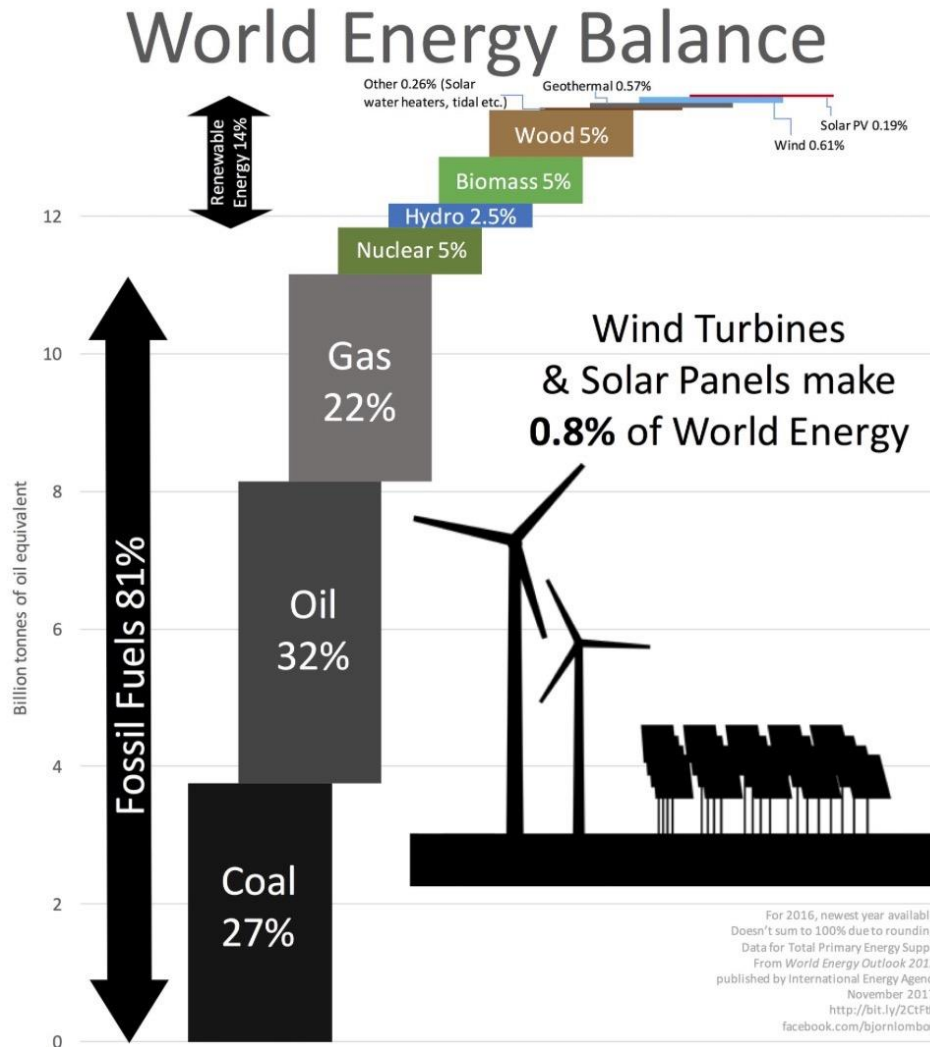


# Role of fossil fuels in supporting renewable energy deployment

Vladimir Budinsky

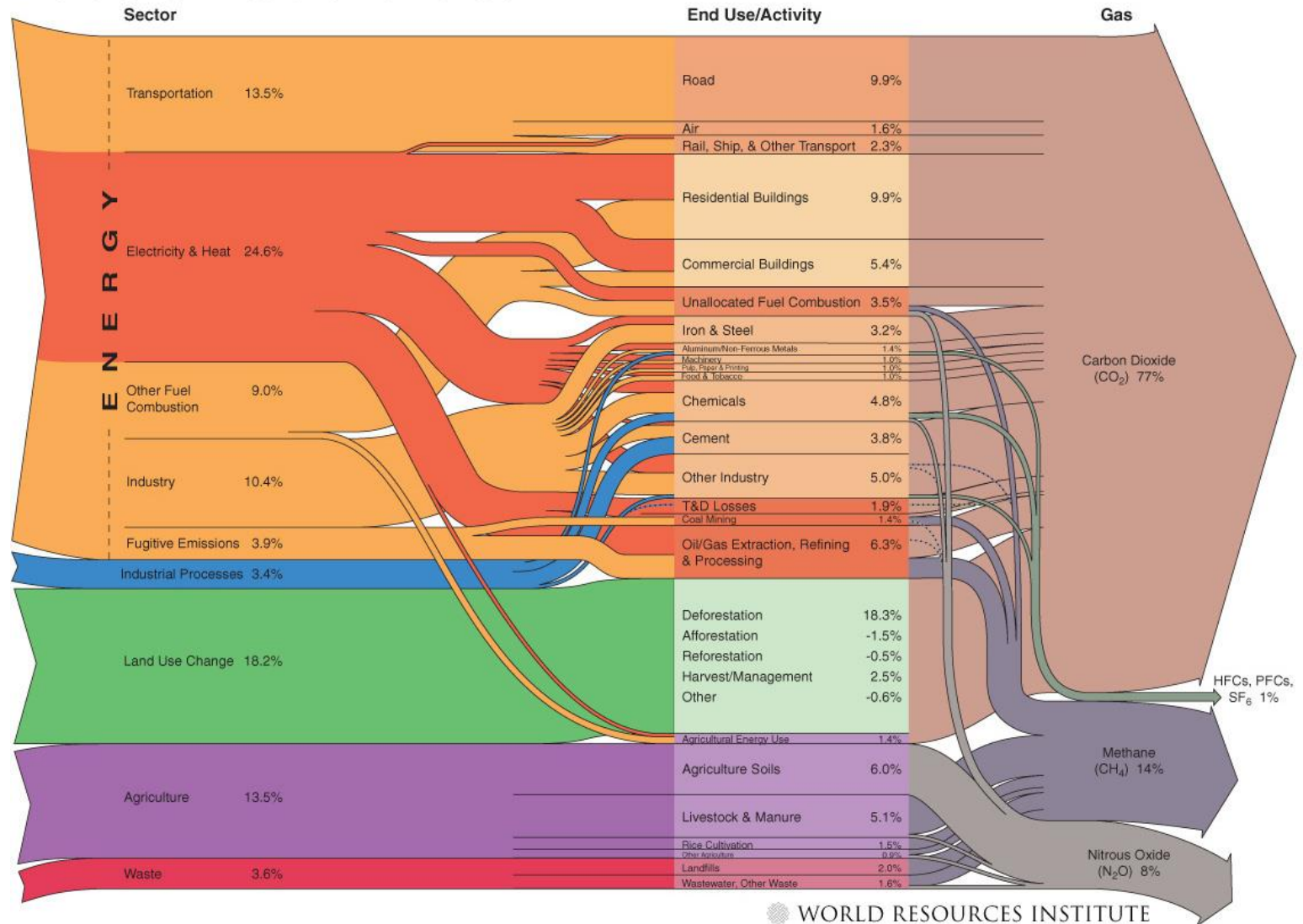
Vice-chairman Group of Experts  
Cleaner Electricity Systems UN ECE

