

# How to achieve climate neutrality

Overview of Germany's Energy Transition

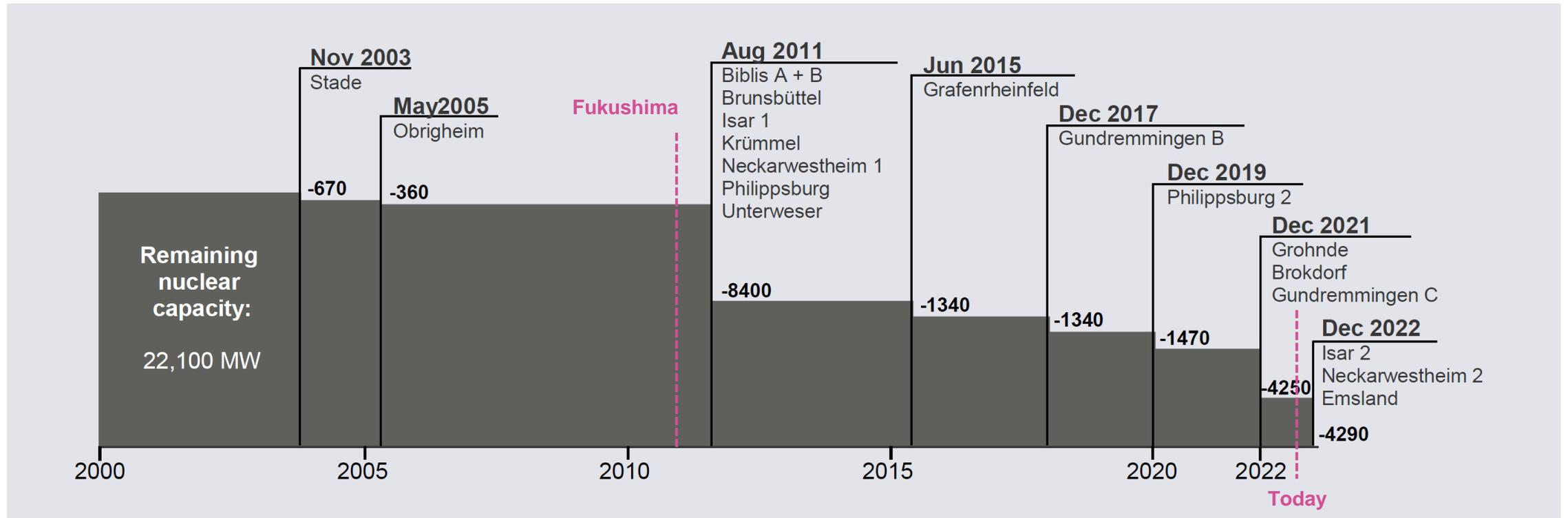
**Simon Müller - Director Germany**

**ONLINE, 18 MAY 2022**



# After the meltdown in Fukushima, the nuclear phase-out of 2000 was reactivated - 14 nuclear power plants have since shut down, 3 will follow until the end of 2022

Decommissioning of nuclear power plants agreed as part of the nuclear phase-out 2000 - 2022

