

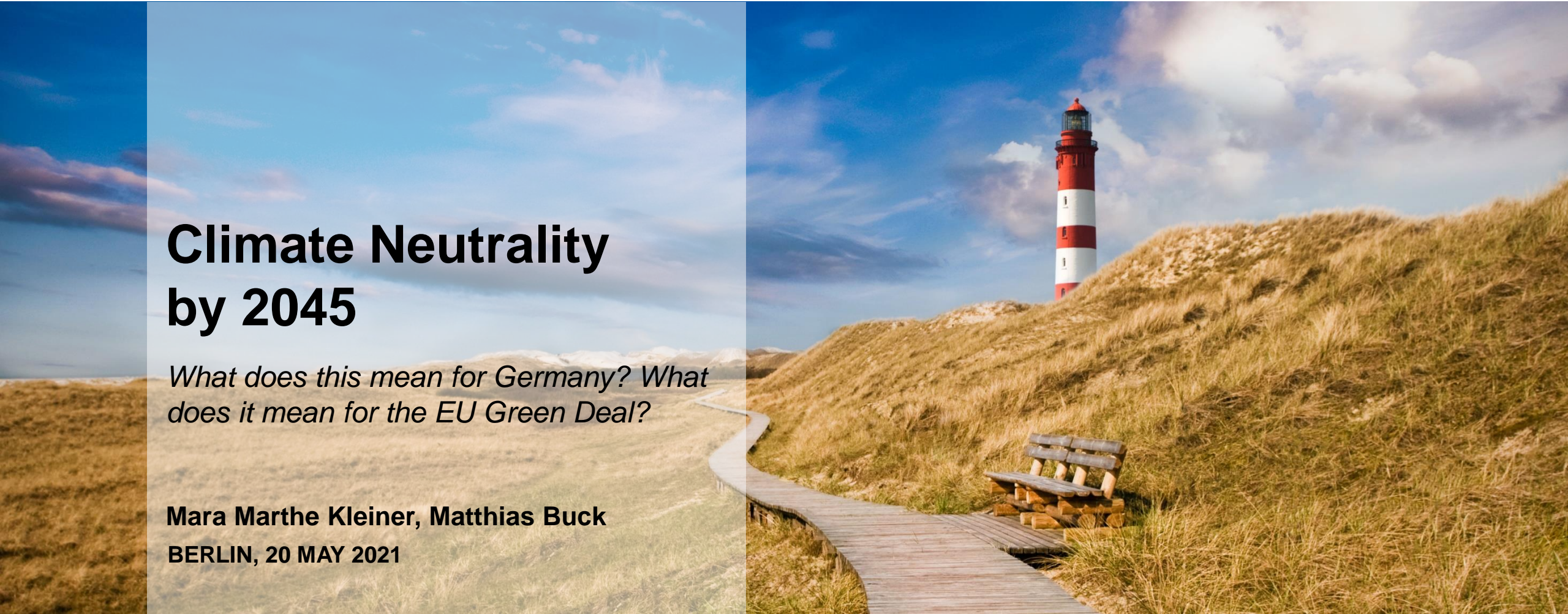
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Climate Neutrality by 2045

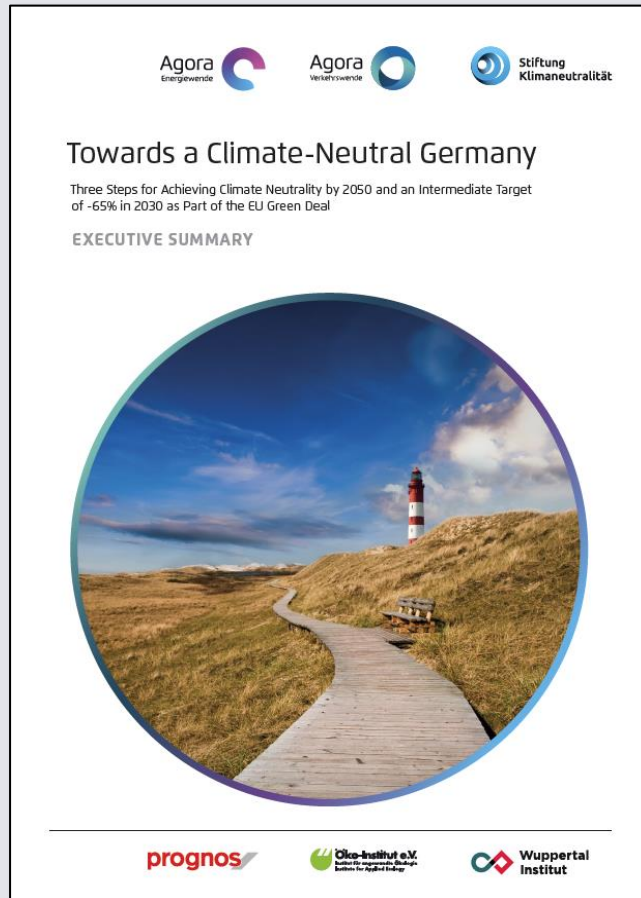
*What does this mean for Germany? What
does it mean for the EU Green Deal?*

Mara Marthe Kleiner, Matthias Buck
BERLIN, 20 MAY 2021



Towards a Climate-Neutral Germany 2050

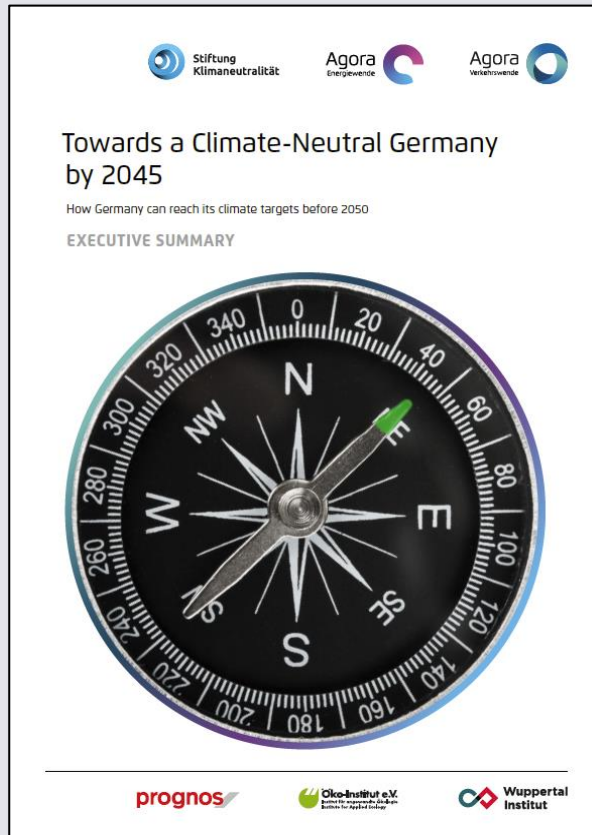
Study on behalf of Agora Energiewende, Agora Verkehrswende and Stiftung Klimaneutralität in Fall 2020



- *Towards a Climate-Neutral Germany*
Study on behalf of Agora Energiewende, Agora Verkehrswende and Stiftung Klimaneutralität
- Written by Prognos/Oeko-Institute/ Wuppertal-Institute
- Mission: Model newly set targets of the German government (Climate Neutrality 2050) and the EU (increased EU-2030-target of -55%) for all sectors
- Goal: Present a path towards climate neutrality taking into account costs and acceptancy

Towards a Climate-Neutral Germany 2045

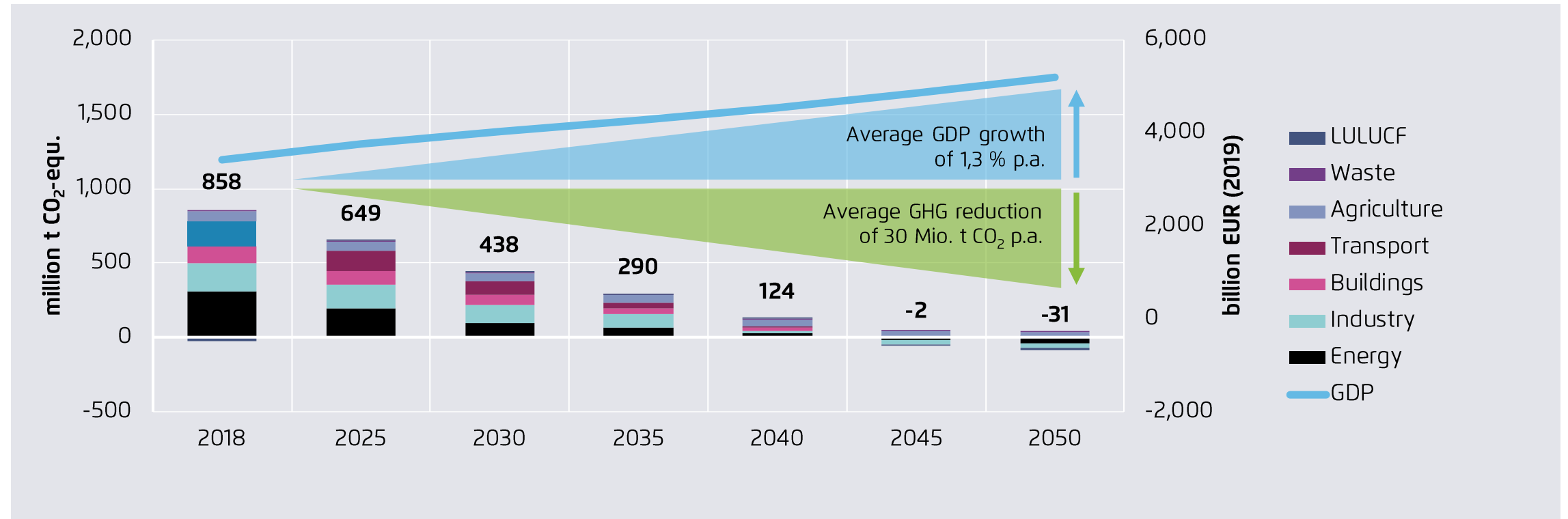
Study on behalf of Agora Energiewende, Agora Verkehrswende and Climate Neutrality Foundation in Spring 2021



- *Towards a Climate-Neutral Germany 2045* extends the logic of *Towards a Climate-Neutral Germany 2050*
- Mission: Model an ambitious Climate Neutrality 2045 target for all sectors
- Goal: Present a path towards climate neutrality 2045 taking into account costs and acceptancy
- Published on 26 April 2021
- German constitutional court published its decision on the Climate Law 2019 on 29 April 2021, stating it unconstitutional with regards to the freedom of future generations

Climate neutral Germany 2045 is a growth scenario: 1.3% economic growth p.a, industrial structure remains, 75 Mrd. Euros additional investments p.a.