# Fossil fuels provide 81% global energy



# Fossil fuels use produce GHG emissions

World GHG Emissions Flow Chart



# GHG - it is not only CO<sub>2</sub>

CARBON DIOXIDE



transportation  
fossil fuel combustion  
coal and crude oil

METHANE



natural gas systems  
landfills  
agriculture

NITROUS OXIDE



manufacturing  
agriculture  
cars

HYDROFLUOROCARBONS



semiconductor manufacturing

PERFLUOROCARBONS



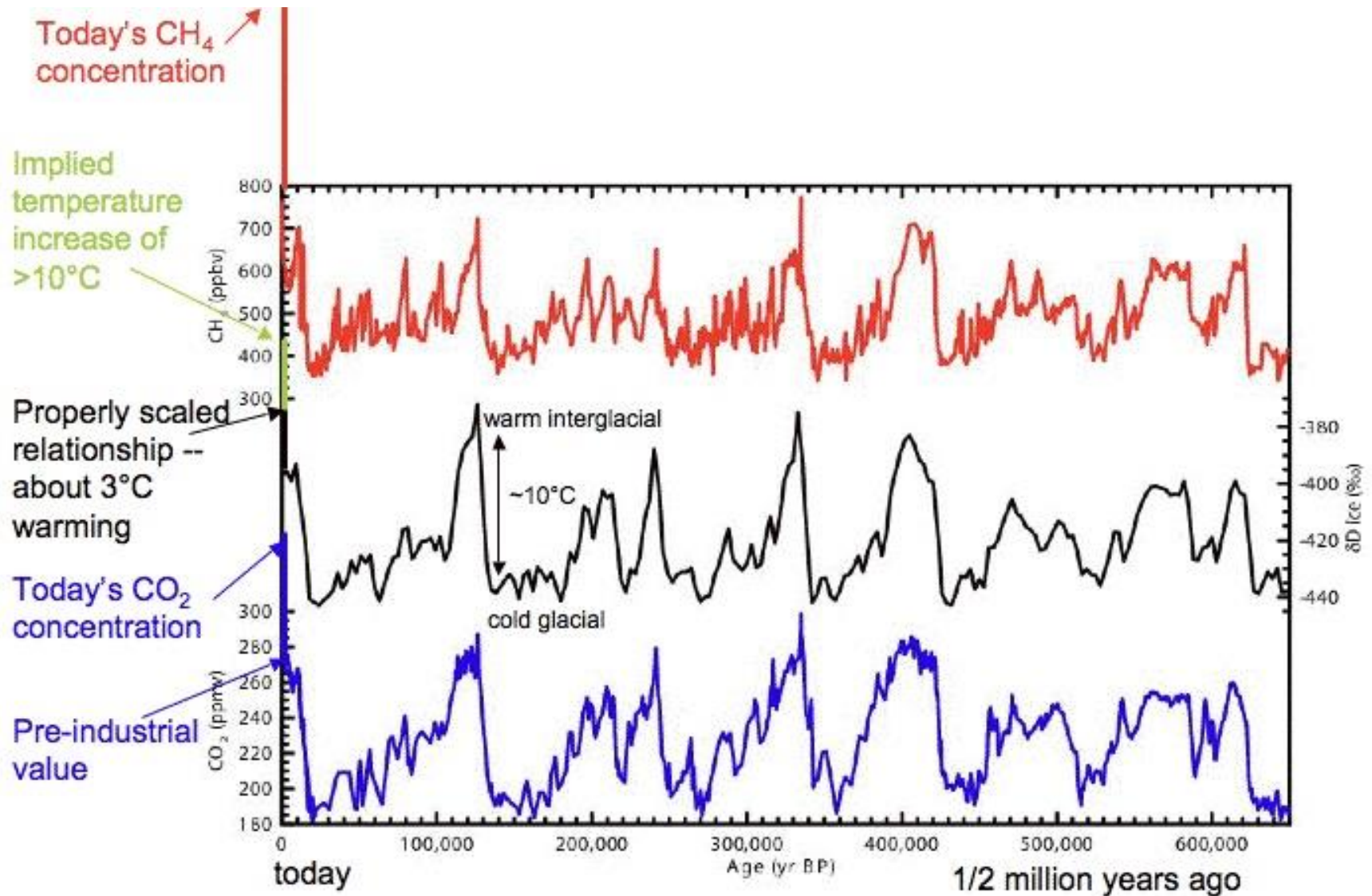
aluminium production

SULFUR HEXAFLUORIDE



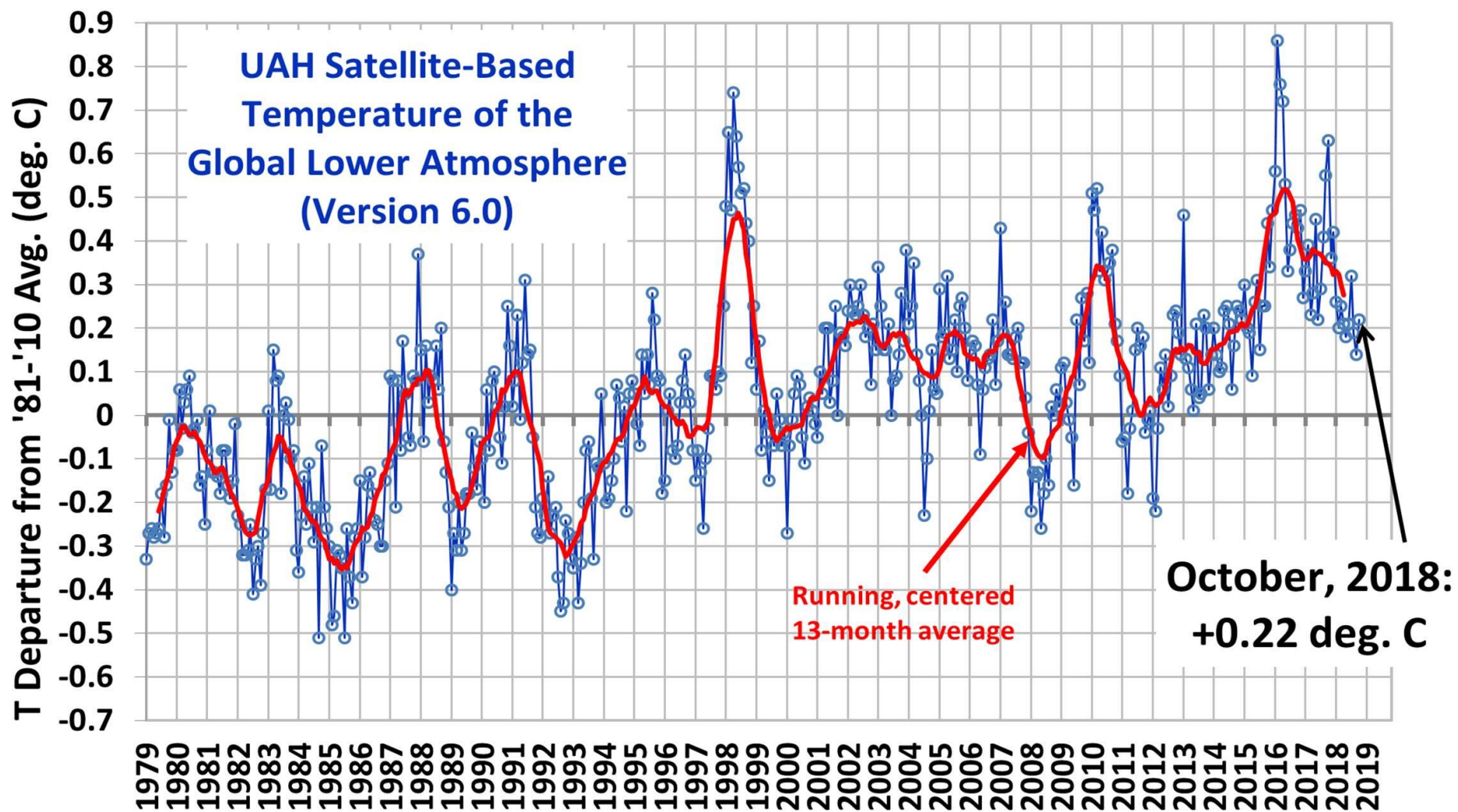
electrical transmission  
magnesium production