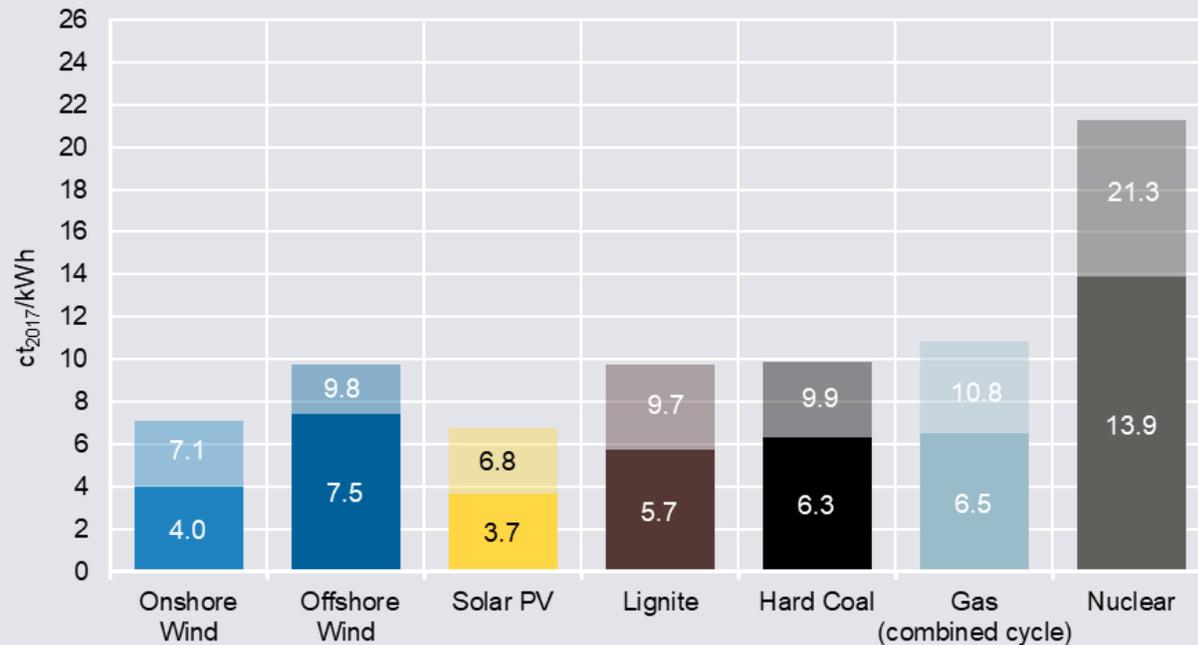


Own depiction based on Energytransition.org

# Outlook: Is there a renaissance of nuclear power?

## Nuclear power plants are by far the most expensive technology for generating electricity in the area of new plants

LCOE of individual power generation technologies in Germany 2017



Own calculations based on Prognos and Fichtner (2017), Fraunhofer ISE (2018), Lazard (2020).

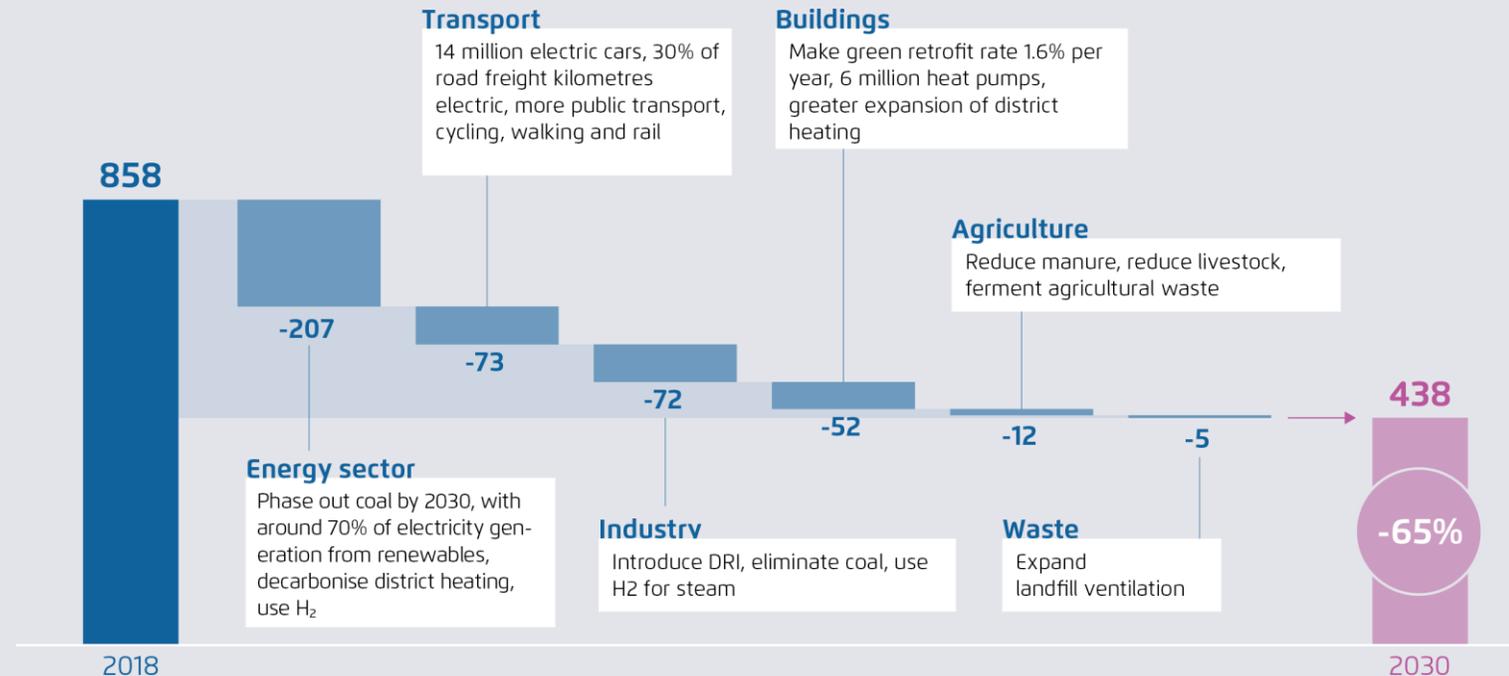
- New wind and solar plants are now competitive with conventional power generation technologies - and significantly cheaper than electricity from new nuclear power plants.
- Wind and PV technology costs continue to fall; at favorable locations around the world, wind and solar power can be produced for under 2 cents/kWh, making it by far the cheapest way to produce electricity.
- The cost of fossil power plants depends crucially on the cost of CO<sub>2</sub>.
- A renaissance of nuclear energy is therefore not to be expected for cost reasons alone, not to mention the long construction times of 10 to 15 years. The share of nuclear energy in the electricity mix has therefore remained at 10% for years.