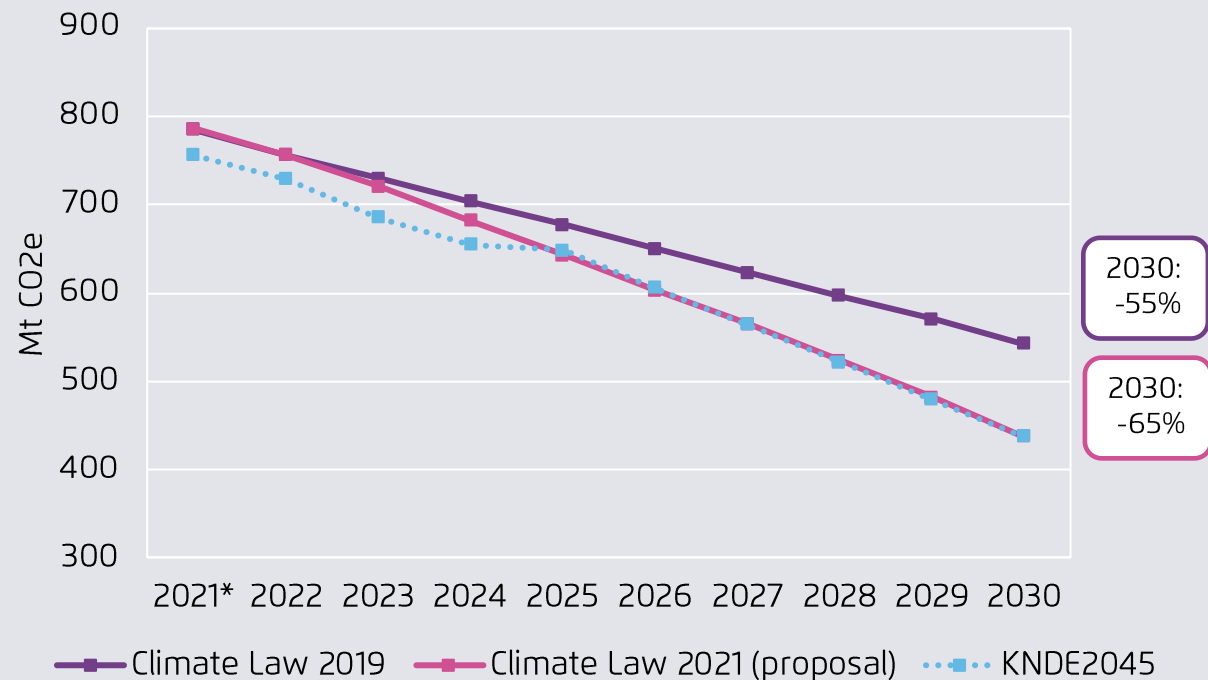
Key indicators of the Climate Neutrality 2045 scenario



Prognos, Öko-Institut, Wuppertal Institut (2021)

Proposal of a reformed Climate Law 2021 in Germany: new targets & climate neutrality in 2045

Differences between climate law 2019 & climate law 2021 (proposal) until 2030



Own illustration

Higher ambition until 2030: instead of -55% compared to 1990, Germany now aims to reduce emissions by 65% until 2030

Climate neutrality by 2045 at the latest

Inclusion of LULUCF emissions

Raised targets for energy and industry until 2030, increased ambition for transport and buildings only past 2025

Additional elements on governance

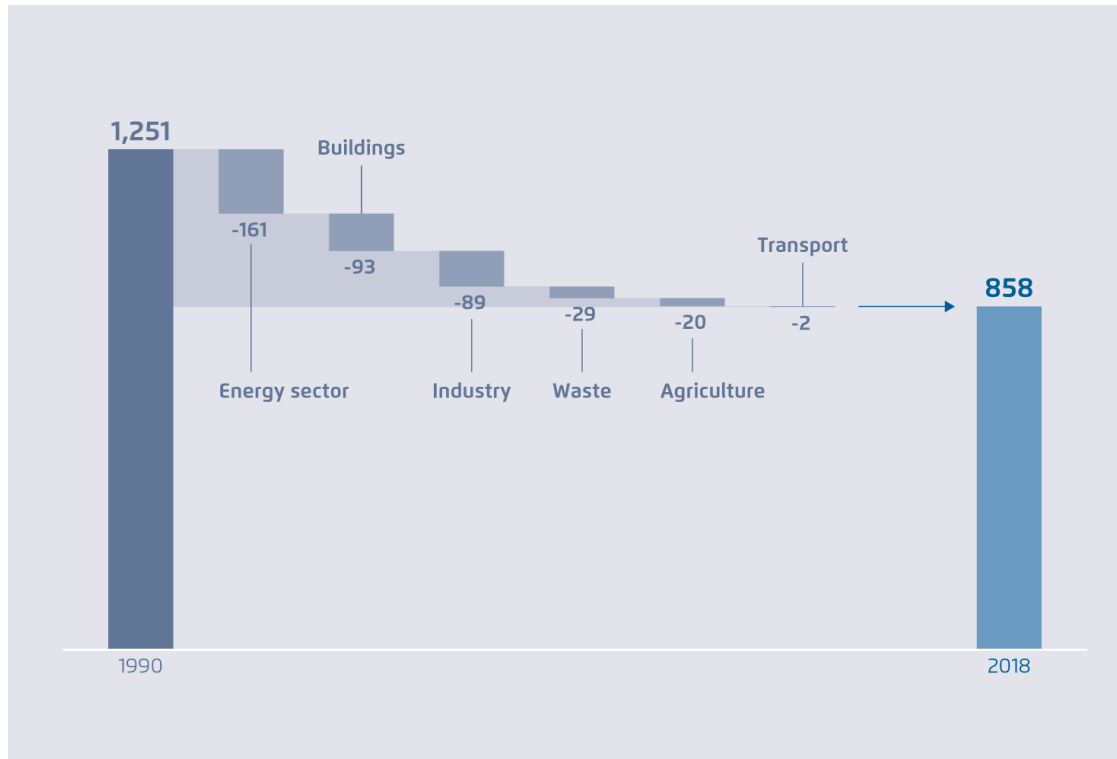


**Three steps towards
climate neutrality**

Where we stand today in Germany:

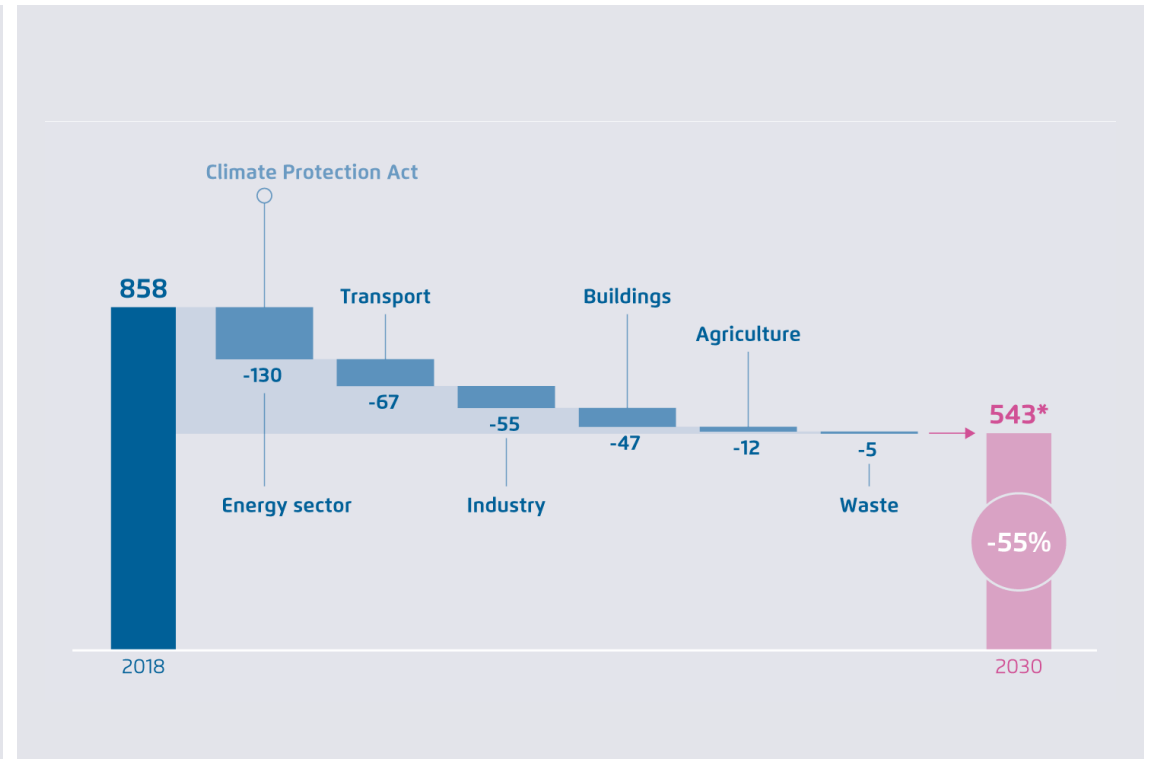
- 1990 until today: approx. -42% in 2020 (w/o COVID -38%)
- Current 2030 target: -55% below 1990 levels