# CH<sub>4</sub> and CO<sub>2</sub> correlate with Temperature

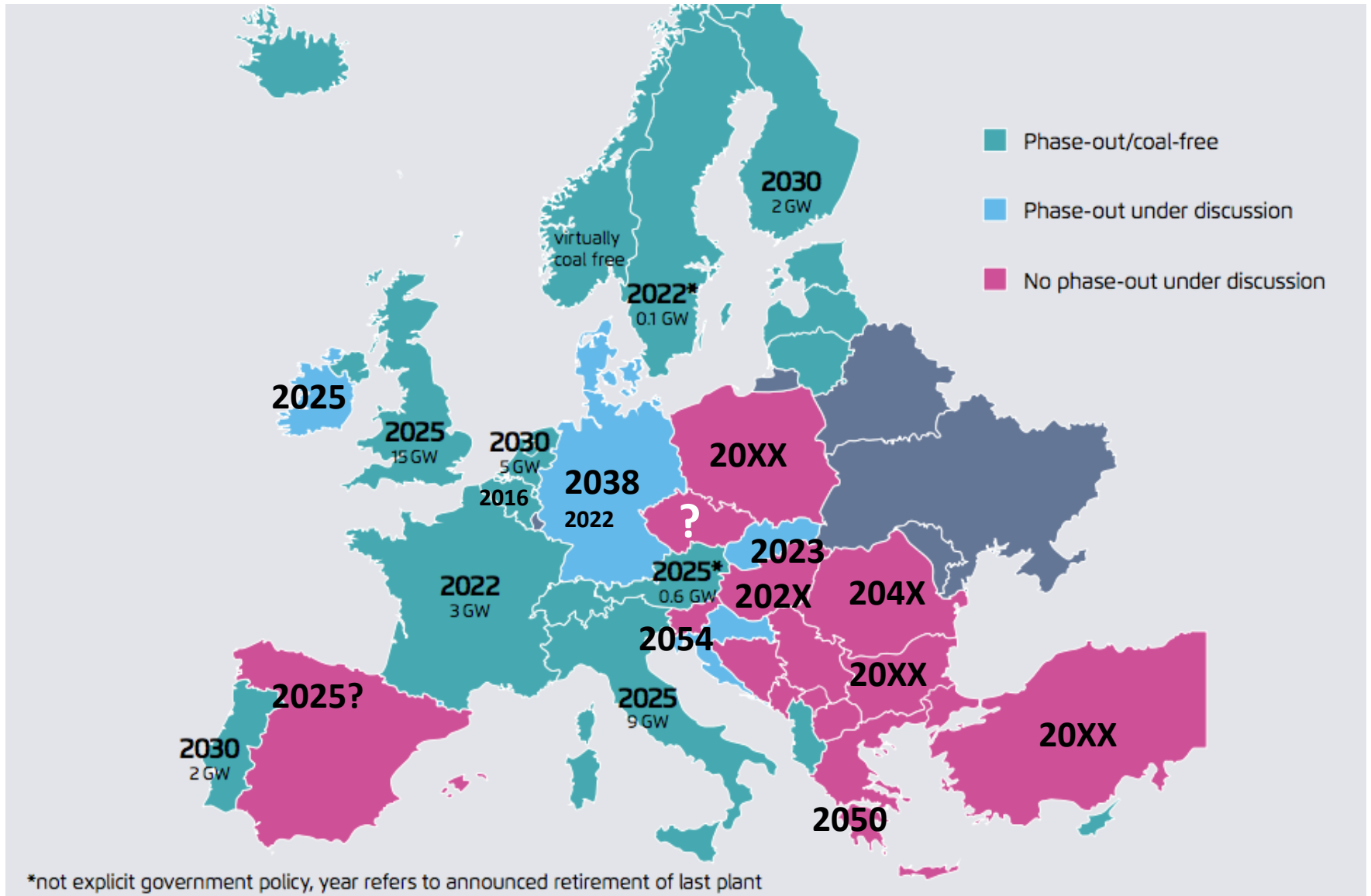




# Global Climate Change – Warming Slow Down



# Europe Coal Phase Out



Since 1990 World Emissions (WE) have grown by 60% and Emissions from Lignite dropped by 54% - 0,47%



Weltweit ist der CO<sub>2</sub>-Ausstoß seit 1990 um 60 Prozent angestiegen. Die Emissionen aus dem Einsatz der Braunkohle in Deutschland sind im selben Zeitraum um 54 % gesunken. Ein nationaler Ausstieg aus der Braunkohle vermindert den globalen Anstieg um etwa 0,8 %.



CO<sub>2</sub>-Ausstoß der deutschen Braunkohle 1990  
353 Mio. t - Globaler Anteil: 1,66 Prozent

+ 60 %



- 54 %



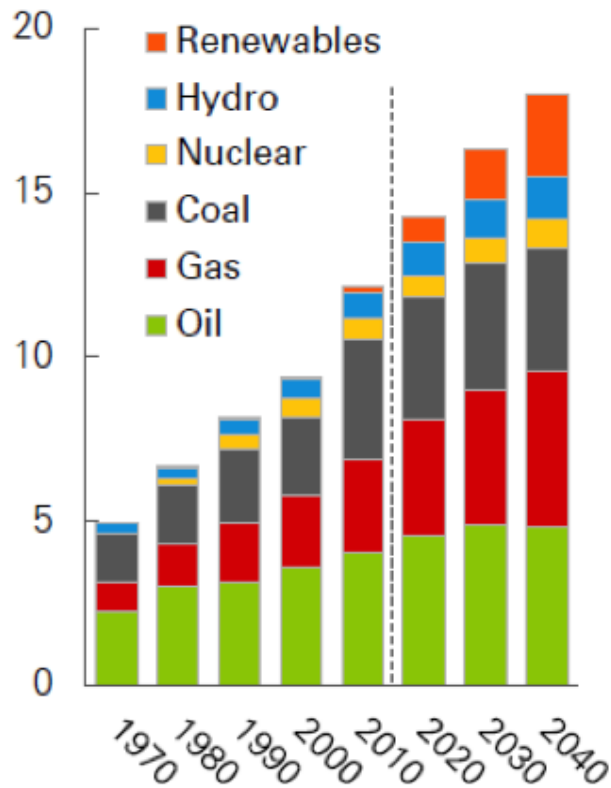
CO<sub>2</sub>-Ausstoß der deutschen Braunkohle 2018  
161 Mio. t - Globaler Anteil: 0,47 Prozent



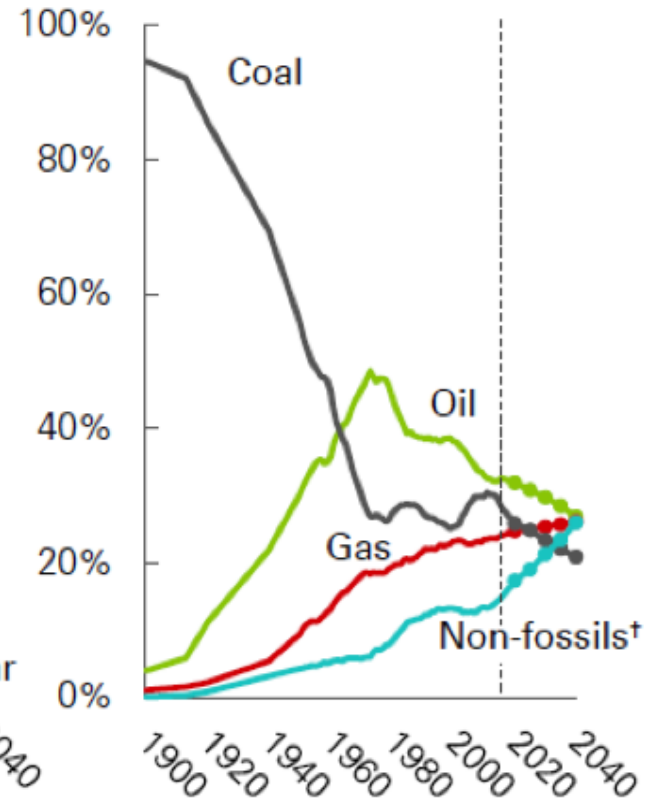
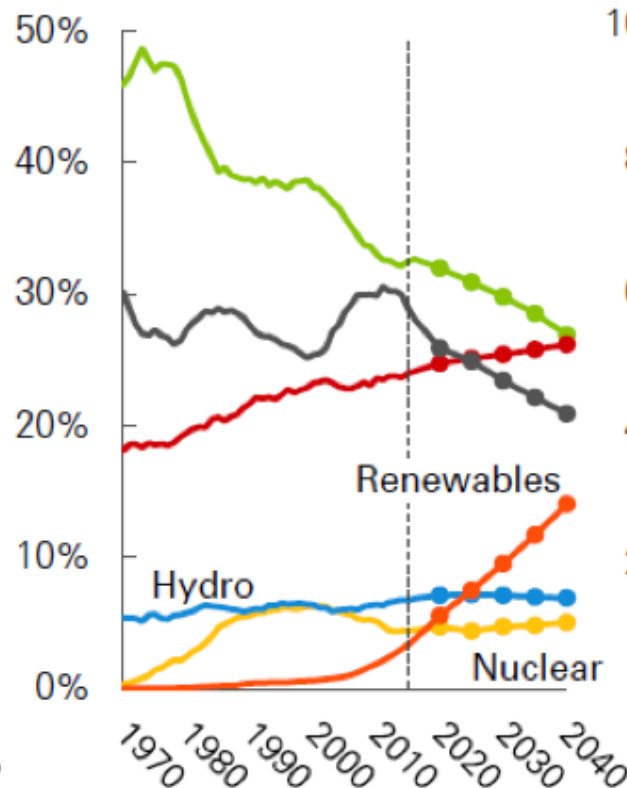
# In 2040 Fossil Fuels 80% - Coal 20%

