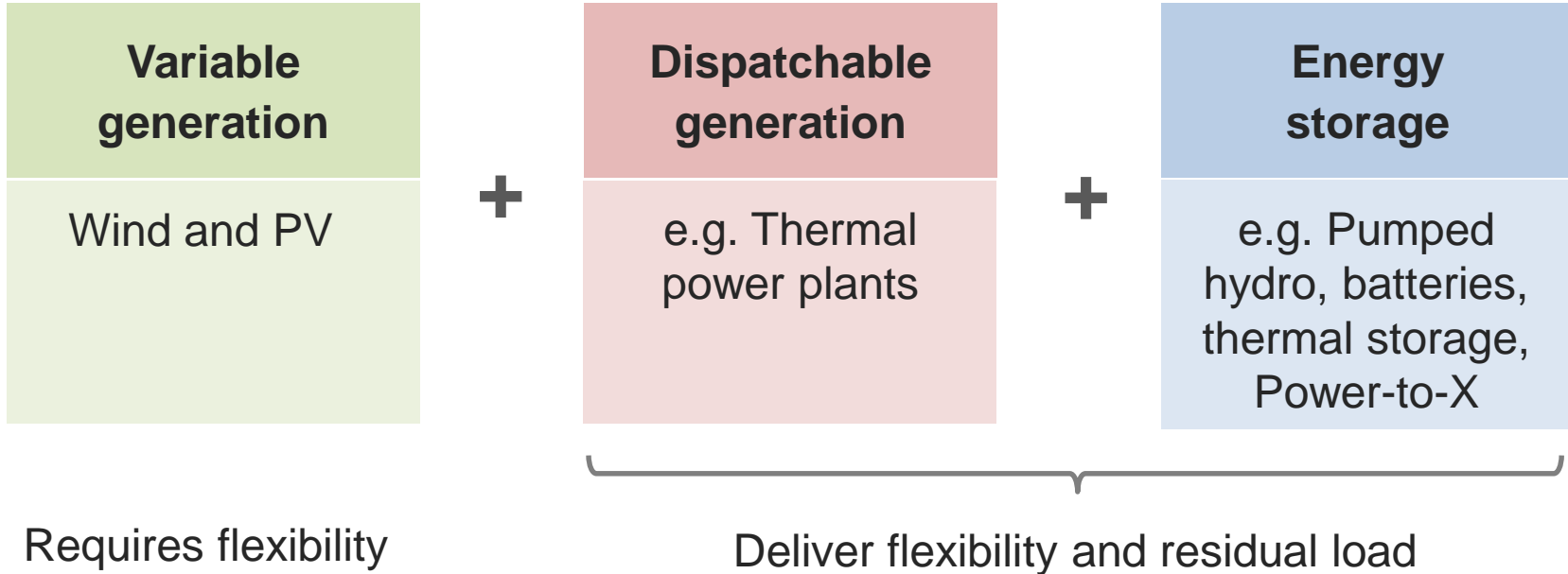


Generation portfolio in GW, Germany, March 2020

Power Generation in Germany: Coal-fired Power Plants



Generation portfolio in GW, Germany, March 2020



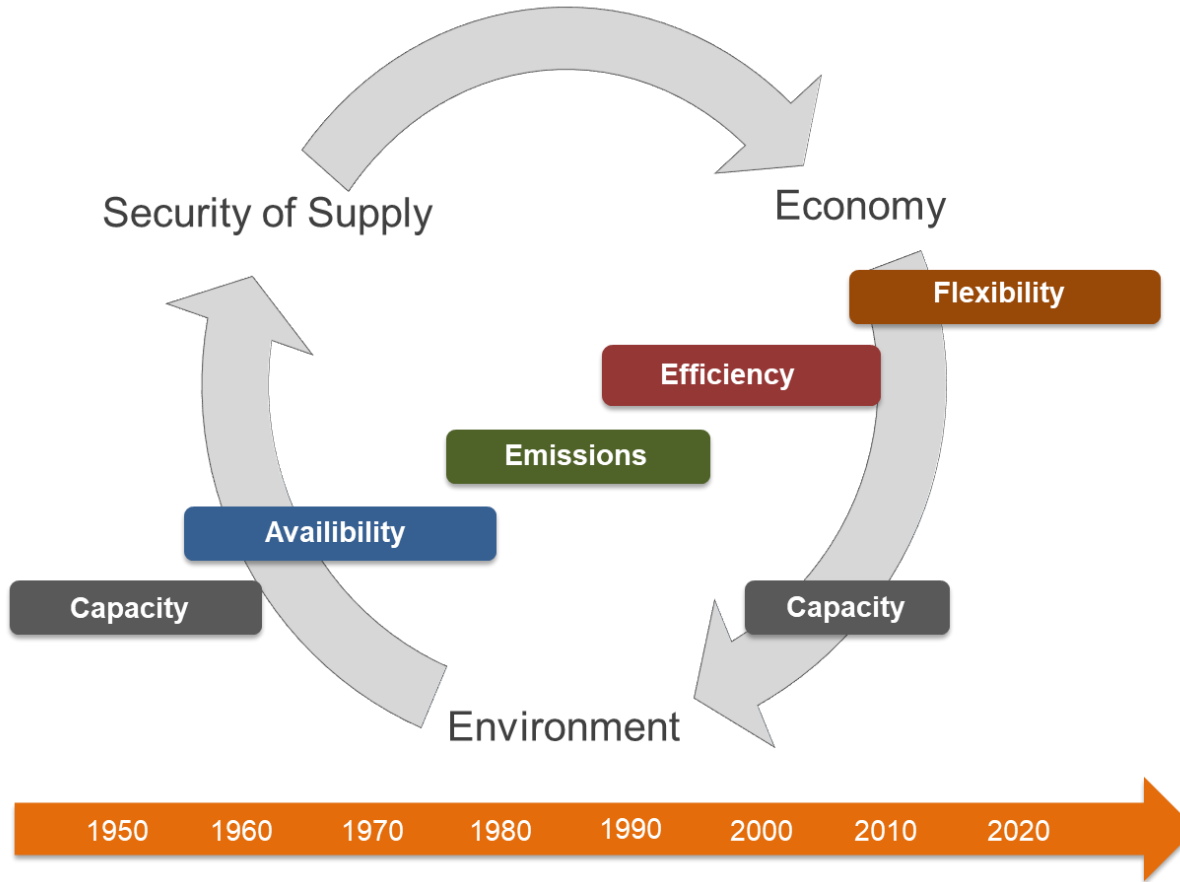
Flexible power plant operation:

- is characterized by low minimum load, high ramp rates and fast start-ups and shut-downs.
- requires a complete new way of thinking w.r.t. to the operational philosophy.
- has become a key design criteria for new thermal power plants.



Dispatchable power plants – e.g. thermal power plants – are important facilitators for the system integration of variable renewables.

Flexibility: Key Driver for Power Plant Technologies



3. Flexibility parameters of dispatchable generation

Plant type	Hard Coal	Lignite	CCGT	Pumped Storage
Ramp rate [% / min]	2 / 4 / 9	2 / 4 / 8	4 / 8 / 12	> 40%
in the load range [%]	40 to 90	50 to 90	40* to 90	
Minimum load [%]	40 / 25 / 10	60 / 40 / 20	50 / 40 / 30*	10
Start-up time hot start <8 h [h]	3 / 2 / 1	6 / 4 / 2	1.5 / 1 / 0.5	< 0.2
Start-up time cold start >48 h [h]	7 / 4 / 2	8 / 6 / 3	3 / 2 / 1	< 0.2

Source: VDE and own studies

Conservative / state of the art / very advanced; *as per emission limits for NO_x and CO



- Facts and figures about flexibility provided by dispatchable generation
- Reports and publications as downloads available – e.g. “Flexibility Toolbox for coal-fired power plants“

धन्यवाद

Thank you
for your interest!

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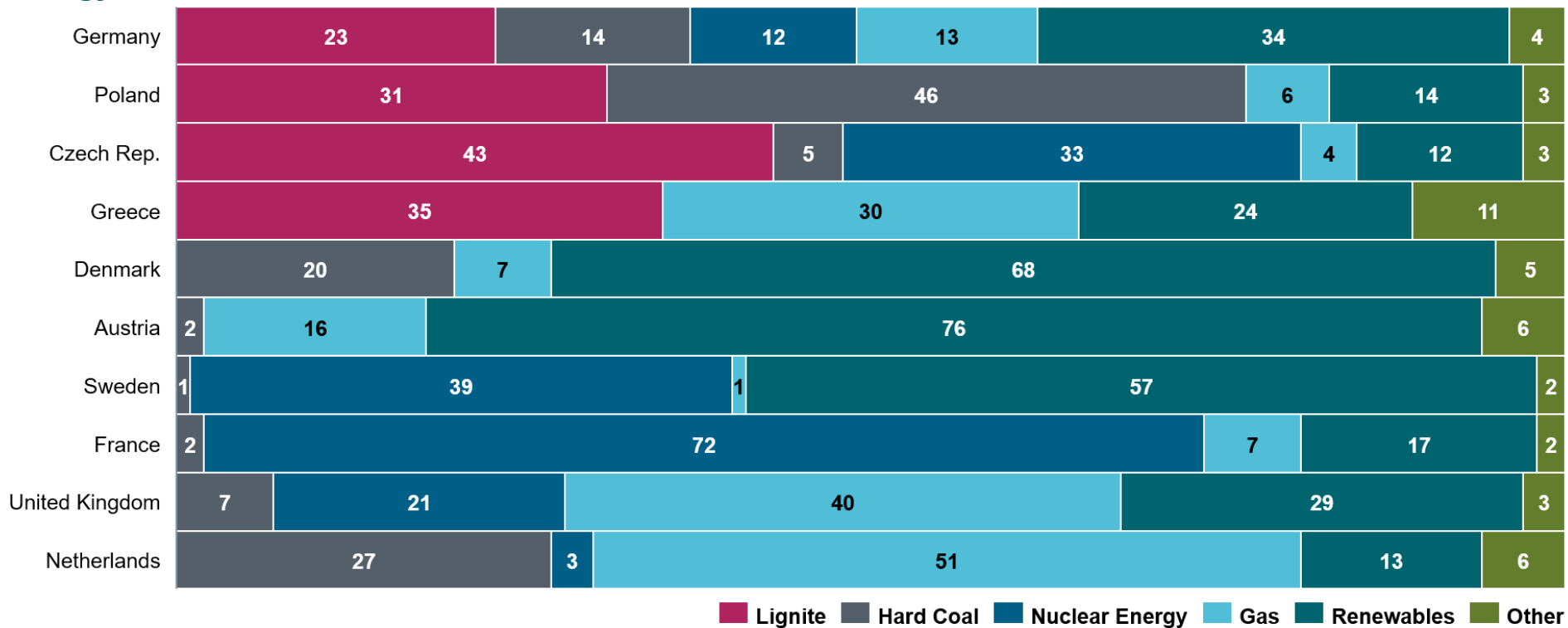
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Energy mix in % based on 2017 data



■ Lignite
 ■ Hard Coal
 ■ Nuclear Energy
 ■ Gas
 ■ Renewables
 ■ Other

Source: IEA, Electricity Information 2018