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prognos

Wir geben Orientierung.

Climate Paths for Germany

How the transport sector could
contribute to national climate targets

Stefan Schönberger, BCG

Ludwigsburg, February 21, 2018



Climate Paths for Germany

Unique fact base

All sectors
Analysis level: individual
GHG reduction measures
Optimized to minimize
GHG abatement costs
Investments, costs,
GDP effects

Broad validation of results

68 industry associations and
companies
~ 200 industry experts
~ 40 workshops
Scientific board

Agenda for today



Overview on climate paths for Germany:
all sectors



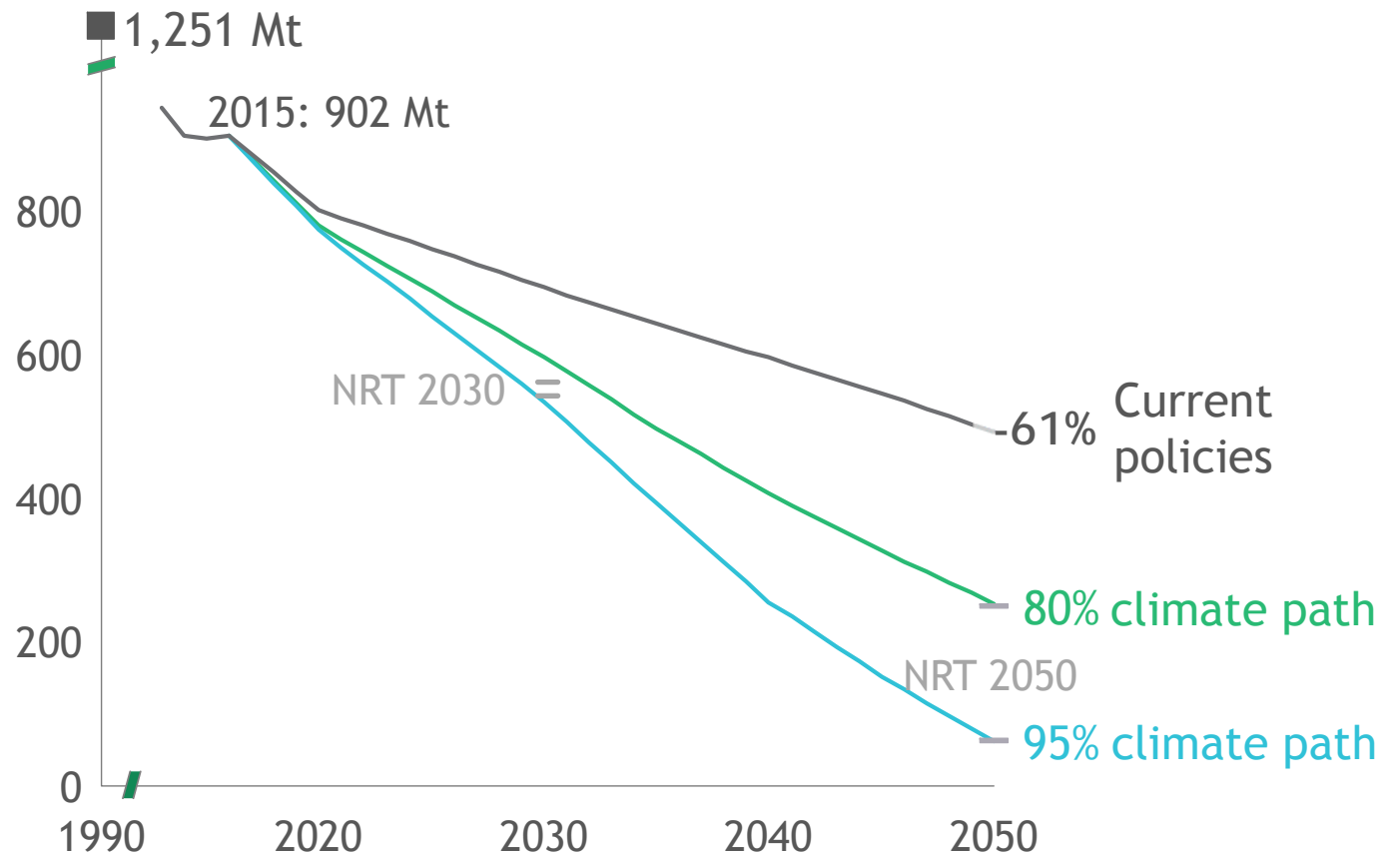
Deep-dive transport sector



Investments, costs and macroeconomic
implications

61% GHG
reduction under
"current policies"
scenario, but
major gap to
national reduction
targets