Primary energy  
consumption by fuel

Billion toe

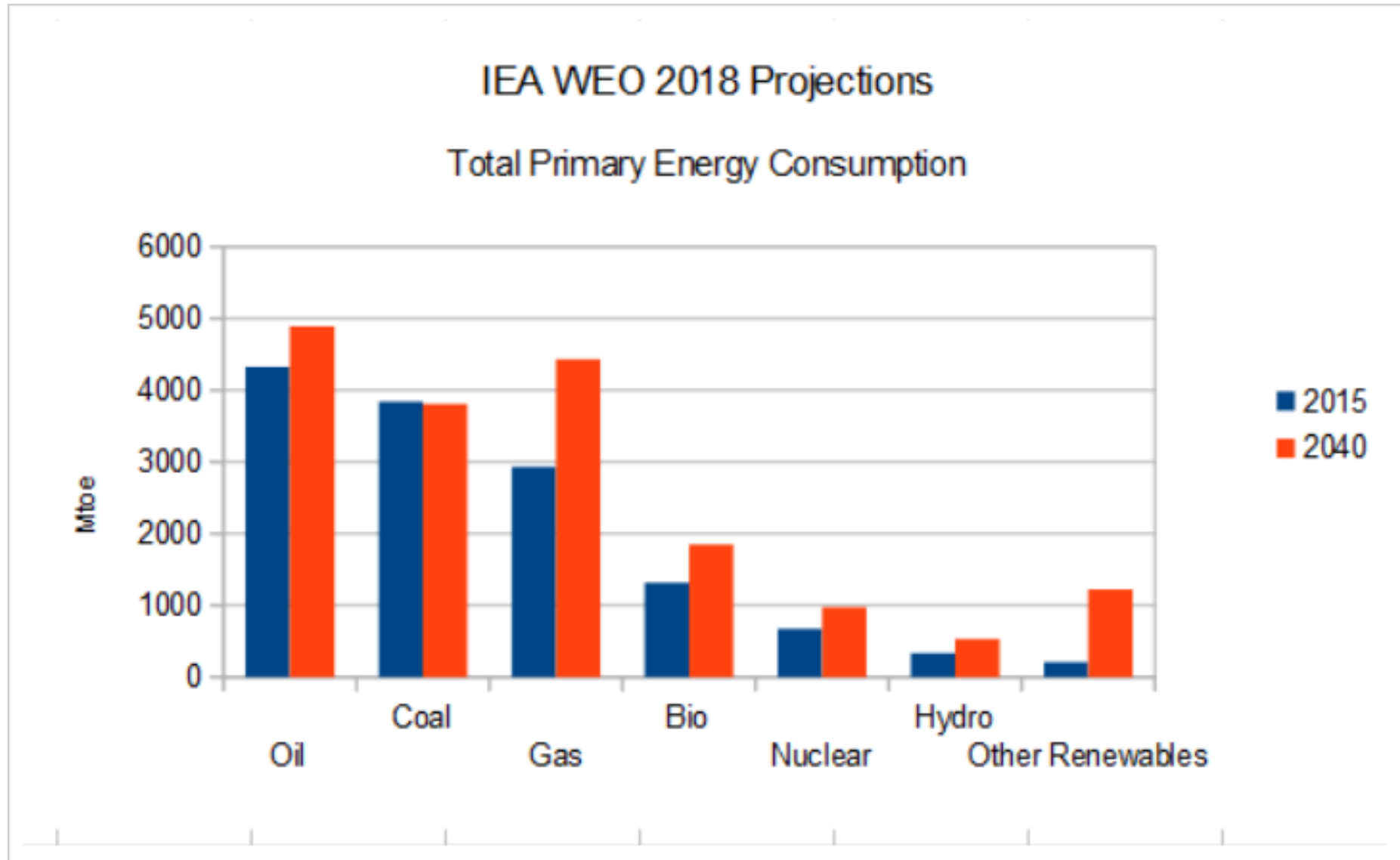


Shares of primary energy

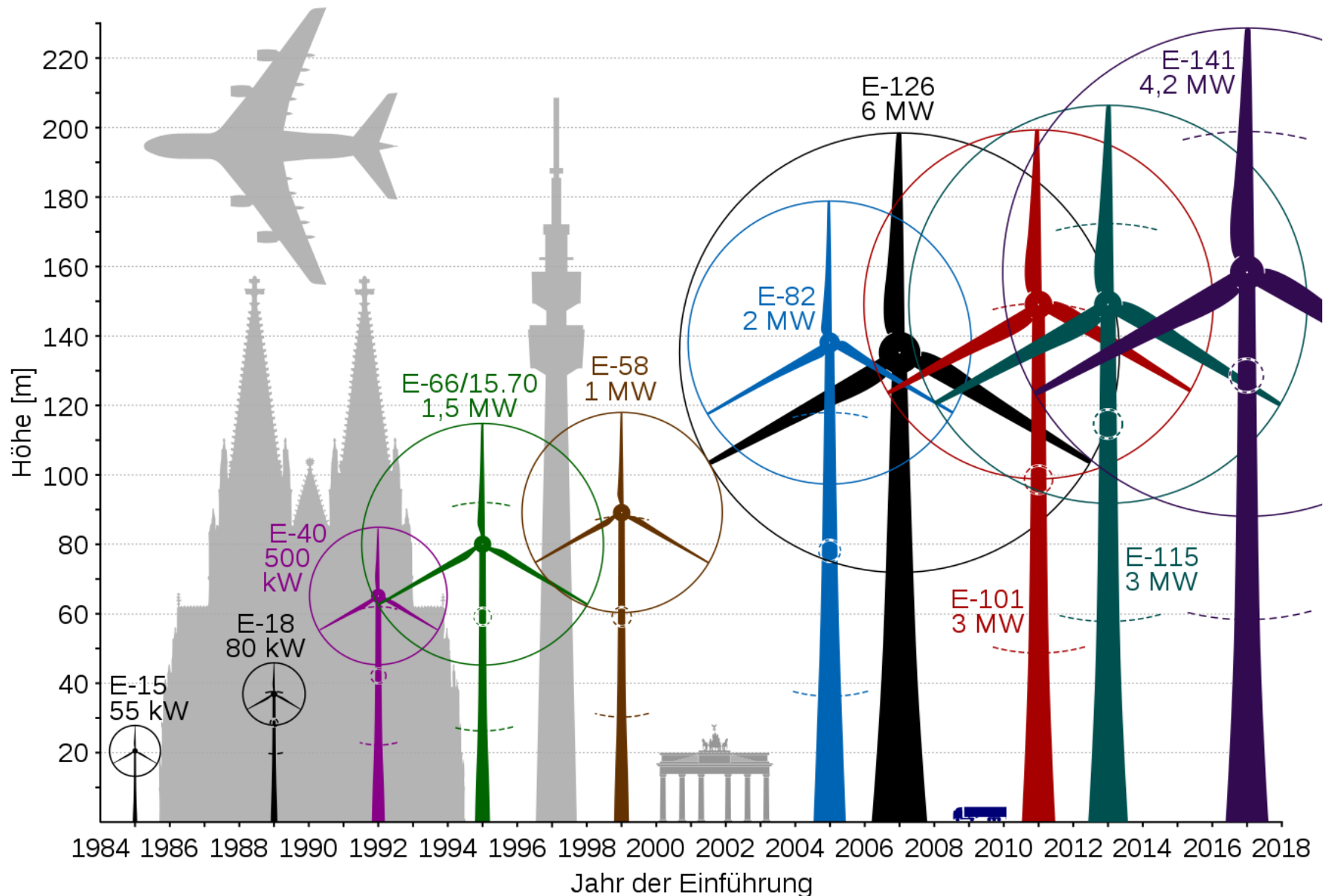


\* Non-fossils includes renewables, nuclear and hydro

# IEA NPS – Fossil Fuels will keep 80% share



# Windturbines are getting bigger



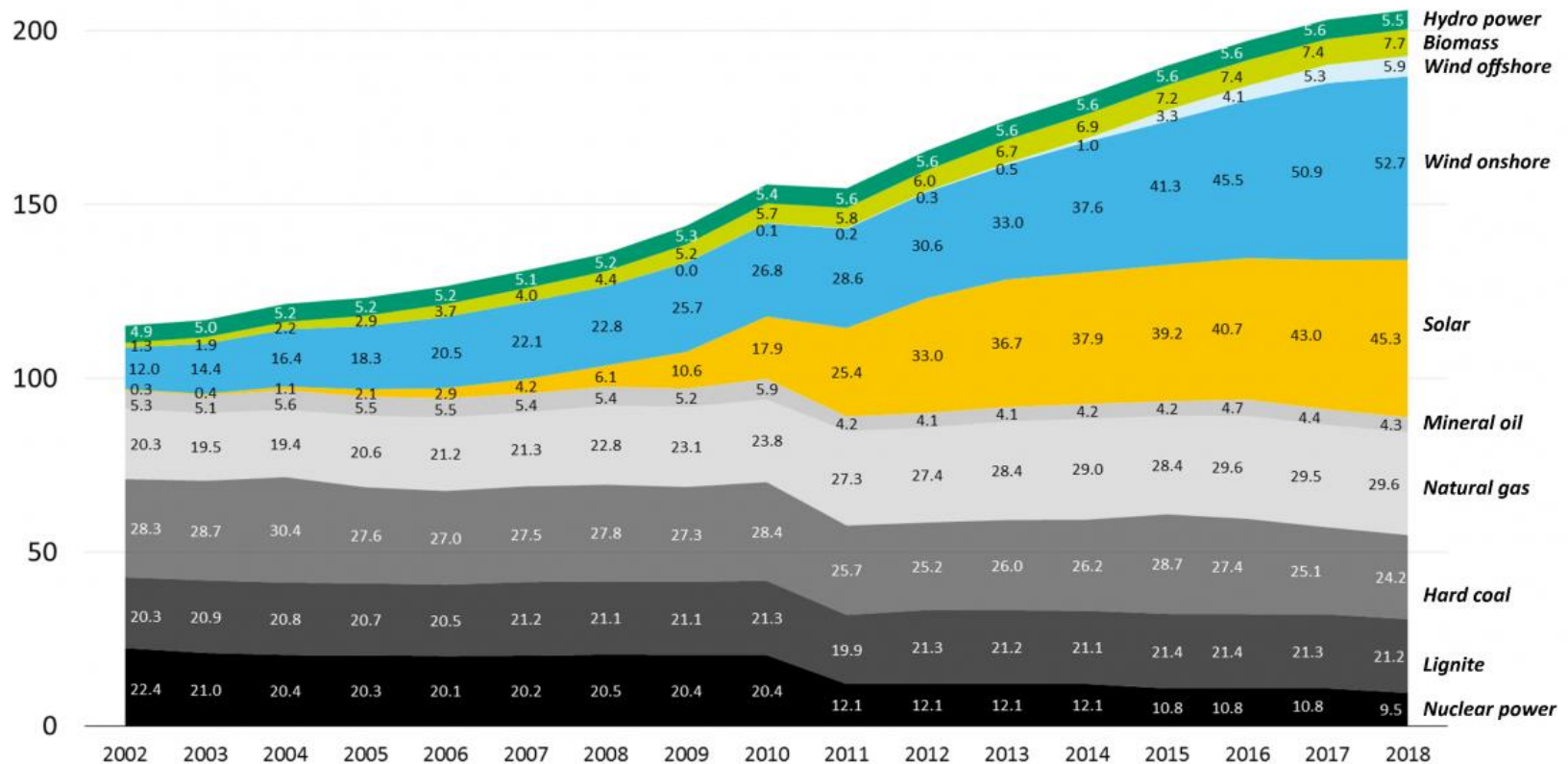
# RE installed capacity share is 59%

## Installed net power generation capacity in Germany 2002 - 2018.

Data: Fraunhofer ISE 2018.