# Three steps to climate neutrality



# It still applies: We must achieve climate neutrality in 3 steps (1) 65% reduction by 2030, (2) -95% by 2045, and (3) CCS for the remaining emissions...

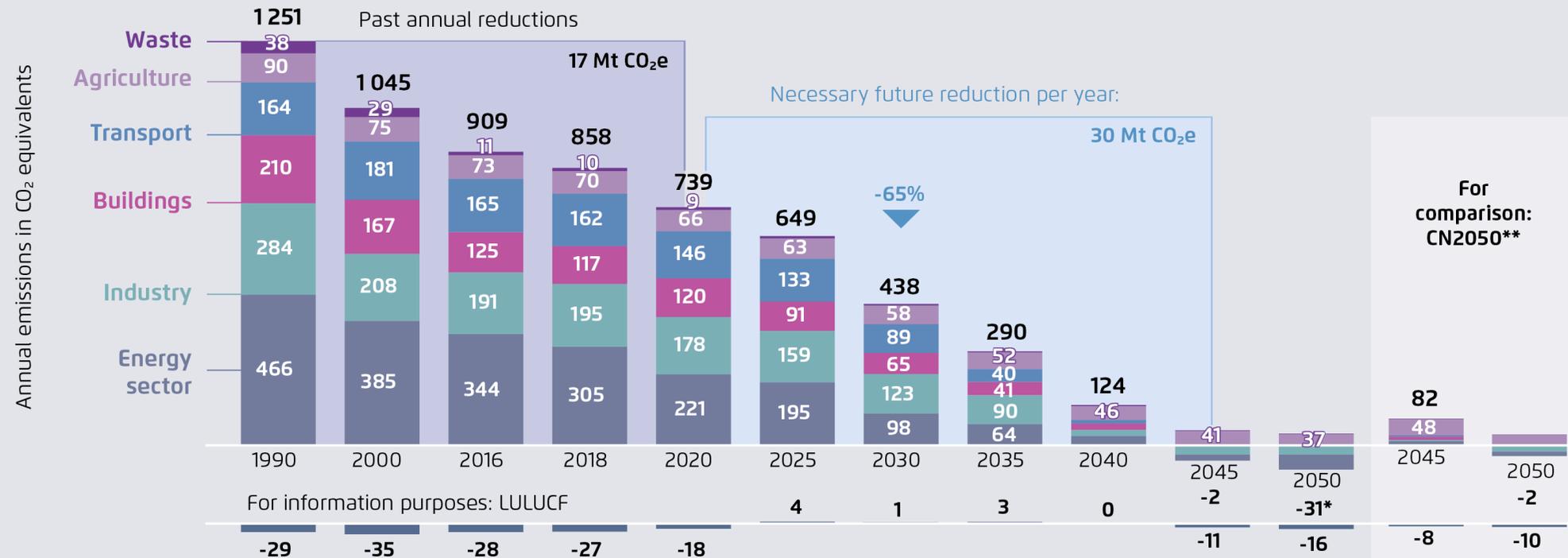
Step 1: Increase the 2030 target to -65% GHG (GHG emissions in mio. t CO<sub>2</sub>-eq)



Prognos, Öko-Institut, Wuppertal-Institut (2020): Towards a Climate-Neutral Germany. Executive Summary conducted for Agora Energiewende, Agora Verkehrswende and Stiftung Klimaneutralität.