Reduction of GHG emissions from 1990 – 2018 (mt CO₂ eq)



UBA (2020)

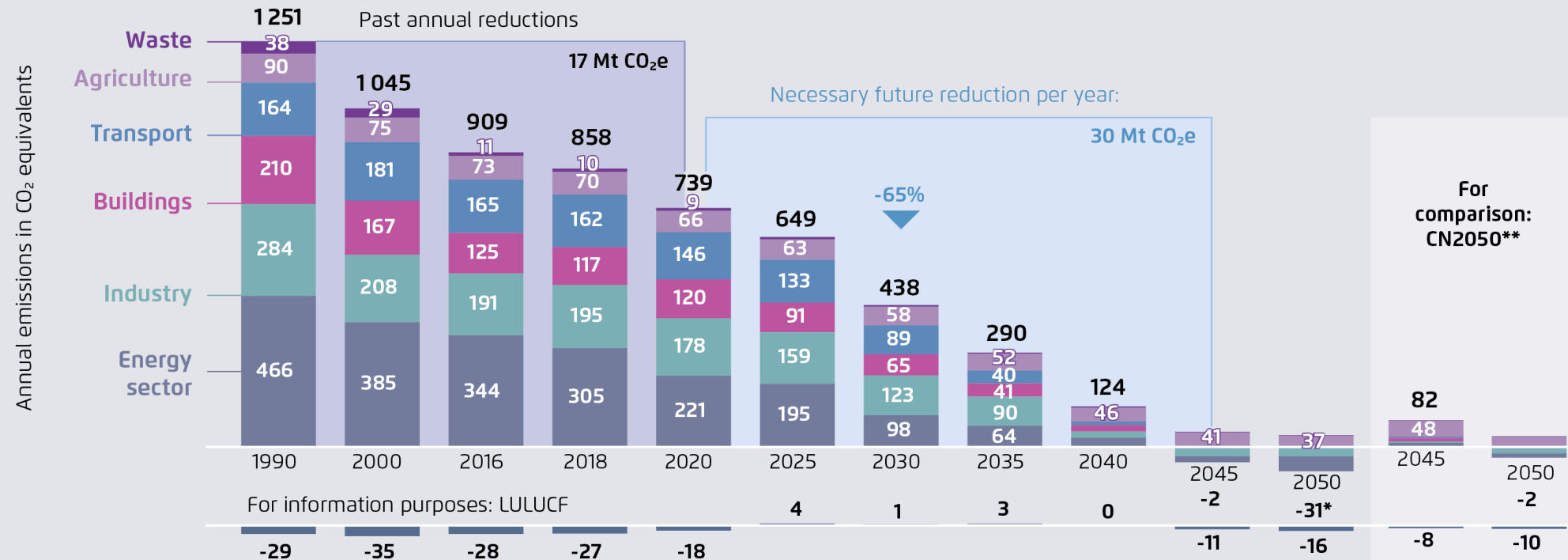
Existing targets based on Germany's Climate Protection Act



German Climate Protection Act (2020)

What we need to aim for given the latest EU and German climate policy announcements: Climate Neutral Germany 2045 and -65% until 2030

Overview development of GHG emissions by sector



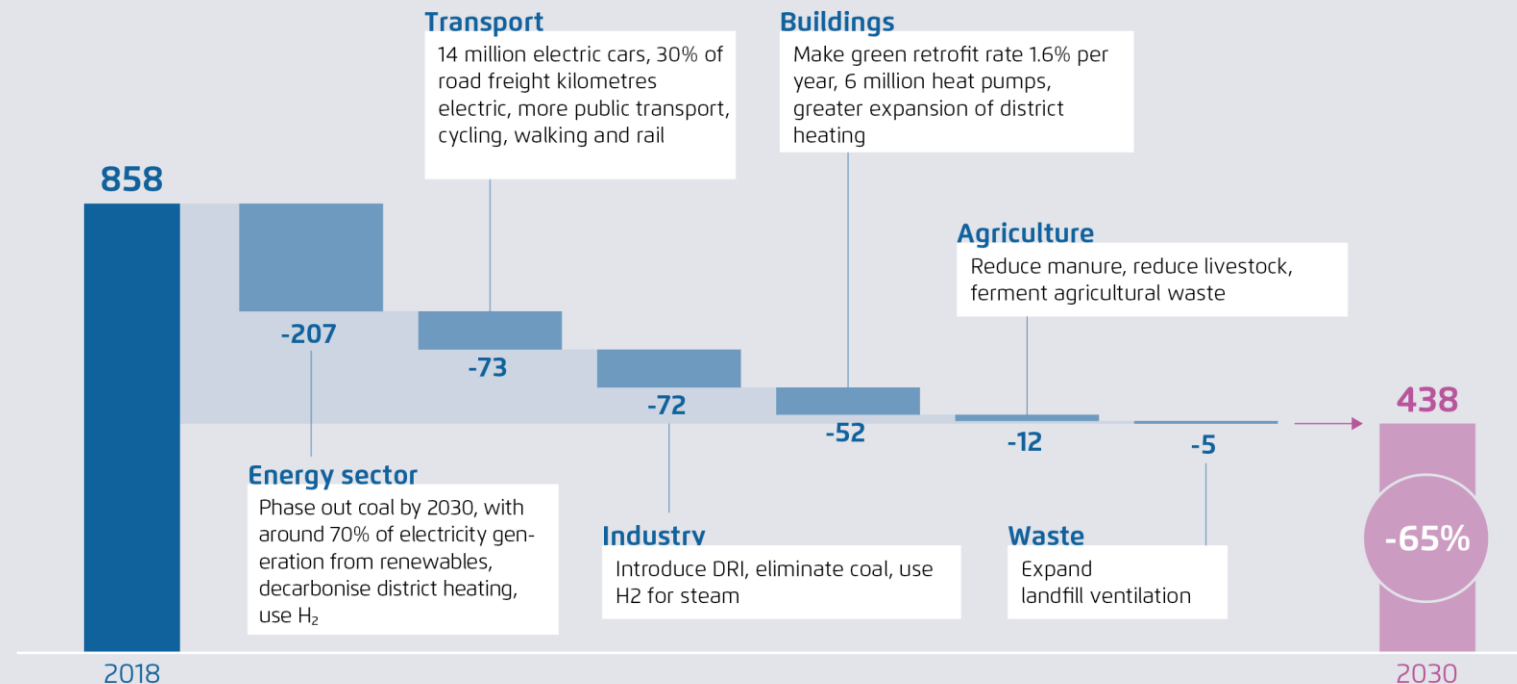
Prognos, Öko-Institut, Wuppertal-Institut (2021)

In 3 steps towards climate neutrality (net zero GHG emissions)

Step 1: Increase the 2030 target to -65% GHG

In 3 steps towards climate neutrality:

Step 1: Increase the 2030 target to -65% GHG (GHG emissions in mio. t CO₂-eq)

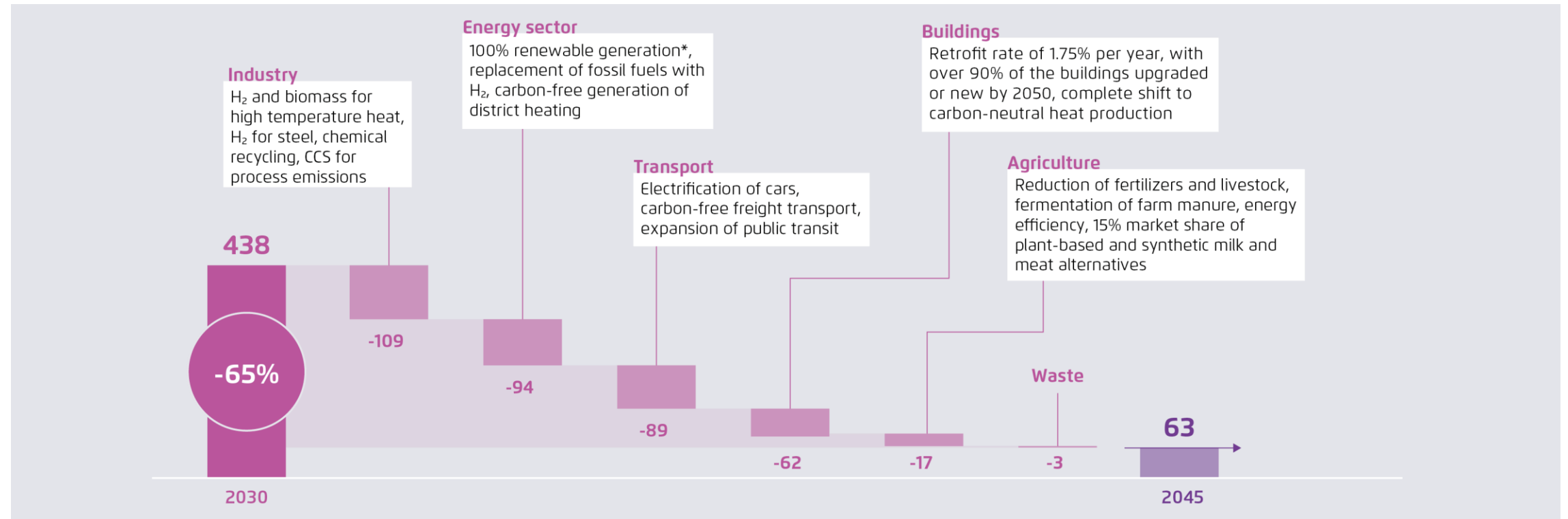


Prognos, Öko-Institut, Wuppertal-Institut (2020): Towards a Climate-Neutral Germany. Executive Summary conducted for Agora Energiewende, Agora Verkehrswende and Stiftung Klimaneutralität.