Capacity in gigawatts (GW)

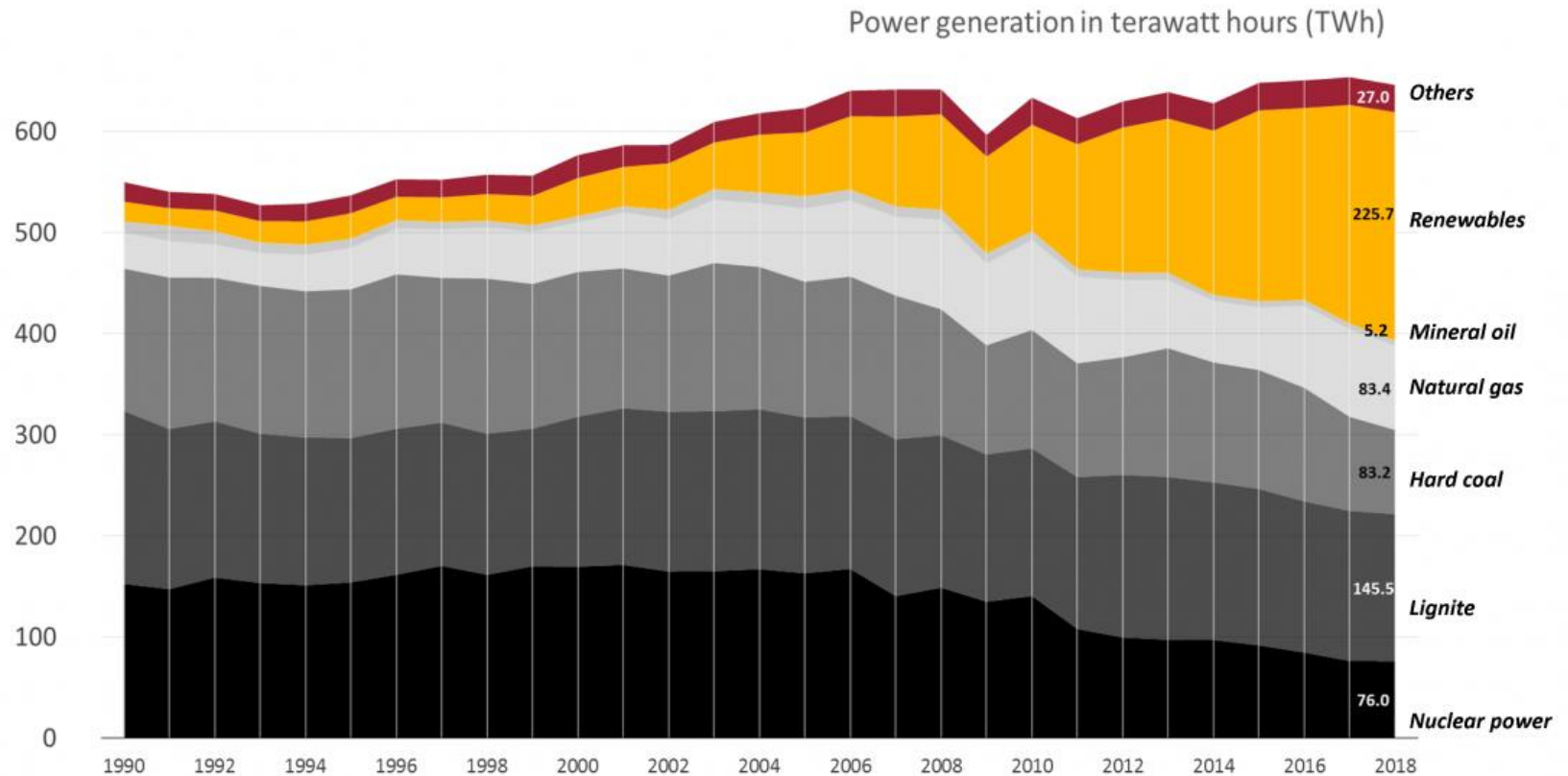




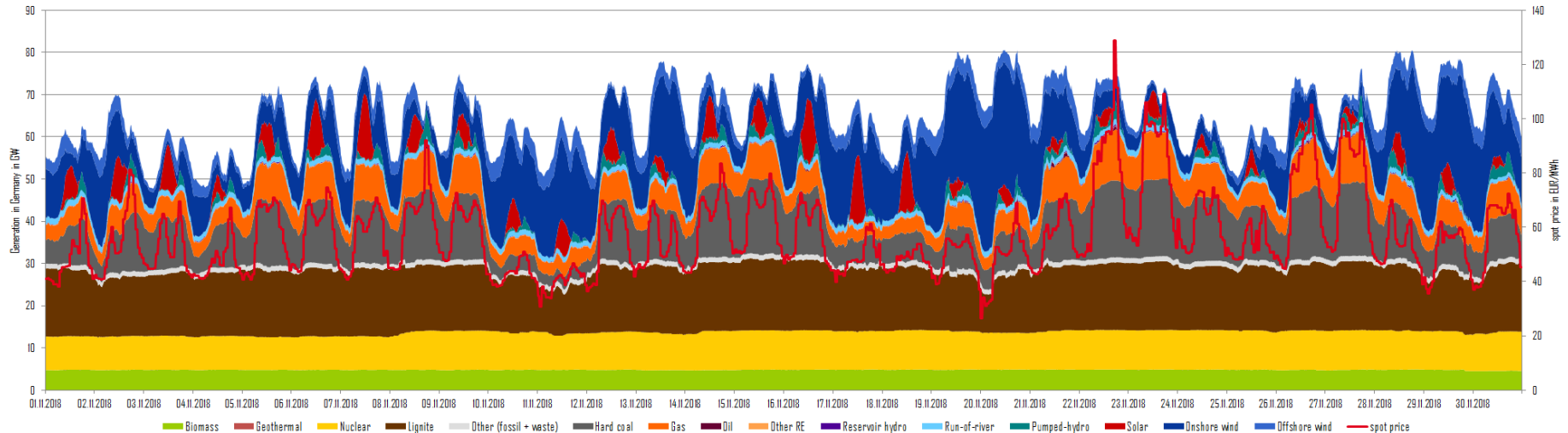
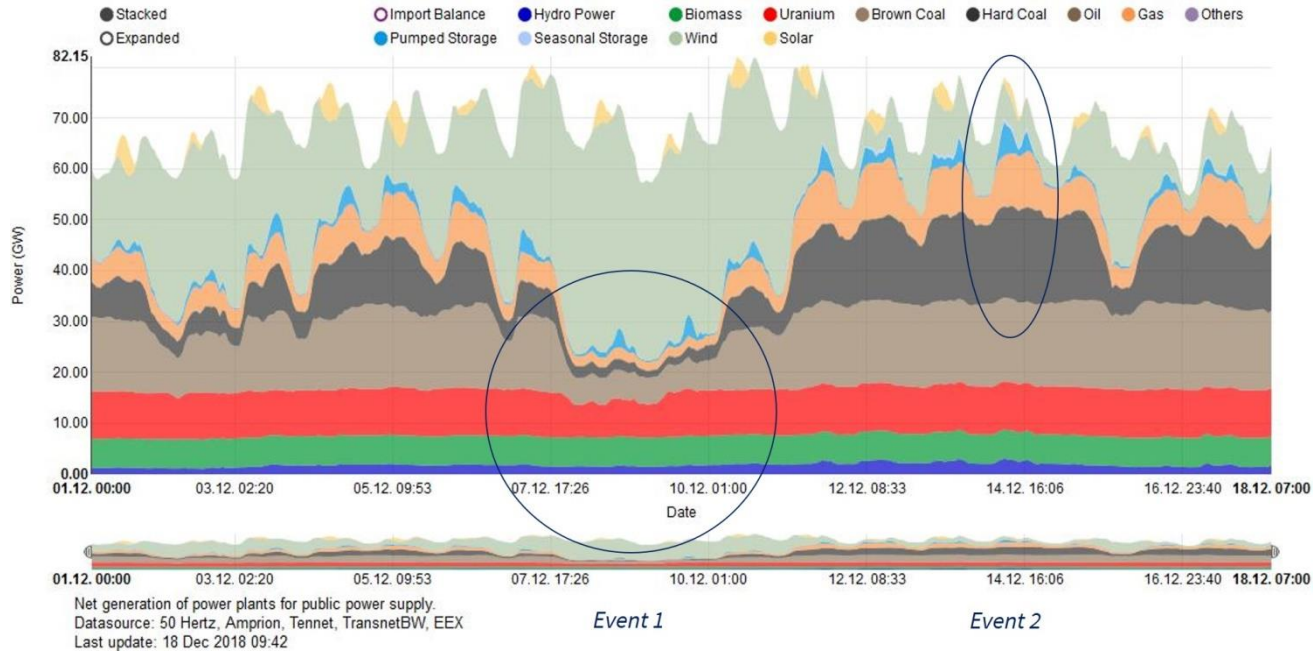
# RE produce 35% Electricity in Germany

## Gross power production in Germany 1990 - 2018, by source.

Data: AG Energiebilanzen 2019, preliminary.