# It still applies: We must achieve climate neutrality in 3 steps (1) 65% reduction by 2030, (2) -95% by 2045, and (3) CCS for the remaining emissions...

Overview development of GHG emissions by sector



Prognos, Öko-Institut, Wuppertal-Institut (2021)

# The five key strategies for climate neutrality

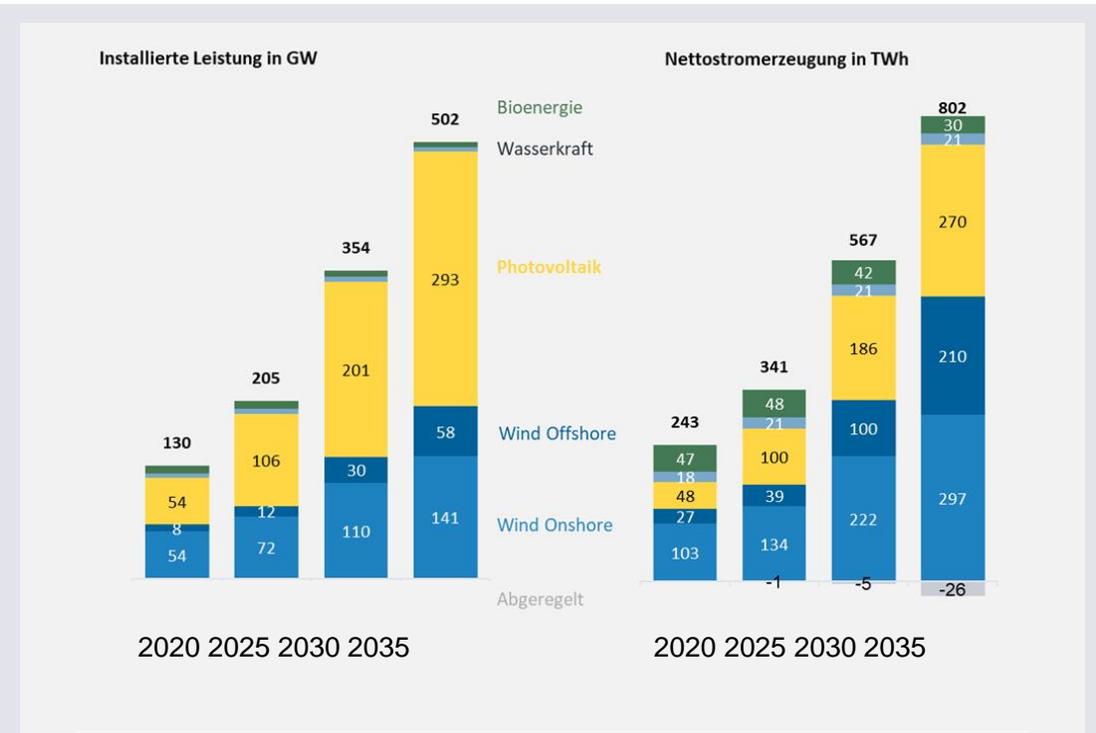


# The five strategies for climate neutrality:

## Strategy 1: Massive expansion of renewable energies

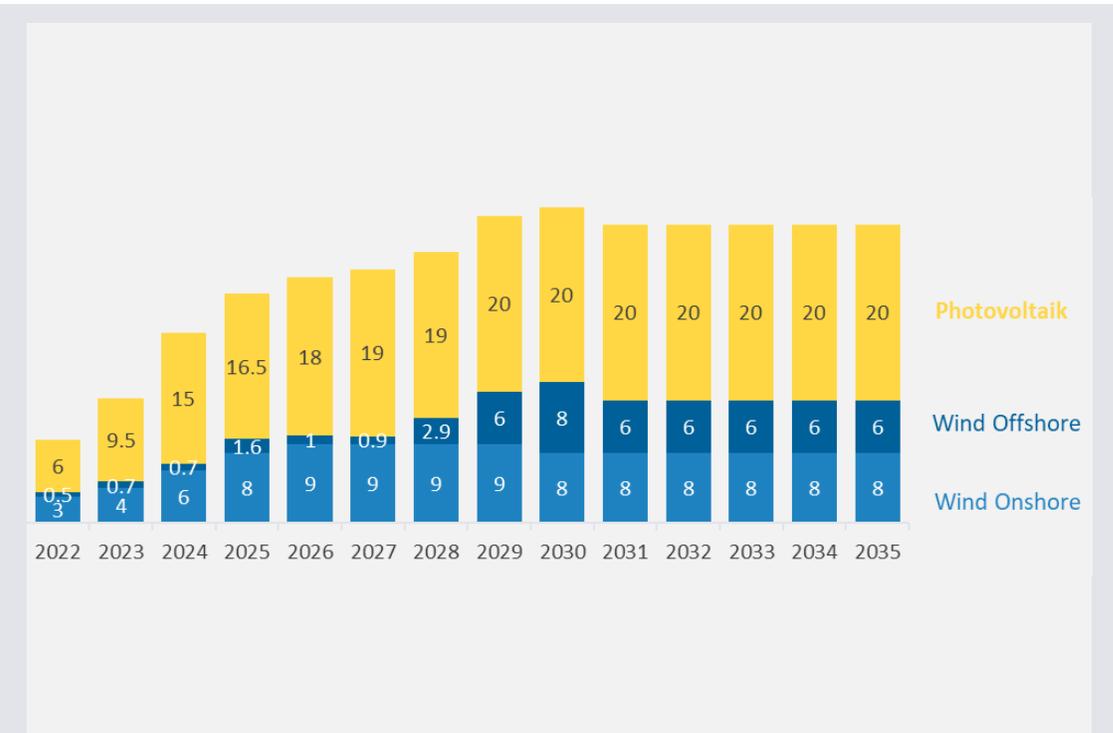
### The new goals of the traffic light government are *very ambitious*.