In 3 steps towards climate neutrality (net zero ghg emissions)

Step 2: Beyond 2030, only carbon-free technologies are installed in industry, electricity, heating and transport

Step 2: 95 percent reduction without negative emissions (GHG emissions in mio. t CO₂-eq)

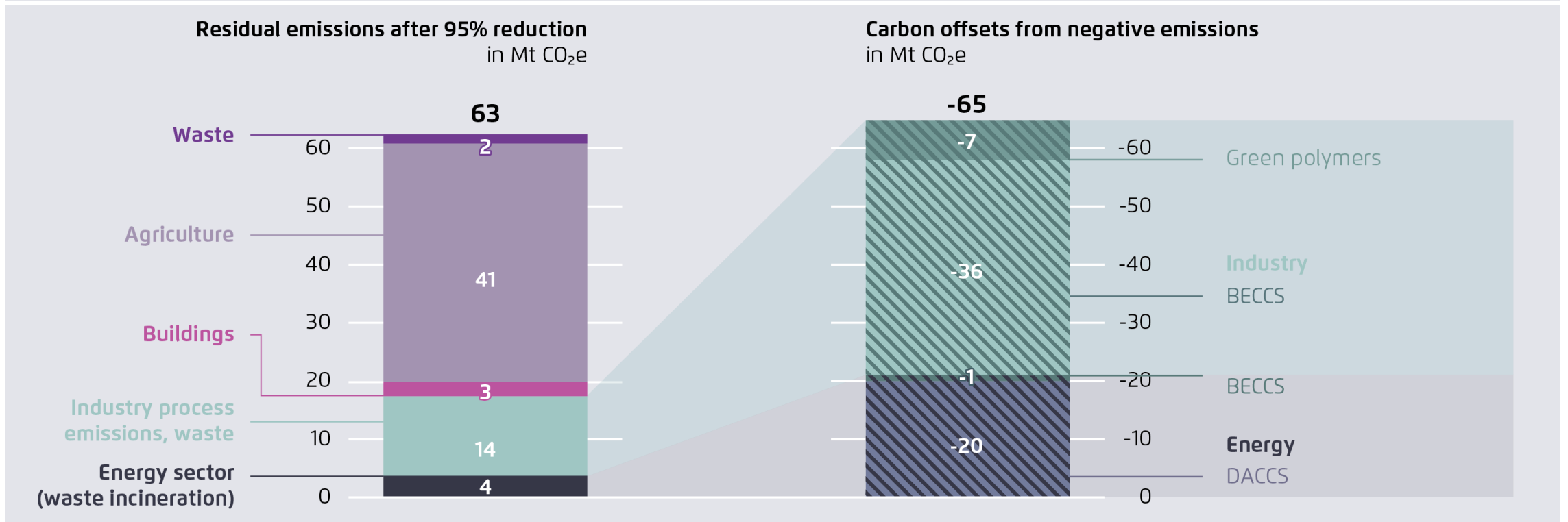


Prognos, Öko-Institut, Wuppertal-Institut (2021)

In 3 steps towards climate neutrality:

Step 3: The 5% non-avoidable ghg emissions from agriculture and cement are offset via (biomass-) CCS

Step 3 im detail – residual GHG emissions and their compensation in 2045



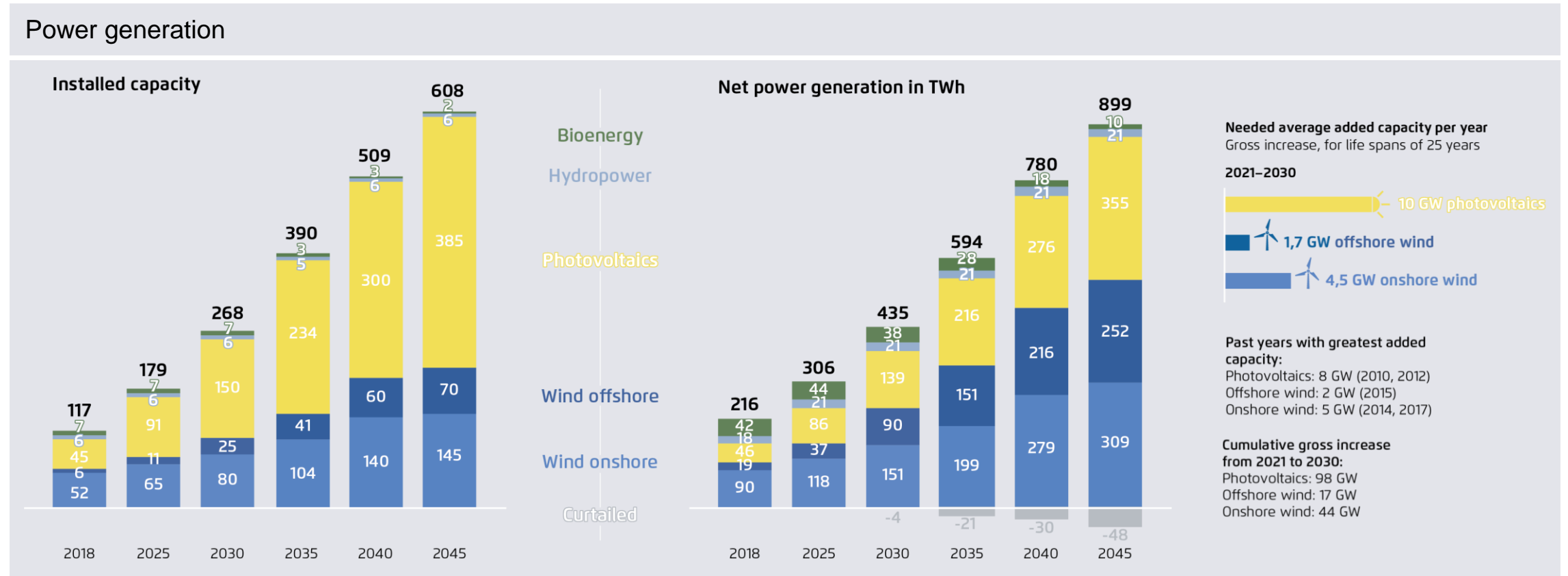
Prognos, Öko-Institut, Wuppertal-Institut (2021)



**Five central
strategies for climate
neutrality**

The five strategies for climate neutrality:

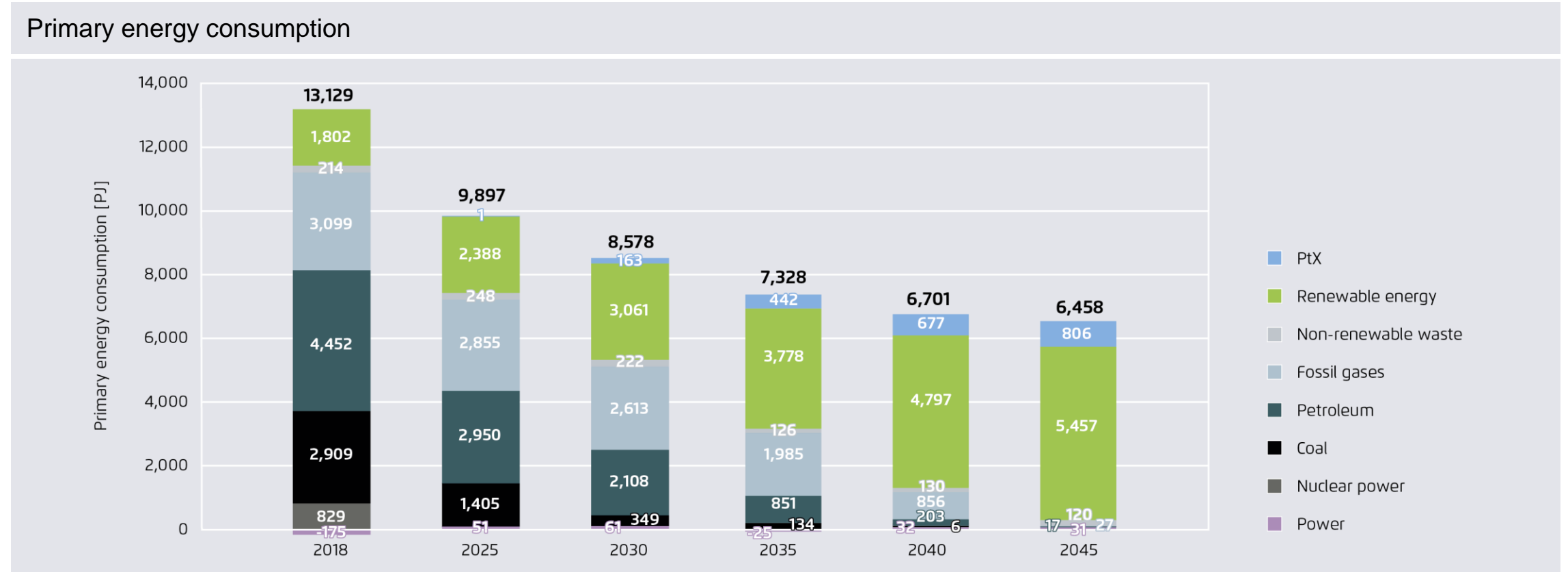
Strategy 1: Renewable energies – towards 70% share of electricity by 2030, to 100% by 2045 at the latest...