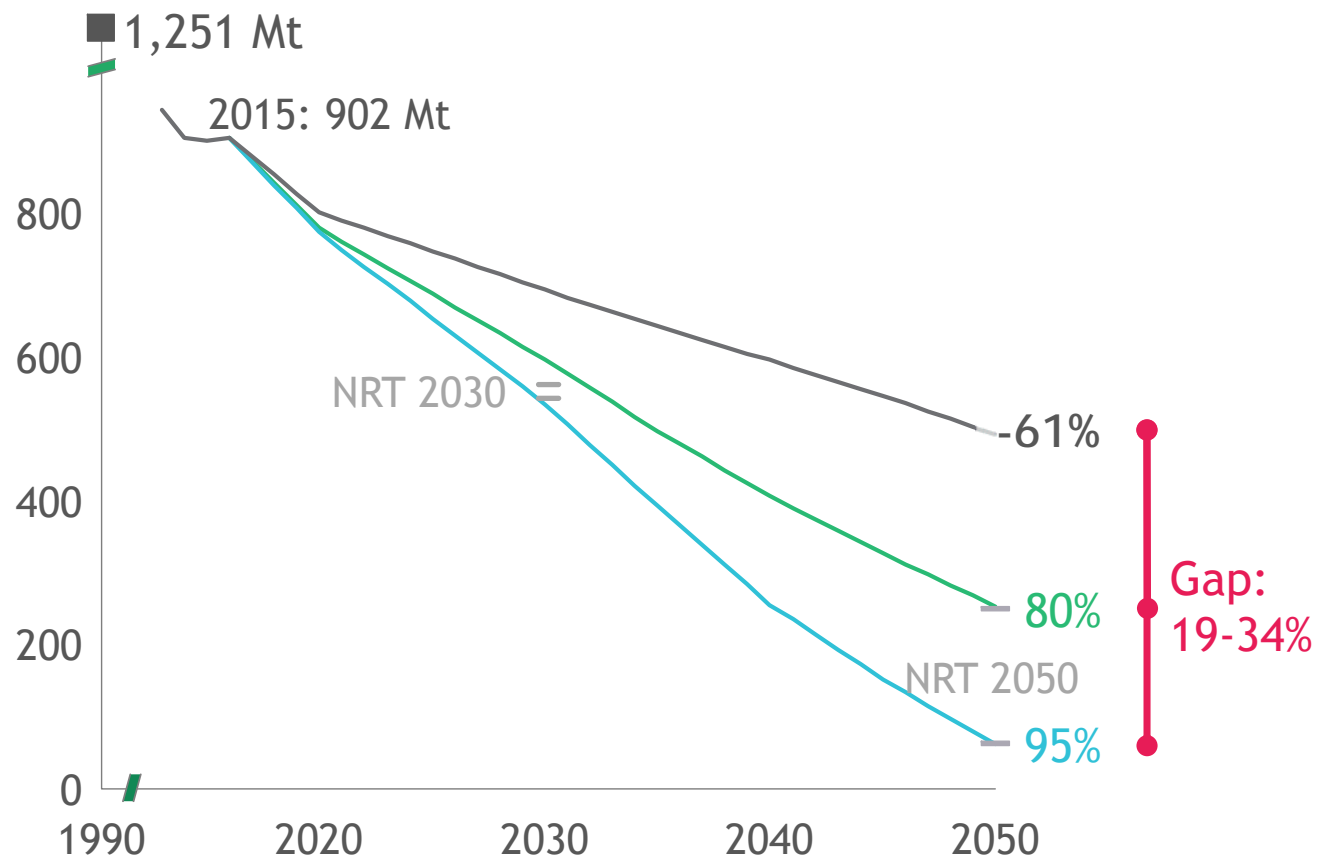
Greenhouse gas (GHG) emissions in Germany
Mt CO₂e



NRT = national reduction targets of the German government (corridor)