# RE seen as the GHG solution

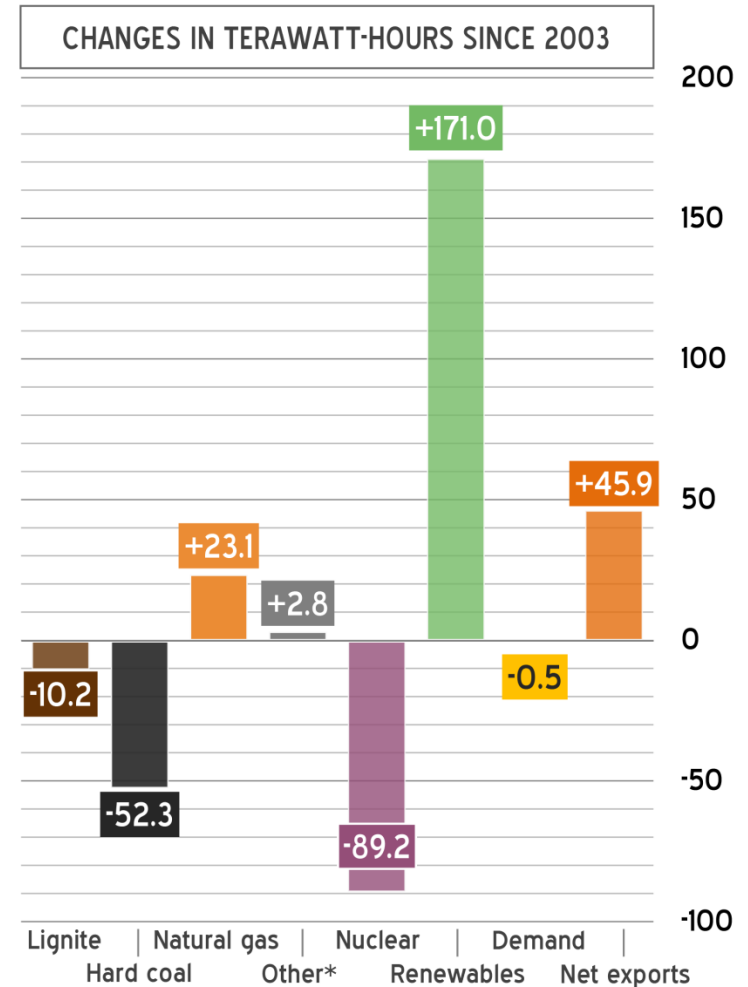
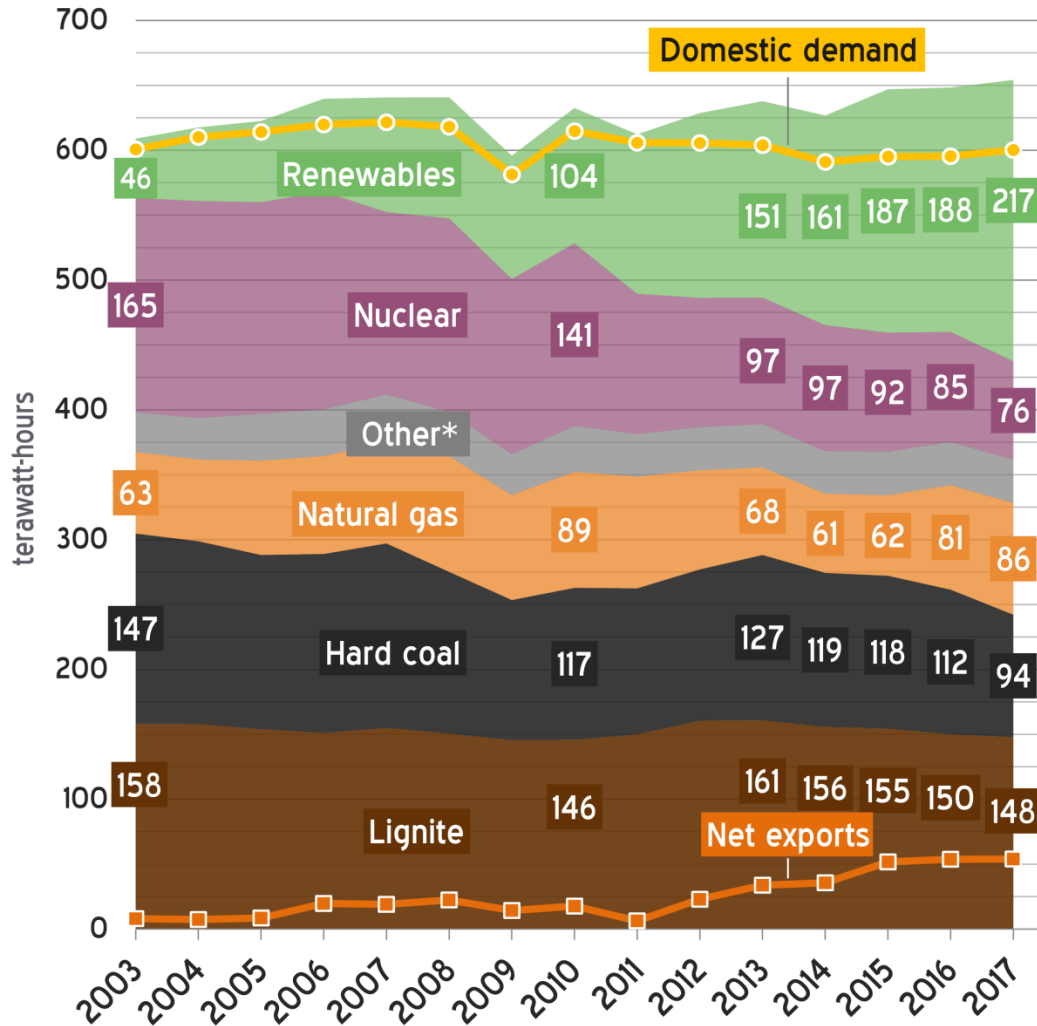