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

The five strategies for climate neutrality:

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

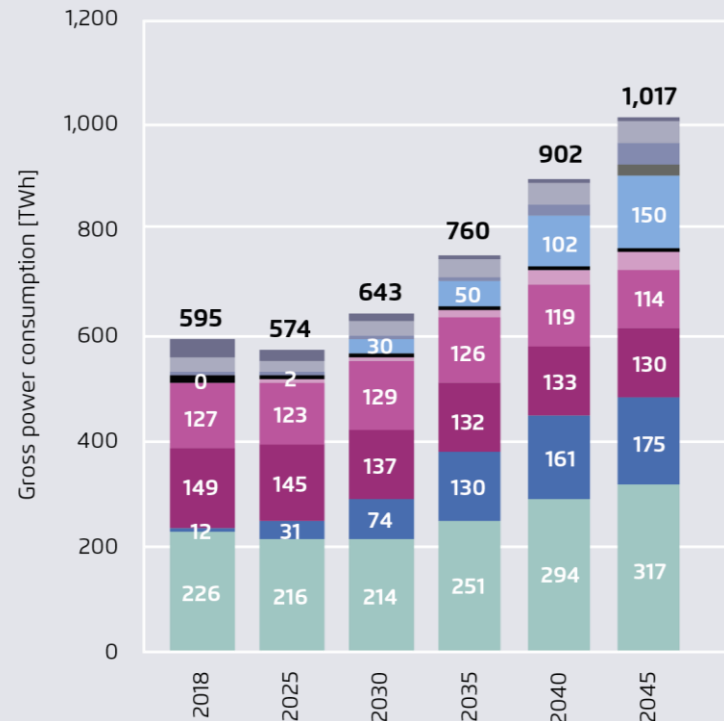


Prognos, Öko-Institut, Wuppertal-Institut (2021)

The five strategies for climate neutrality:

Strategy 3: Electrification – in transport, heat and industry electric cars, heat pumps, electric boilers replace oil and gas

Gross power consumption



H₂/CO₂

2030
Production 19 TWh H₂

2045
96 TWh H₂, 20 Mt CO₂ DAC



5,6 million heat pumps, efficient electric appliances, efficient lighting, decline in direct electric heating

14 million heat pumps, increased use for cooling and ventilation, efficient heat pumps, decline of direct electric heating, efficient appliances



Heat pumps, efficient lighting

Heat pumps, efficient lighting



25% of vehicle kilometers travelled in road freight with batteries and overhead lines, 14 million electric cars

80% of vehicle kilometers travelled in road freight with batteries and overhead lines, 36 million electric vehicles



Electrified process heat, electricity-based steam production, efficient cross-sectional technologies

Electrification of process heat, CO₂ capture, electricity-based steam production in electric boilers and high-temperature heat pumps

- Power station consumption
- Other losses
- Storage
- DAC
- Electrolysis (H₂)
- Other forms of conversion
- District heat generation
- HH
- BTS
- Transport
- Industry

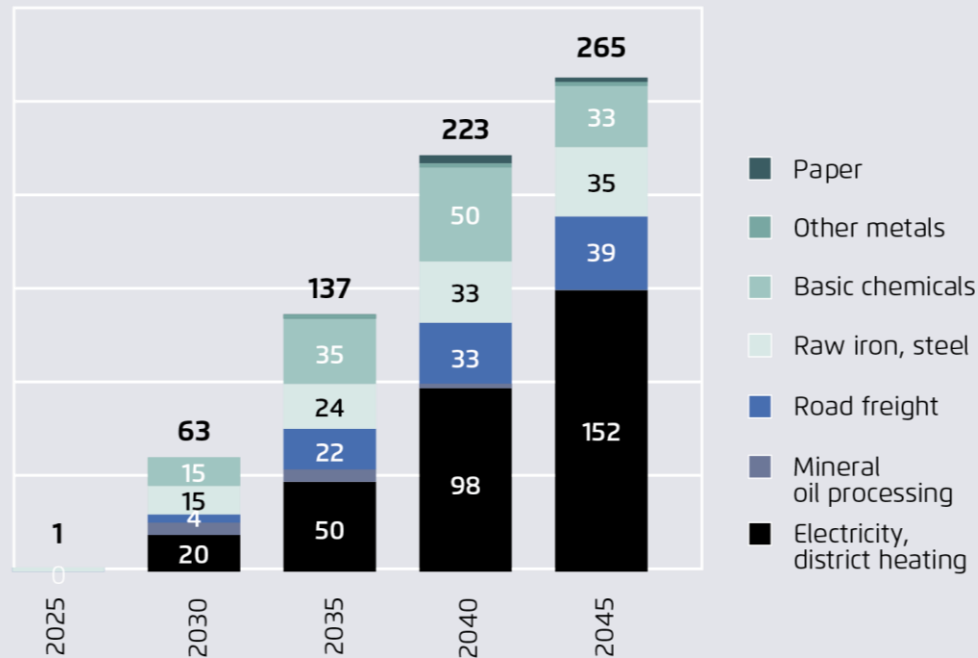
Prognos, Öko-Institut, Wuppertal-Institut (2021)

The five strategies for climate neutrality

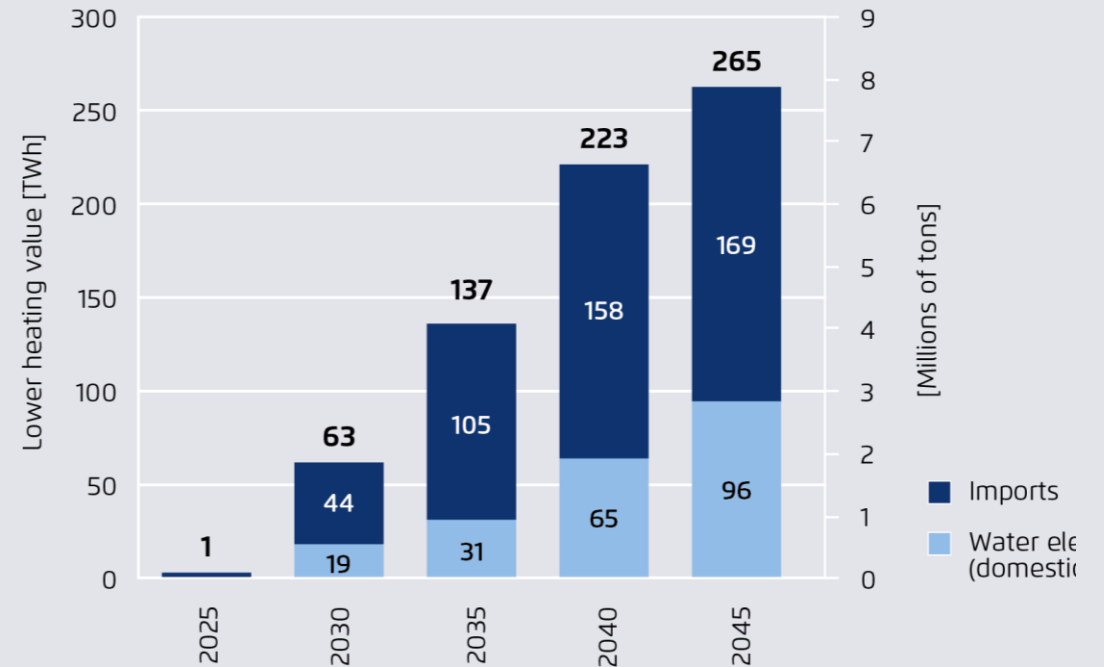
Strategy 4: Hydrogen – for safeguarding security of supply in the energy system and to create a climate neutral industry

CO₂ free hydrogen production and consumption in Germany

Hydrogen demand



Hydrogen generation

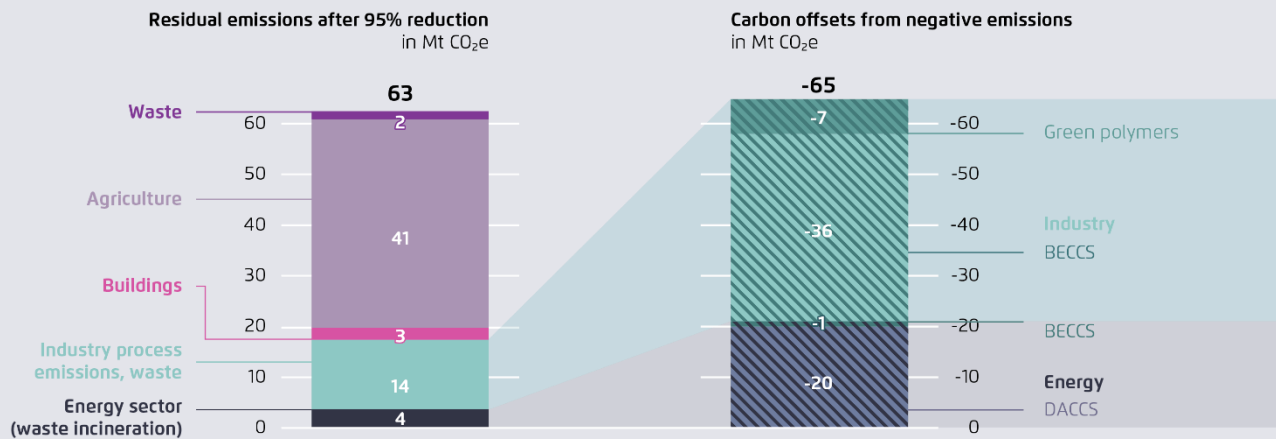


Prognos, Öko-Institut, Wuppertal-Institut (2021)