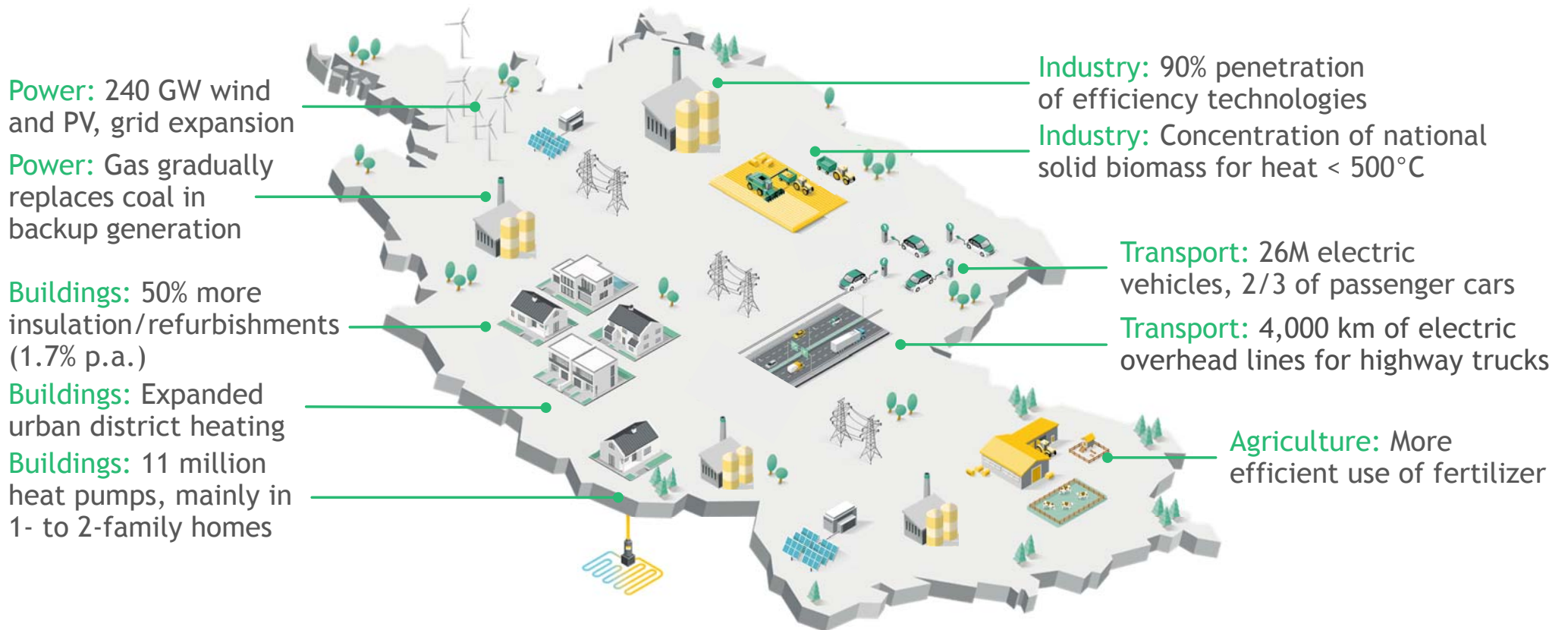
... but a major gap
to national
reduction target
remains

Greenhouse gas (GHG) emissions in Germany Mt CO₂e



NRT = national reduction targets of the German government (corridor)

80% path achievable with existing technologies



PV = Photovoltaik
Alle Zahlen beziehen sich auf 2050

95% path pushes boundaries of technology and acceptance

340 TWh Imports
of renewable fuels
(PtL, PtG)

Power: 240 GW wind
and PV, grid expansion

Power: 60% gradually
to **100%** gas grid
backbone and storage

Buildings: 30% more
insulation/refurbishments
(1.7% p.a.)

Buildings: Expanded
Heating free of
fossil fuels through \$4M.

Buildings: 11M heat pumps,
renewable district heating,
mainly in 1- to 2-family homes

Industry: 90% renewable heat and
of efficient technologies PtG ...