# RE grow as well as Gas

## Renewables and power exports hit record high in 2017

Electricity generation, demand & exports in Germany, 2003-2017

Source: AGEF (August 2017) / \*Oil, waste, etc

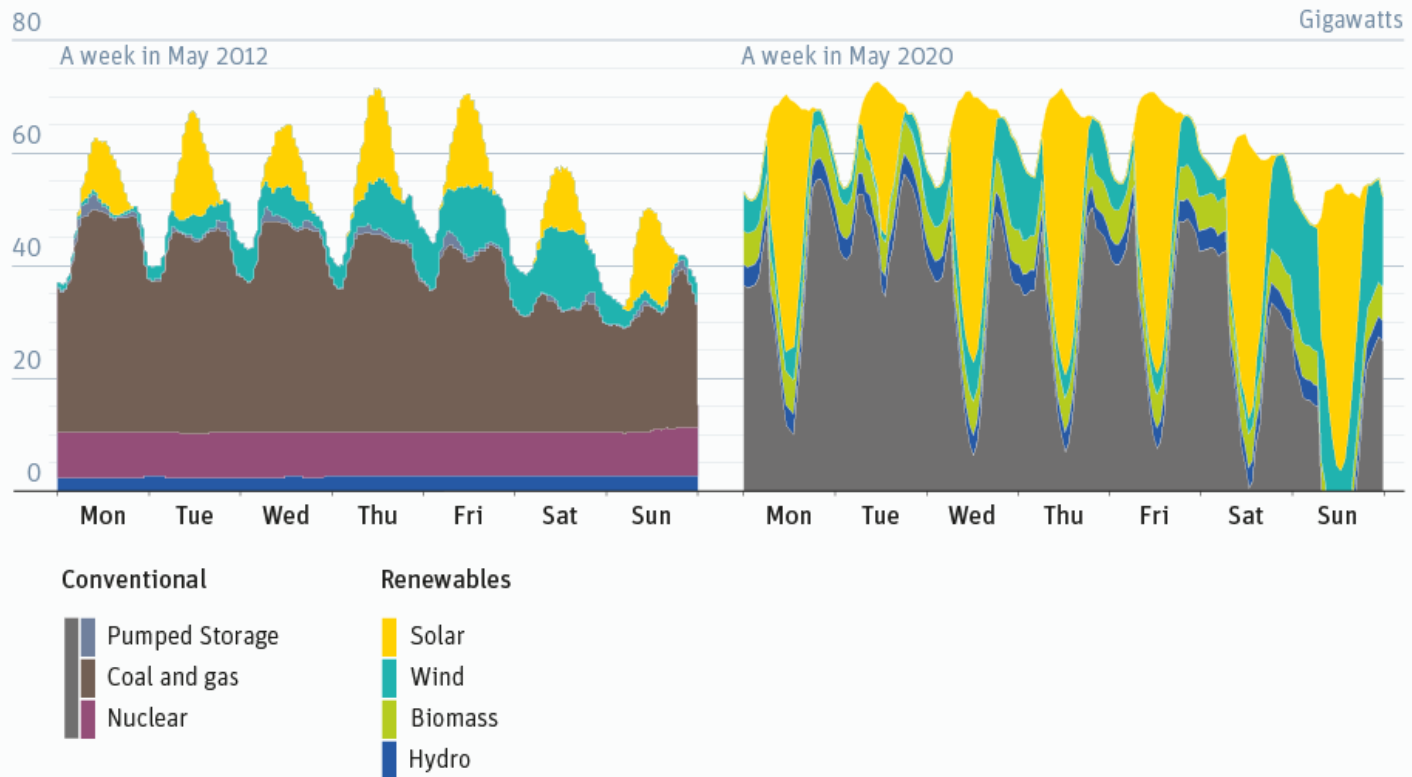


# RE need flexible Back Up not Baseload

## Renewables need flexible backup, not baseload

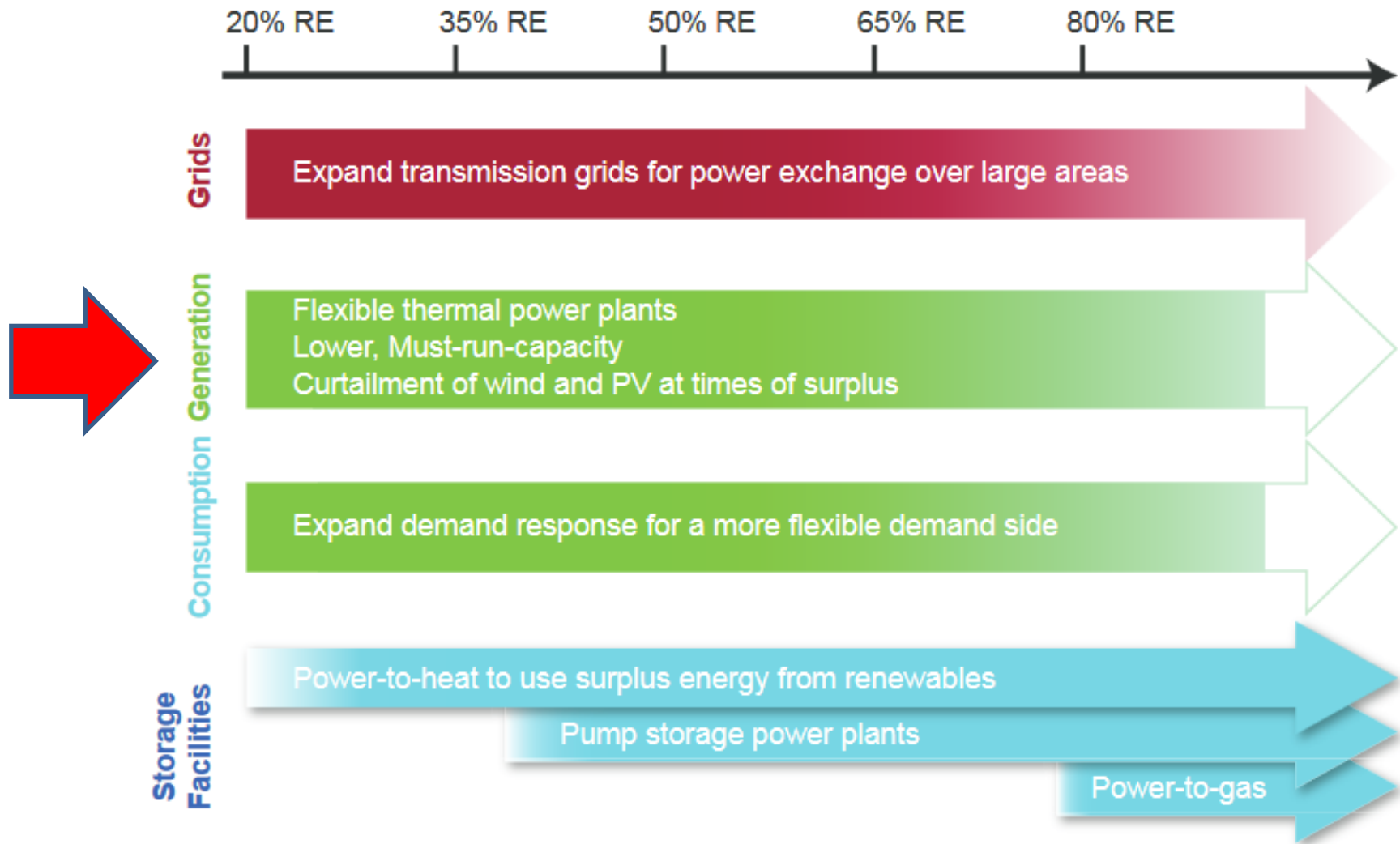
Estimated power demand over a week in 2012 and 2020, Germany