Installed capacity and electricity generation of renewable energies



Prognos (2022): Preliminary results

Annual gross expansion of renewable energies in GW

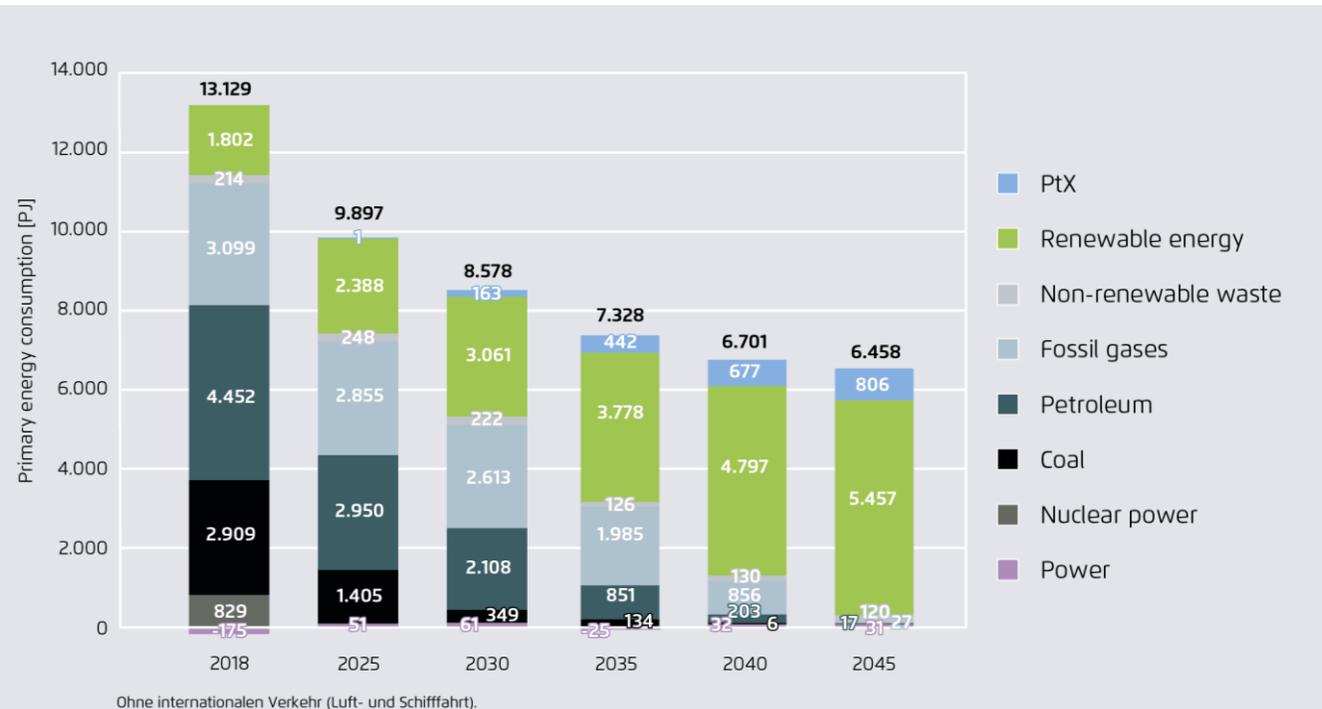


Prognos (2022): Preliminary results

# The five strategies for climate neutrality

## Strategy 2: Energy efficiency - primary energy consumption will be halved by 2045, especially in the heating sector.

Primary energy consumption