Industry: Coproduced with national
solid biomass from heating incineration

Transport: 26M electric vehicles,
4.5M bio-passenger cars

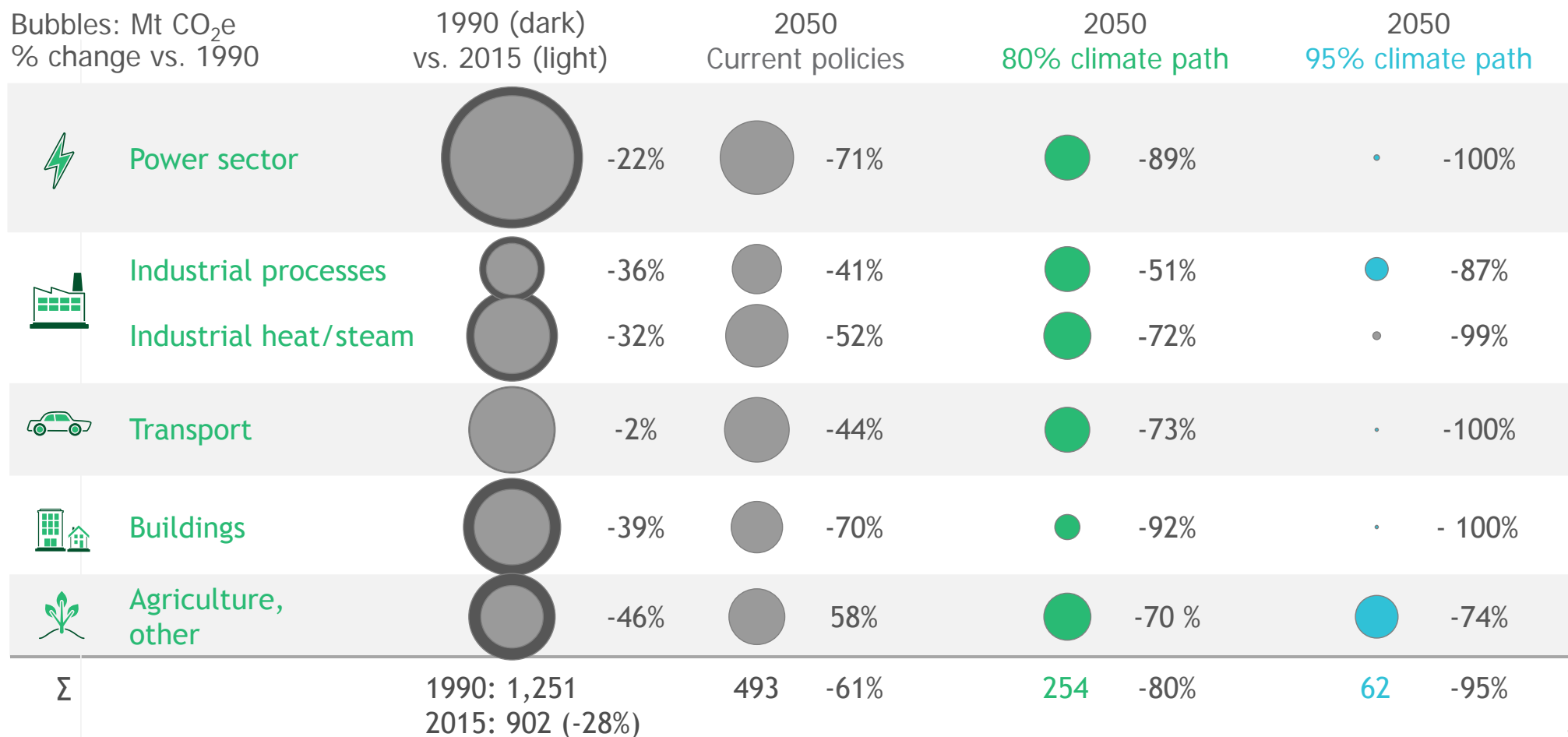
Transport: 8,000 km of electric
overhead lines for highway trucks