The five strategies for climate neutrality

Strategy 5: CCS – from 2030 onwards, the ramp-up of a CCS infrastructure (CO2 transport to Norway) will be required

CCS usage 2045



Prognos, Öko-Institut, Wuppertal Institut (2021)

Steel: BECCS

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

Chemicals: BECCS

- Gasification of wood chips on-site for steam supply

Process-related

- CO₂ from limestone deacidification
- Process-related partial oxidation of carbon-containing raw or auxiliary materials

Energetic utilization of residual materials

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



**A brief look into the
sectors**

Electricity: Accelerate coal phase-out by 2030 and increase renewable expansion rates to 70% RES share by 2030

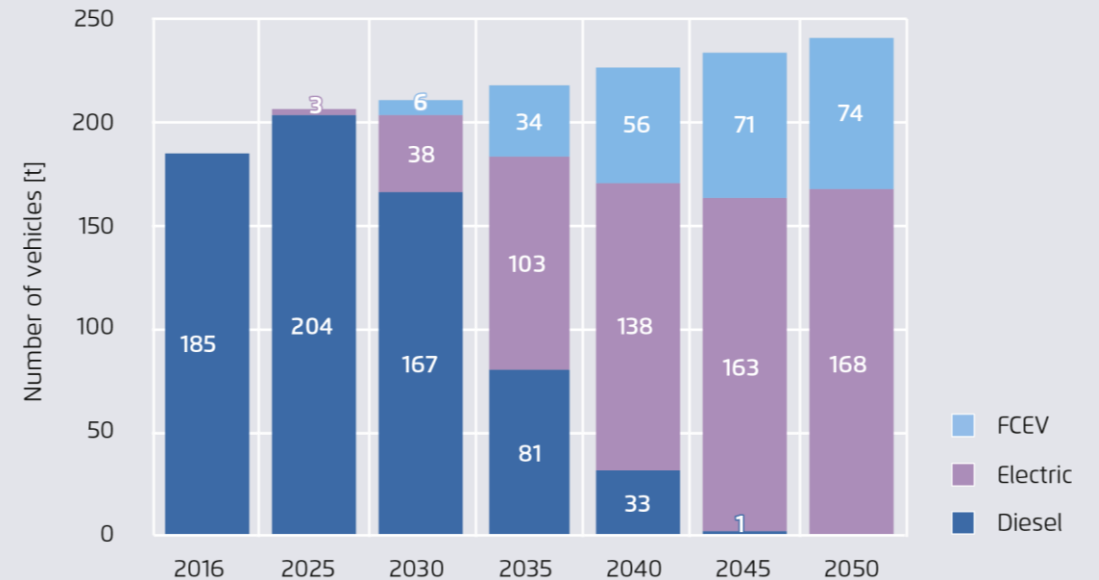
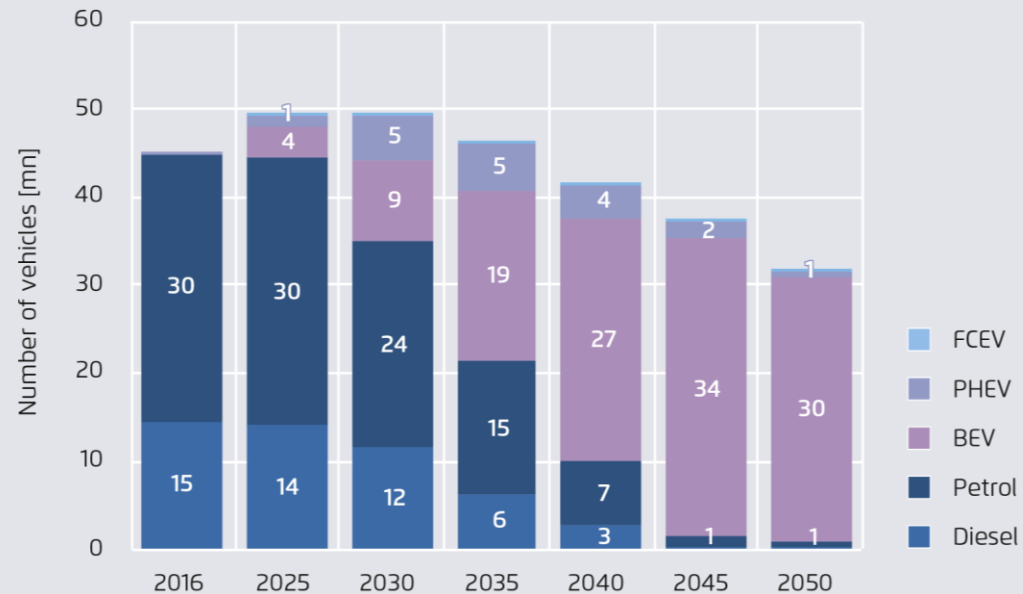
Net power generation and net imports



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

Transport: Cars and trucks become electric, due to new mobility concepts the number of cars after 2030 will be reduced

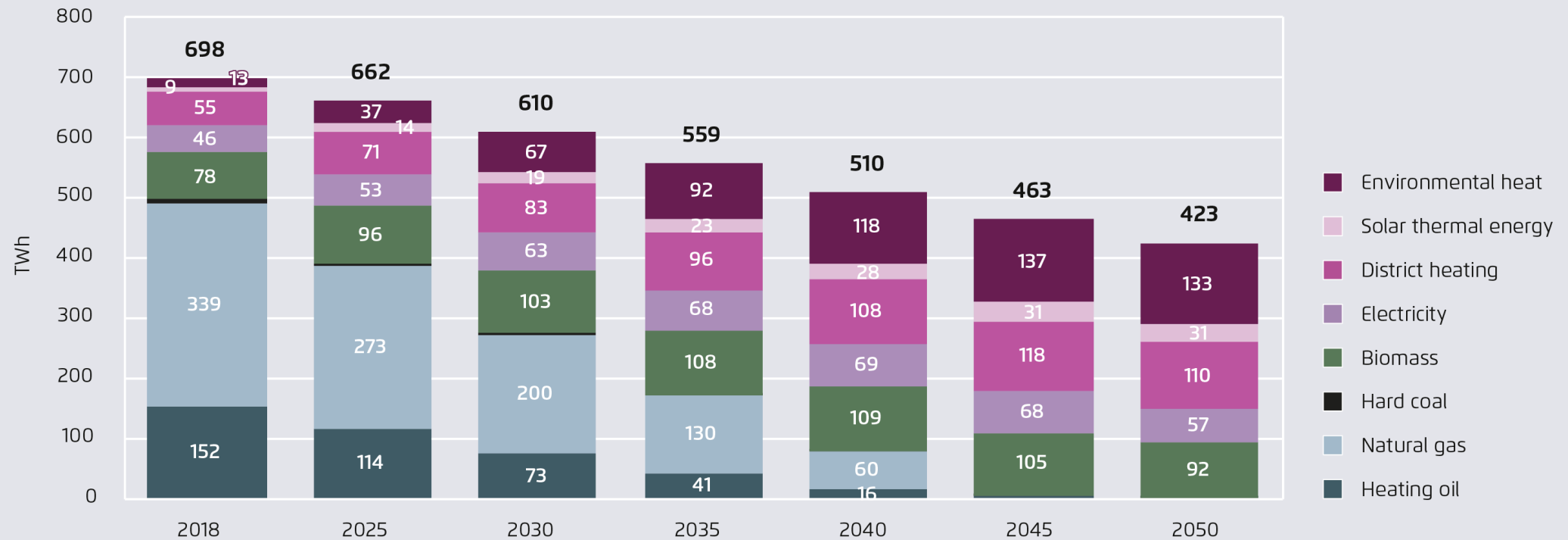
Amount of cars (left) and amount of trucks (right)



Prognos, Öko-Institut, Wuppertal Institut (2021)

Buildings: Heat pumps replace oil and gas heating in 1- and 2-family houses, green district heating supplies city centers