### What has changed in 2022?

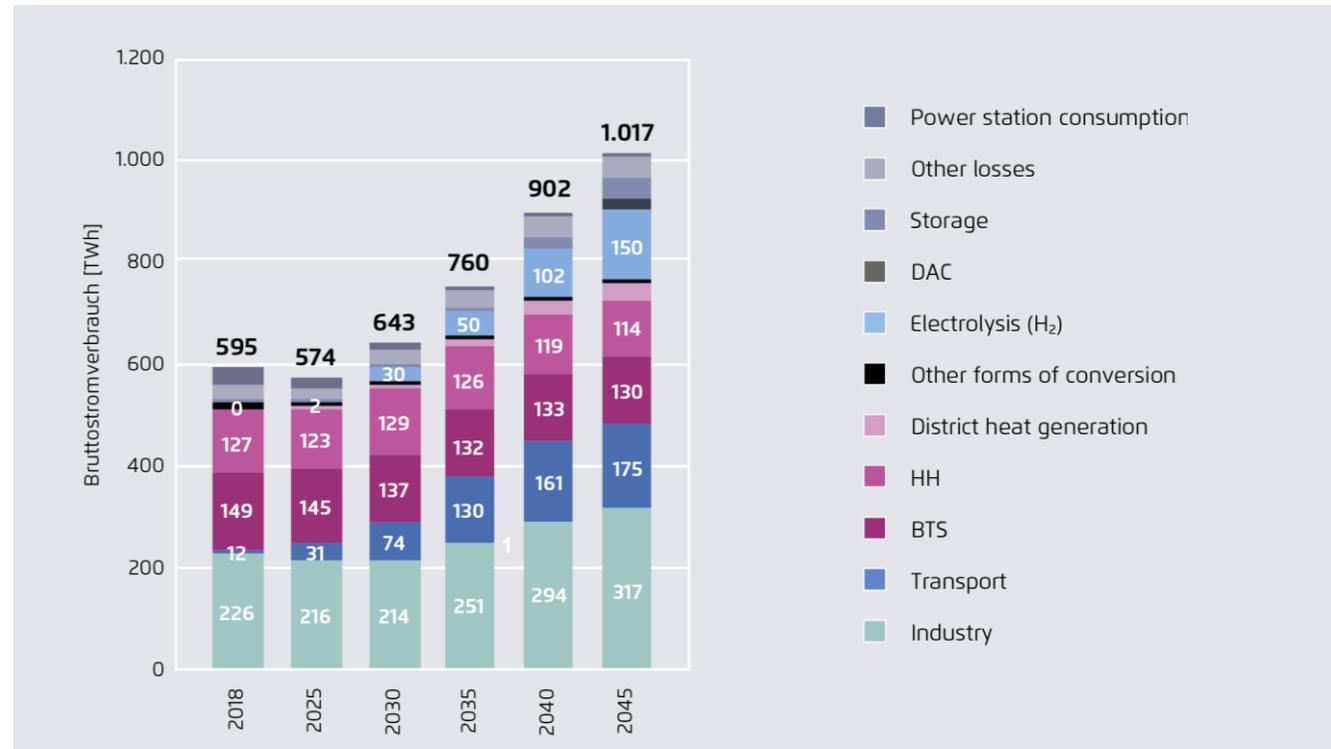
- The war in Ukraine and the resulting exacerbation of the fossil energy crisis **strengthen the importance of energy efficiency**
- Efficiency with high energy costs more quickly economically
- Rapid replacement of fossil imports
- Helps the transformation to climate neutrality
- **Efficiency must be in focus!**