Agriculture: Methane pill"
for efficient use of fertilizer

**Carbon capture and
storage** for steel, cement,
ammonia, refineries, and
waste combustion

PtL = Power-to-Liquid, PtG = Power-to-Gas
Alle Zahlen beziehen sich auf 2050

80% path with uneven sector contributions, 95% means zero emissions for many

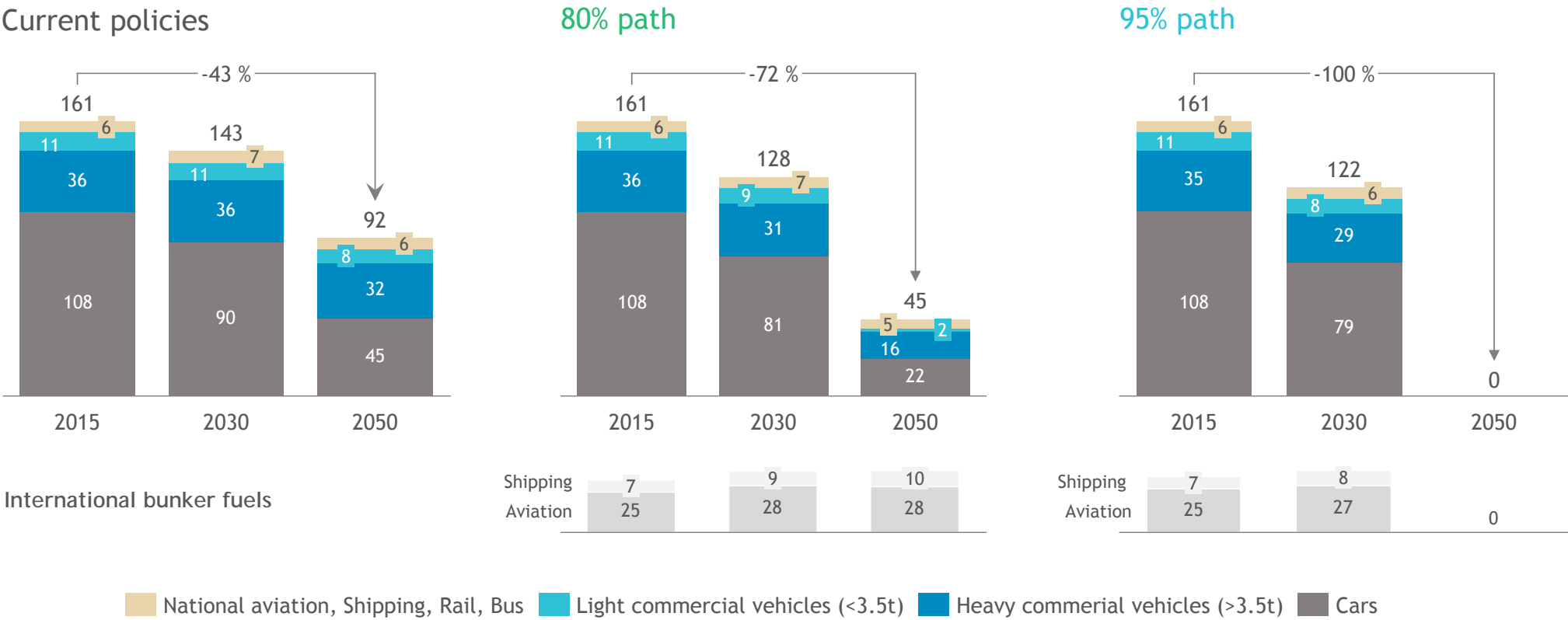


Deep-dive transport sector



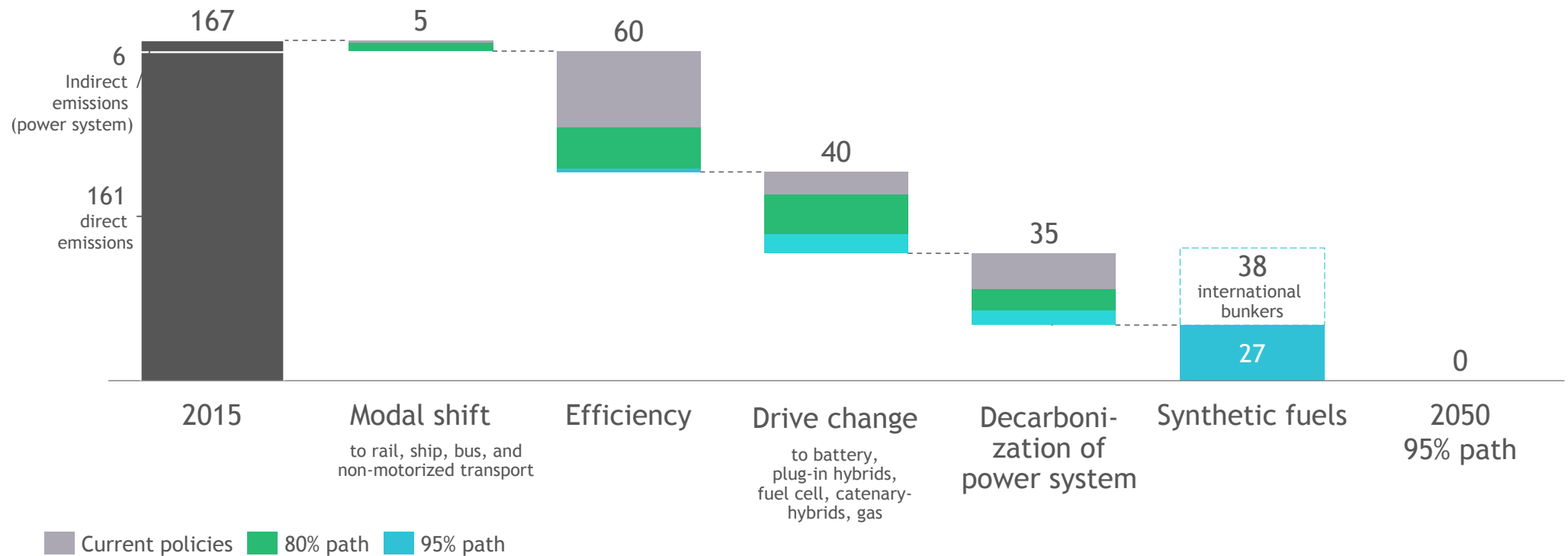
Emissions in the transport sector occur on the road