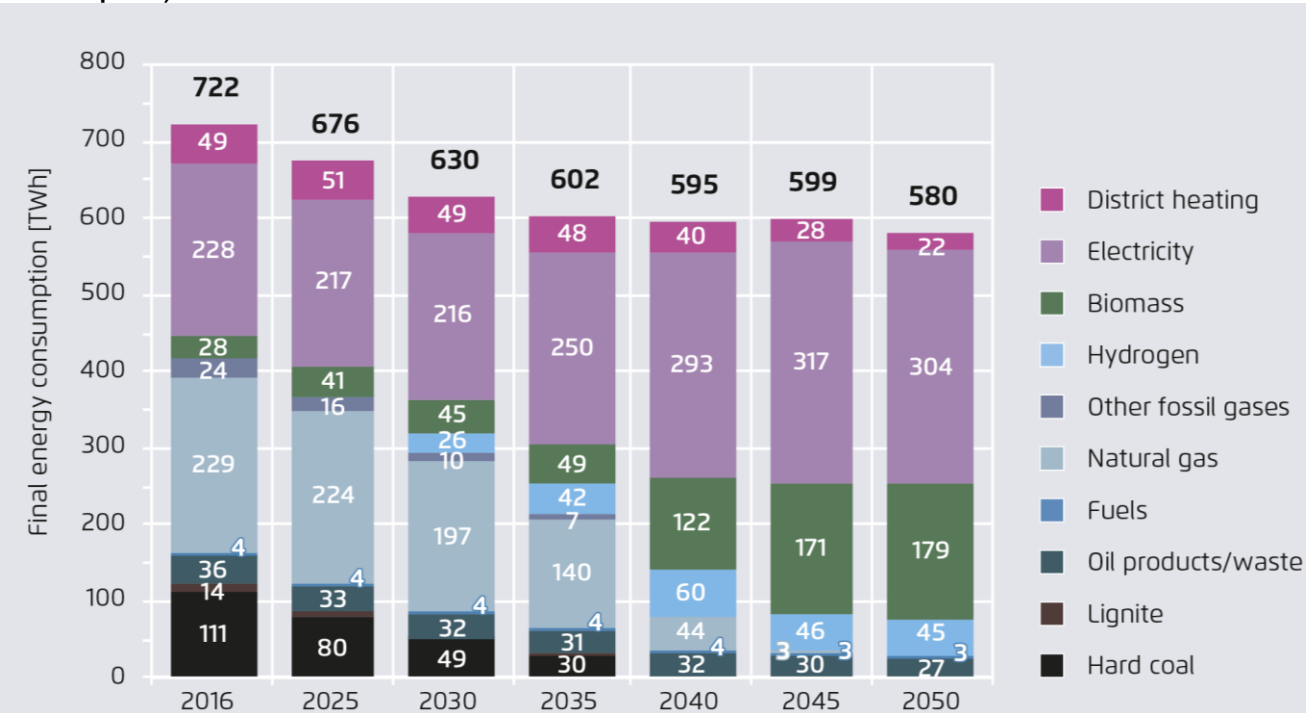
Buildings sector: final energy demand for heating by source



Prognos, Öko-Institut, Wuppertal Institut (2021)

Industry: Hydrogen, electrification and industrial biomass use replace coal and natural gas – industrial output remains constant

Final energy demand of manufacturing industry (and construction-related transport)



- **Coal:** phase-out (CHP by 2030, steel and cement by 2040)
- **Natural gas:** phase-out after 2030
- **Hydrogen:** reducing agent and fuel for steam generation
- **Biomass:** use for BECCS in large plants (steel / chemical)
- **Electricity:** efficient use in electrode boilers, high-temperature heat pumps, and small and medium-sized industrial furnaces
- **District heating:** long-term use only for temperatures < 100°C

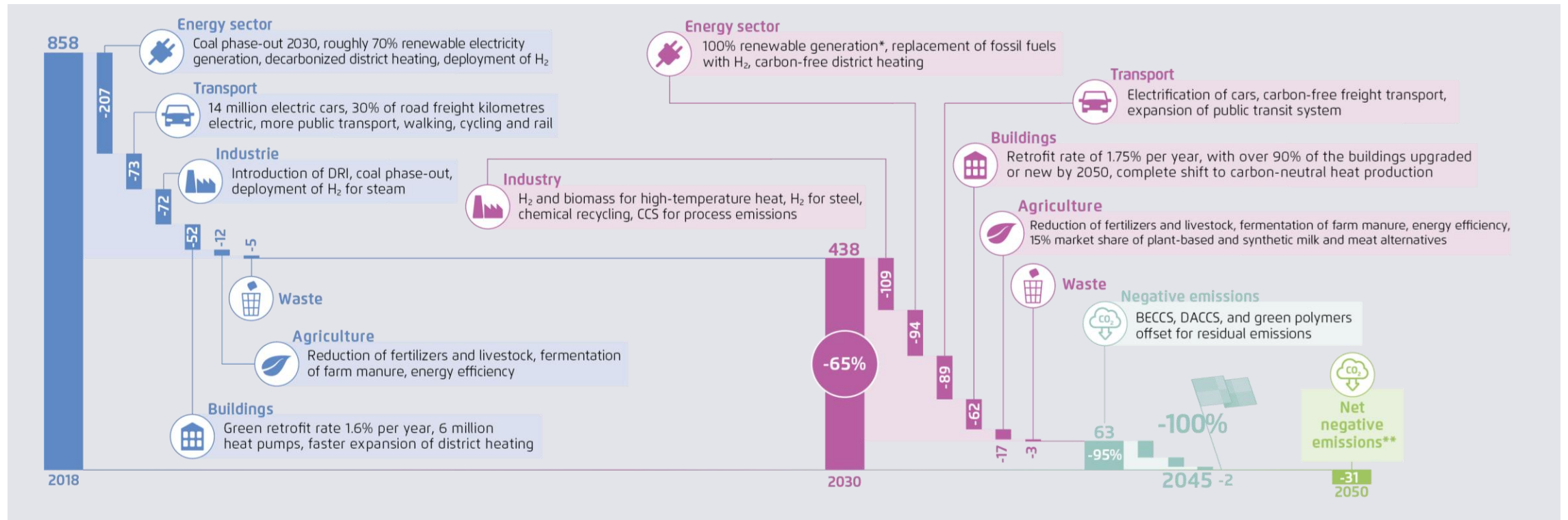
Prognos, Öko-Institut, Wuppertal Institut (2021)

Conclusion



Germany can become climate neutral in 3 steps: (1) reduction of ghg emissions by 65% until 2030, (2) -95% until 2045, and (3) CCS for remaining emissions

Measures in the climate neutrality 2050 scenario (KN2050) (GHG emissions in mio. t CO₂-eq.)



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

Elements of the Climate Law 2021 as proposed

- **Climate Neutrality by 2045**
- Increased ambition for 2030: reducing emissions by 65% compared to 1990 – which is in line with the new EU targets
- Inclusion of LULUCF emissions
- Immediate measures announced, though unclear whether they will be implemented in the current legislative period:
 - Increase CO₂ price in ESD sectors (BEHG)
 - Increase RES capacity additions
 - Next reform in 2022, following finalisation of EU legislation
 - Additional measures for industry, hydrogen, transport, agriculture, building renovations

Climate Neutral Germany 2045 and -65% greenhouse gas emissions by 2030 requires a policy mix to be adopted soon

A „Climate Action Now“ Act for the first 100 days of the new legislative period

Energy

- 4. Boost renewables
- 5. Enact fossil fuel phase-out
- 6. Action plan for green district heating grids

Buildings

- 7. Policy mix with CO₂-price, ambitious standards, incentives for renovation of buildings and all-inclusive rents
- 8. Industrialise renovation and heat-pump production

Transport

- 9. Bonus-Malus tax reform for new cars
- 10. Reform of truck toll
- 11. Mobility act and federal mobility plan

Industry

- 12. Investments into Efficiency Improvements
- 13. Green hydrogen
- 14. Carbon Contracts for Difference

Agriculture

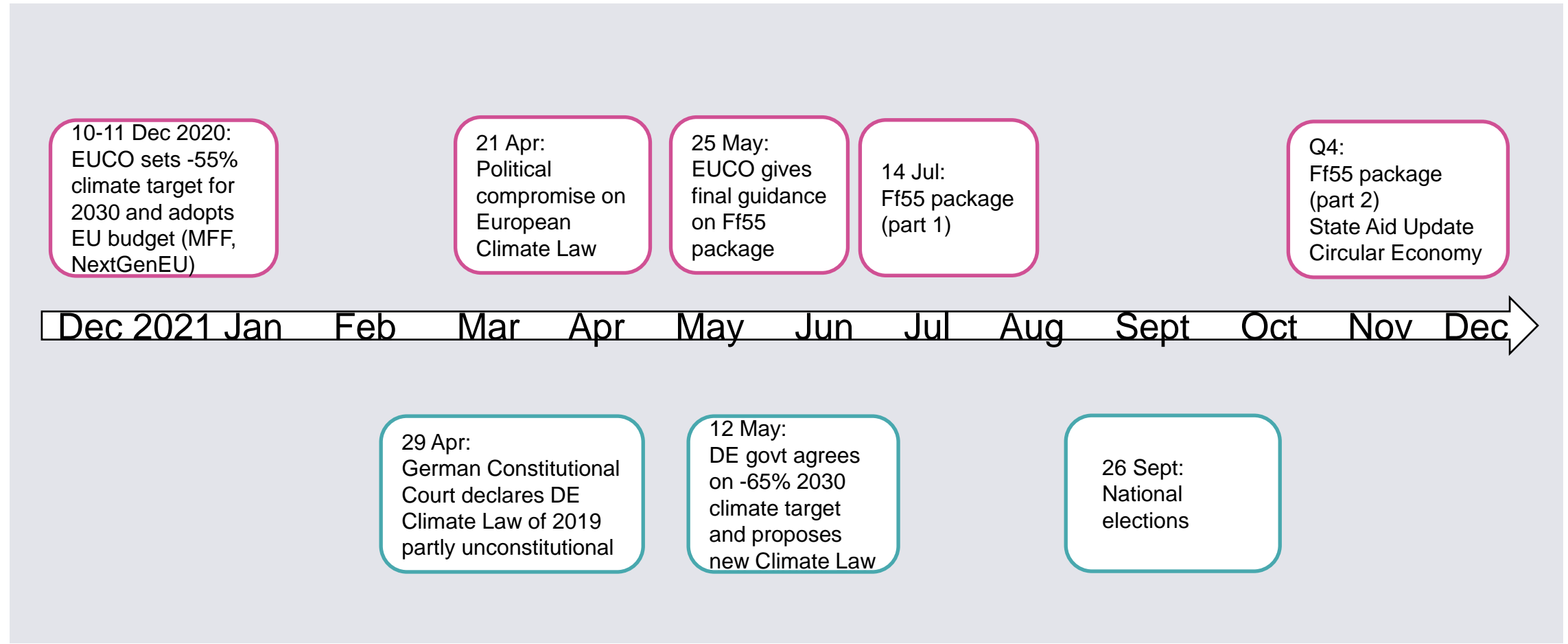
- 15. Reduce livestock
- 16. Reduce fertiliser usage
- 17. Wet moors