Prognos, Öko-Institut, Wuppertal Institute (2021)

# The five strategies for climate neutrality

## Strategy 3: Electrification - transport, heat and industry replace oil and gas as far as possible with electricity by 2045

Gross electricity consumption



Prognos, Öko-Institut, Wuppertal Institute (2021)

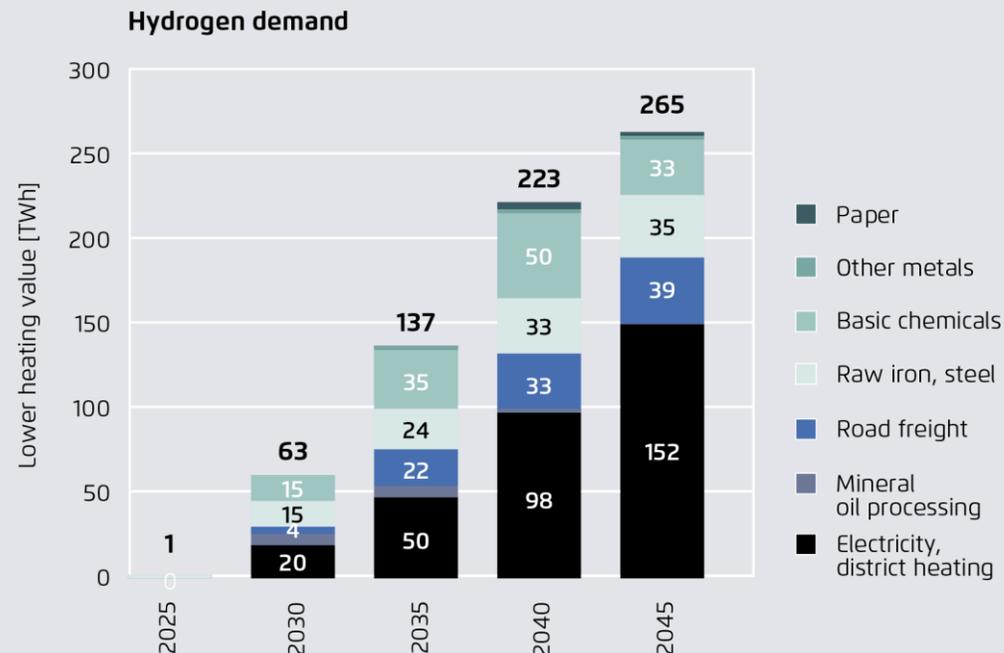
### What has changed in 2022?

- Germany as an industrial location has lost its 'cheap gas' pillar
- Accelerated electrification for process heat critical for location
- Displacing gas from building heat requires heat pumps
- **Ramp-up of heat pumps and E-mobility are key!**

# The five strategies for climate neutrality

## Strategy 4: Hydrogen - backup for renewables and use in district heating, industry

CO<sub>2</sub>-free hydrogen demand in Germany



Prognos, Öko-Institut, Wuppertal Institute (2021)