Direct GHG emissions in the German transport sector (Mt CO₂e)



Technology mix to reach the climate targets

GHG-reduction by major levers (caused emissions; Mt CO₂e)





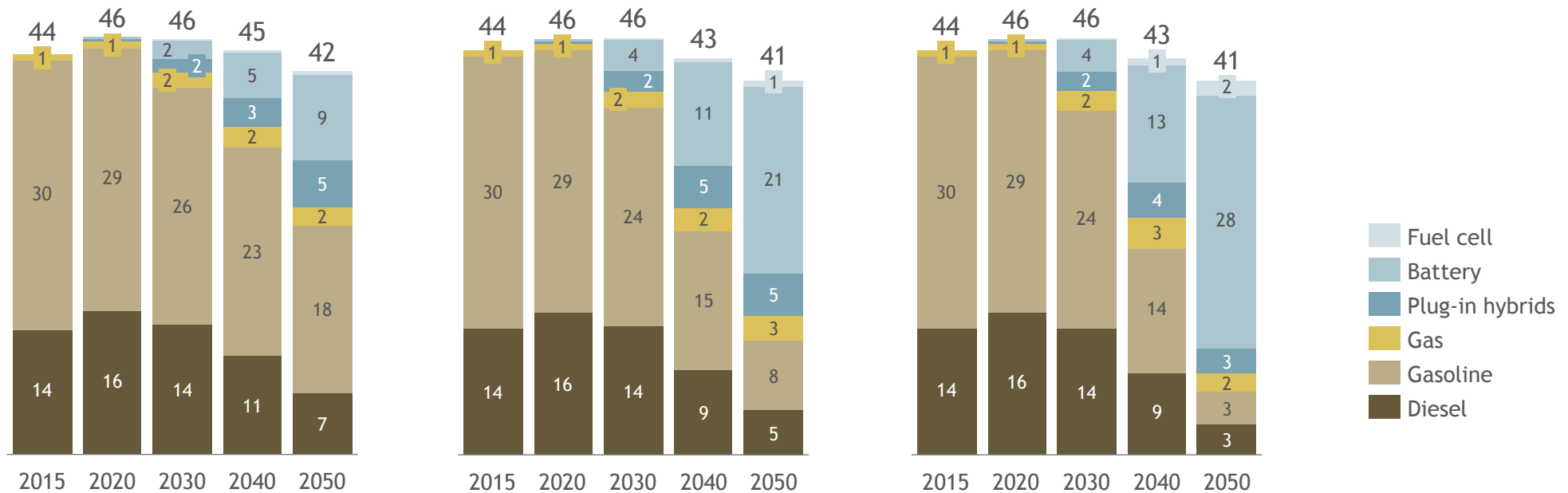
Car fleet: By 2050 2/3 e-mobility share in 80% path, 4/5 in 95% path...