Source: Volker Quaschnig, HTW Berlin

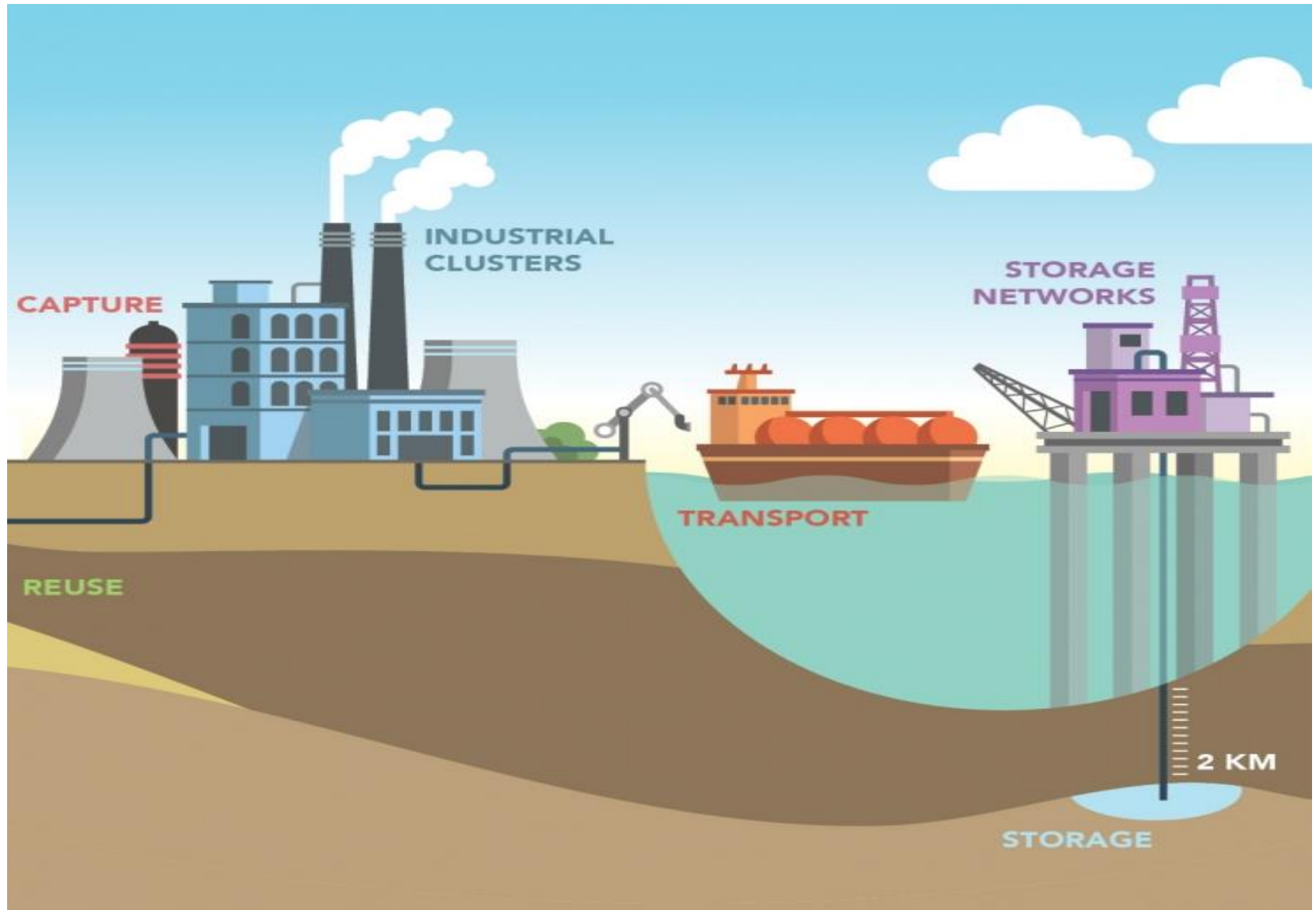




# RE requires flexible Back Up

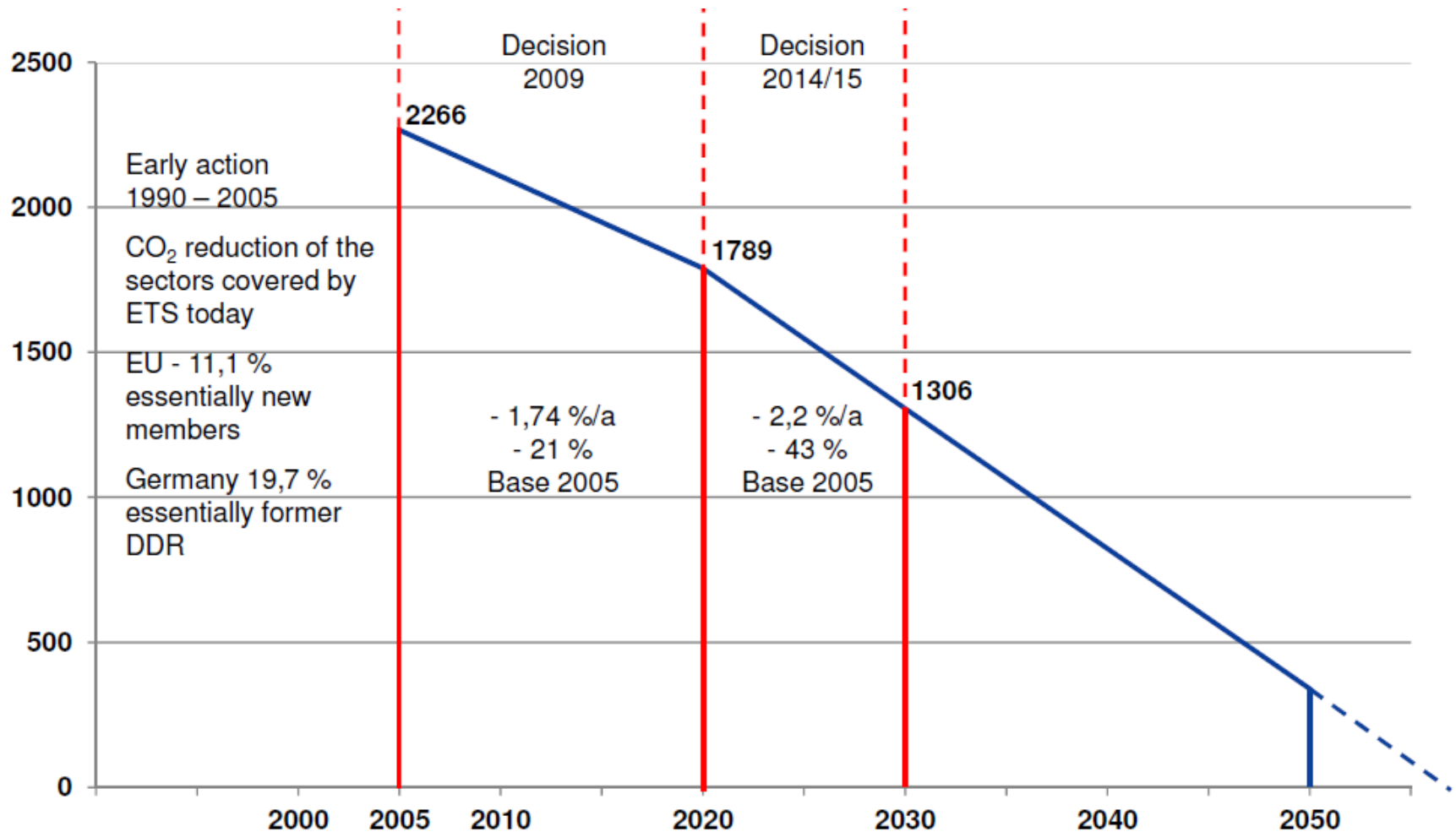


# CCS/CCUS – Chance for Fossil Fuels



# EU ETS Effective Tool for CO<sub>2</sub> Emission Decrease

MtCO<sub>2</sub>-eq.



# EU 2050 Strategy – 2050 EU GHG neutral

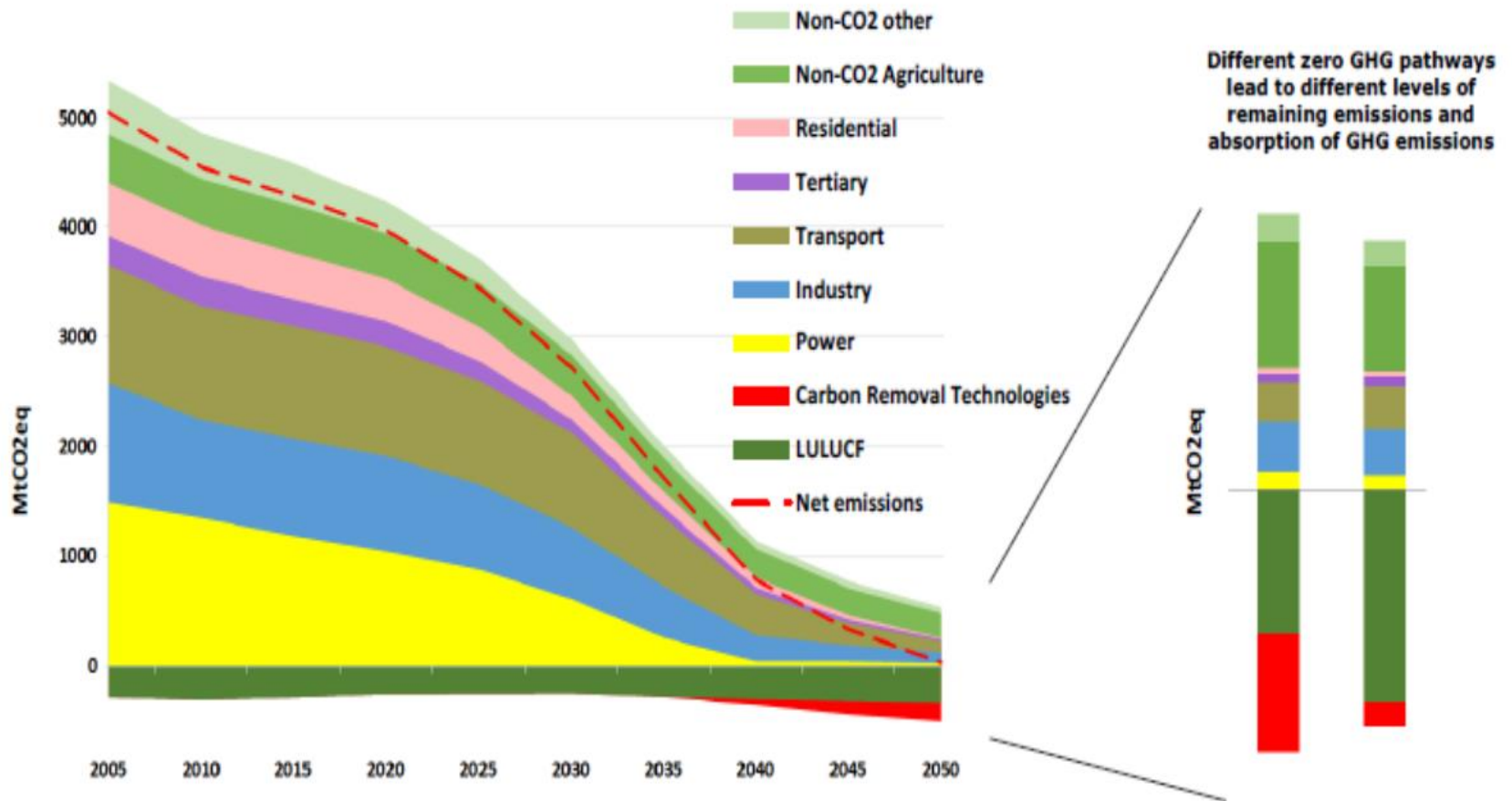


Figure 6. GHG emissions trajectory in a 1.5°C scenario<sup>8</sup>



# CONCLUSION

- More RE deployed require the flexible fossil fuels as the support for renewable energy deployment
- Gas and hard coal play at the moment the role of flexible back up and lignite is mostly used as baseload, but lignite and even the nuclear power plants can be flexible up to 50% of capacity
- Fossil fuels with CCS/CCU are essential for RE deployment when RE share exceeds 20%