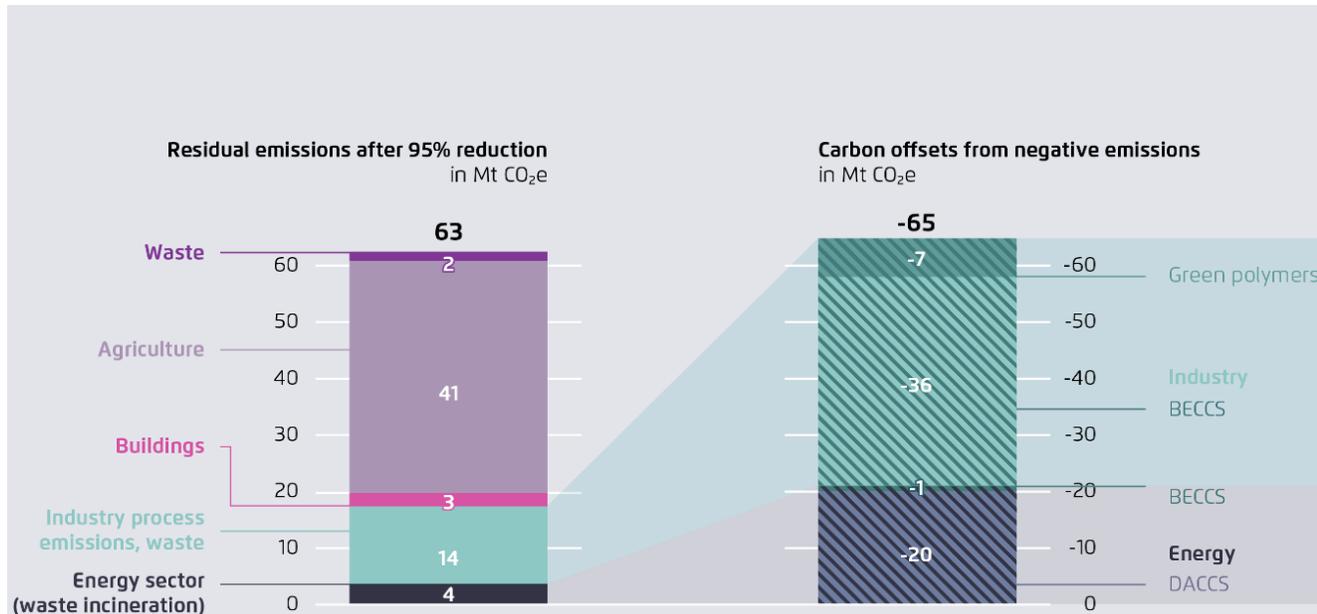
### What has changed in 2022?

- Gas bridge has broken away.
- Blue hydrogen not very economical at current prices.
- Power sector and district heating: controllable power plants must be converted directly to hydrogen and derivatives
- Steel industry: gas for direct reduction only available to a limited extent, green hydrogen needed sooner
- High-temperature process heat: using hydrogen and biomass more quickly
- **We need green hydrogen much faster, especially imports!**

# The five strategies for climate neutrality

## Strategy 5: CCS - from 2030 onwards, the ramp-up of a CCS infrastructure is slowly needed

Residual GHG emissions & their compensation in 2045



### Steel: BECCS

- Gasification of woodchips on-site for high-temperature heat as well as a carbon supplier (metallurgical C demand).

### Chemistry: BECCS

- Gasification of wood chips on-site for steam generation

### Process-related

- CO<sub>2</sub> from limestone deacidification
- Process-related partial oxidation of carbon-containing raw or auxiliary materials

### Energetic use of residual materials

- Use of alternative fuels (cement, lime)
- Incineration of "residual" chemicals

Prognos, Öko-Institut, Wuppertal Institute (2021)

# Strategic consequences and measures



## Conclusion

- Energy security is moving back to the centre of energy policy.
- Nuclear energy is not a strategic option for Germany due to cost and lead-time problems.
- Measures **Energy security and climate protection go hand in hand.**
- We need **massive efforts in all sectors** to reach the 2030 target of -65% greenhouse gas emissions.
  - Basic prerequisite: immediate, massive and sustainable acceleration in RE expansion
  - And: We can only achieve the goals with a paradigm shift in buildings, industry and transport.
- Three **central consequences** of the new situation in 2022
  - **Efficiency** comes more into focus due to rising prices and tight supply
  - **Heat pump ramp-up** for heating and process heat critical in buildings and industry
  - Imports and production of green **hydrogen** needed even faster

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# Vielen Dank für Ihre Aufmerksamkeit!

Haben Sie noch Fragen oder Kommentare? Kontaktieren  
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