German car fleet (million cars registered in Germany)

Current policies

80% climate path

95% climate path





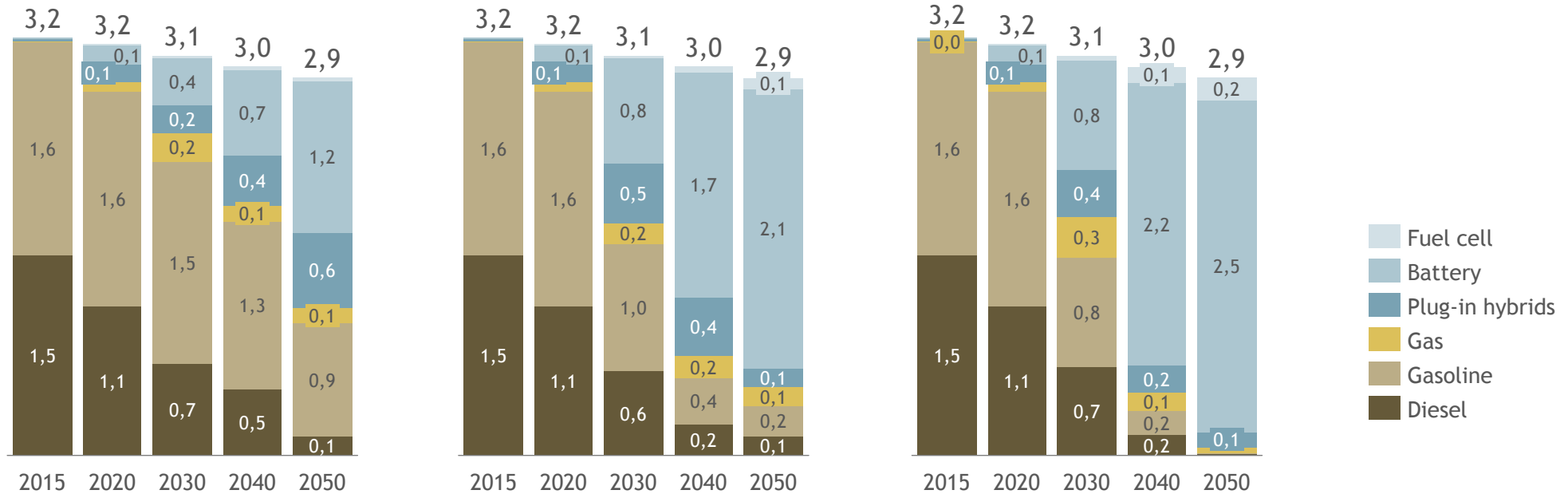
...at much higher shares of new car sales

Cars newly registered in Germany (million)