- 1. Climate Change Act as framework law
- 2. Increase carbon price
- 3. Make climate-related risks transparent to financial markets



Implications for the EU Green Deal

Timeline of EU and DE Climate Policy in 2021



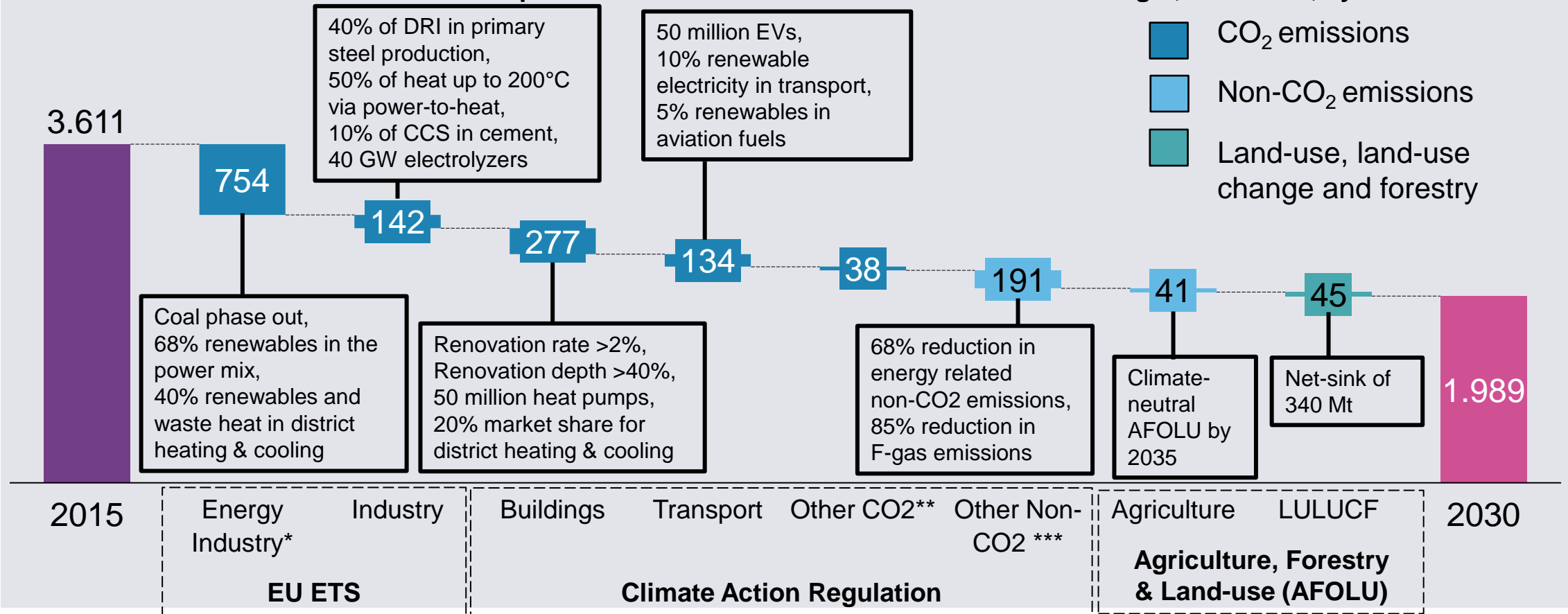
Political compromise on the EU Climate Law means, a 2030 target of at least 55% net domestic greenhouse gas reductions compared to 1990 levels will become binding in some weeks

Key elements of the provisional agreement on the EU Climate Law

- Sets a legally binding 2030 climate target of **at least 55% net domestic ghg-reductions** compared to 1990 levels as well as a binding objective to reach climate neutrality at the latest by 2050.
- Defines the 2030 target as a **domestic** target with regards to net-GHG reductions (emissions after deduction of removals) .
- Limits the contribution of removals towards the 2030 target to **225 million tons CO₂eq**, which corresponds to a 52.8% reduction relative to 1990 levels (excluding sinks).
- The Commission will propose to revise the LULUCF Regulation to increase the EU carbon sink to levels **above 300 million tons CO₂eq** by 2030, which would de facto correspond to a **net 57% target** for 2030.

55% net domestic greenhouse gas reductions by 2030 implies major changes in all sectors

Reduction in GHG emissions in MtCO₂-eq in a net-55% scenario with an ambitious sinks target, 2015-2030, by sector



Source: Agora Energiewende (2021) based on the MIX and LULUCF+ Scenarios of the European Commission Impact Assessment for 2030 Climate Target Plan.

*** 340 Mt is based on the COM LULUCF+ Scenario. The net-sink in the MIX scenario is 295Mt.

The 14 July package includes at least nine proposals to reform EU climate and energy laws, as well as proposals for own resources and aviation and shipping fuels.



Legislation anticipated on 14 July

- 1) The EU ETS Directive
- 2) Revision of the LULUCF Regulation
- 3) Revision of the Climate Action Regulation
- 4) The Renewable Energy Directive (tbc)
- 5) The Energy Efficiency Directive (tbc)
- 6) the Alternative Fuels Infrastructure Directive
- 7) CO2 emission standards for cars and vans
- 8) Carbon Border Adjustment Mechanism
- 9) the Energy Taxation Directive

Other anticipated proposals

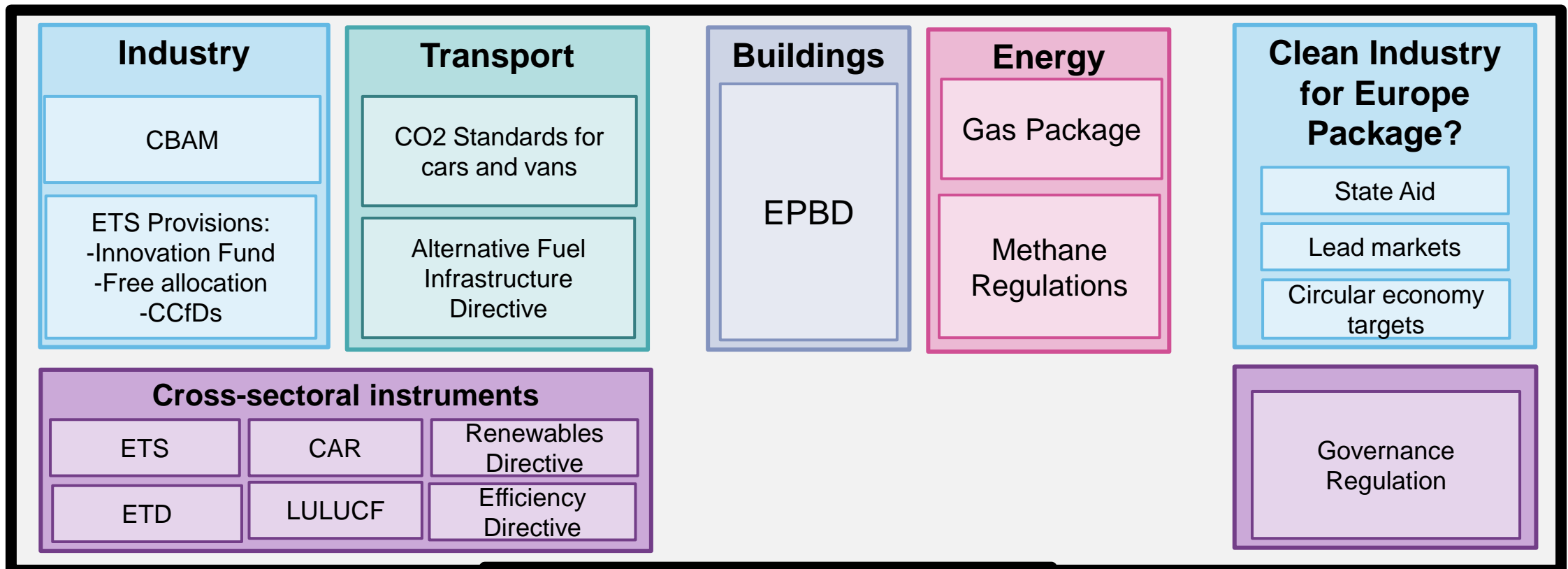
- ReFuelEU Aviation / FuelEU Maritime
- ETS and CBAM as own resources / Digital levy

Important elements are still missing in the second part of the “Fit for 55” package (Q4/2021)!

Part 1: 14 July 2021

Part 2: Q4 2021

Still Missing!



„Fit for 55“ Package

What does the German climate target increase imply for Europe and for dynamics on the Fit for 55 package?

- Germany's new 2030 ghg-reduction target of 65% is in line with the expected German contribution to the EU's increased 2030 target of 55% net domestic reductions.
 - Germany's commitment to achieve climate neutrality by 2045 puts pressure on other Member States that have not yet set themselves national climate neutrality targets to do so.
 - The new German government taking office after the September elections will have to adopt further measures in all sectors to accelerate climate action.
 - Often, corresponding adjustments to EU climate and energy laws will facilitate accelerated climate action in DE (e.g., climate neutral industry); in some cases EU-level measures are the most suitable lever (e.g. CO2 standards for cars, vans, lorries; strengthening carbon pricing; creating lead markets).
- => Negotiations on the Fit for 55 package will pick up momentum in 2022 after a new German government has taken office. Most likely, Germany will proactively work towards ambitious outcomes in the Fit for 55 negotiations right from the start.

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Thank you for your attention!

Questions or Comments? Feel free to contact me:

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