Current policies

80% climate path

95% climate path



Quelle: Prognos; BCG



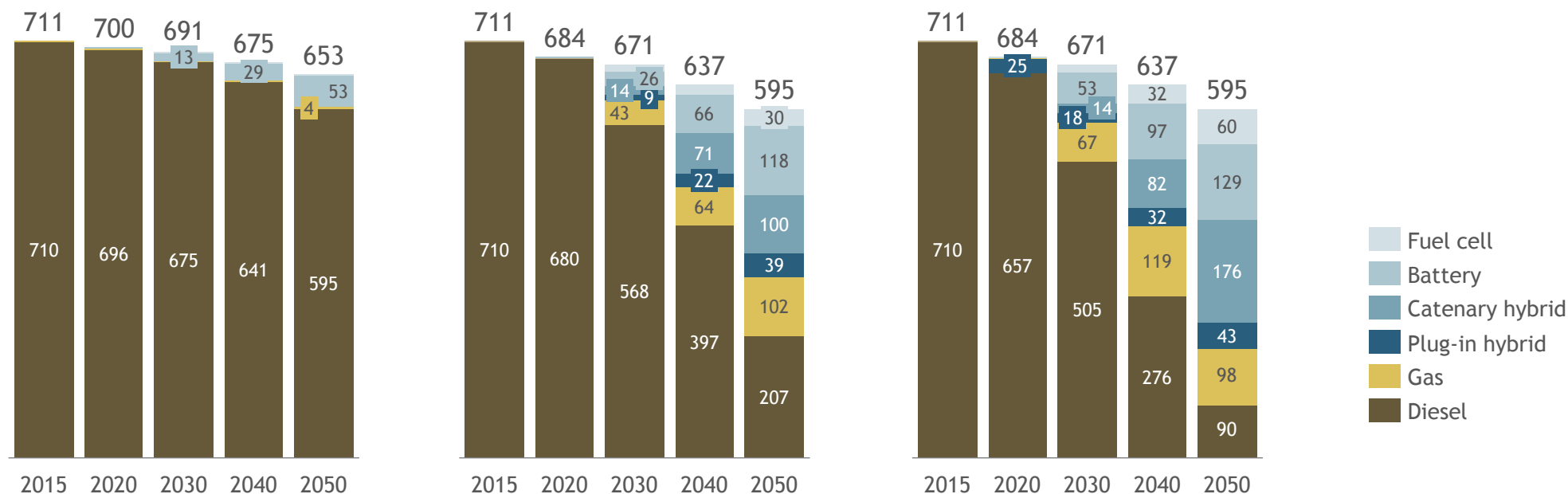
Technology mix in trucks

German heavy commercial vehicle fleet (>3.5t) (thousand vehicles registered in Germany)

Current policies

80% climate path

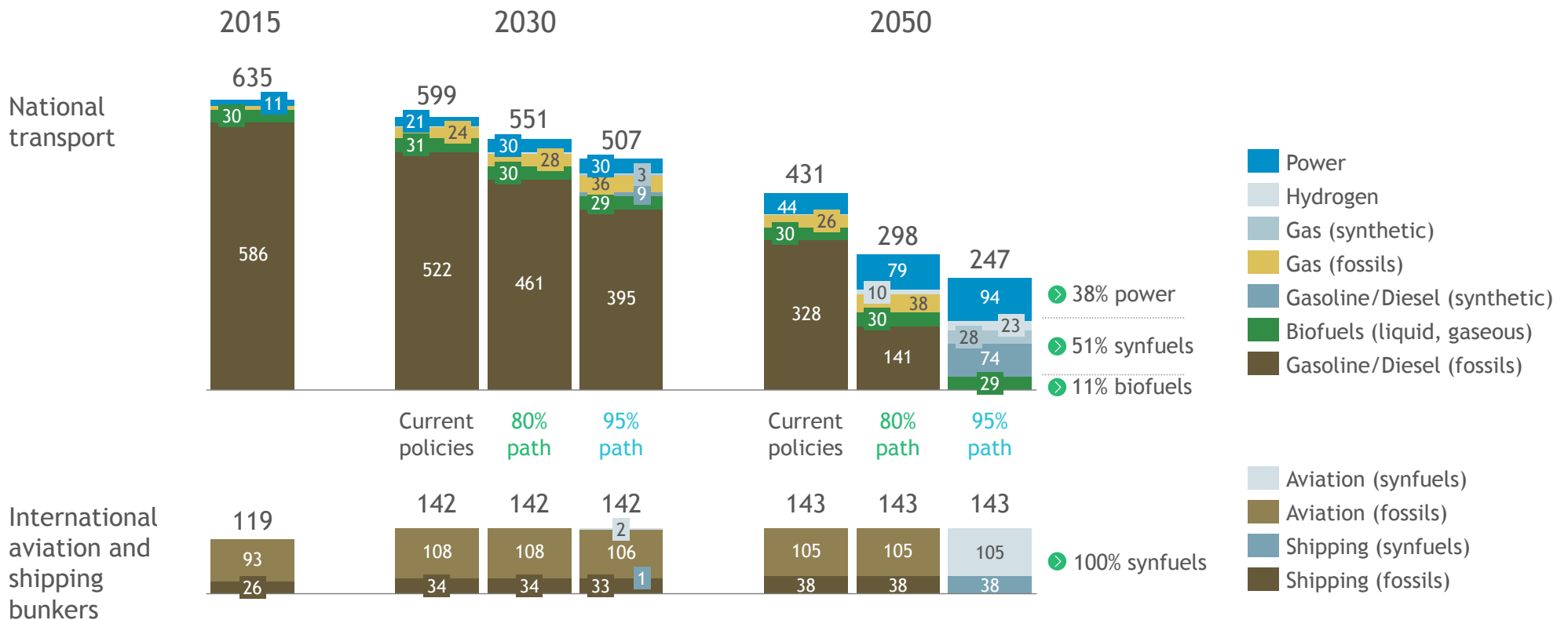
95% climate path



Quelle: Prognos; BCG

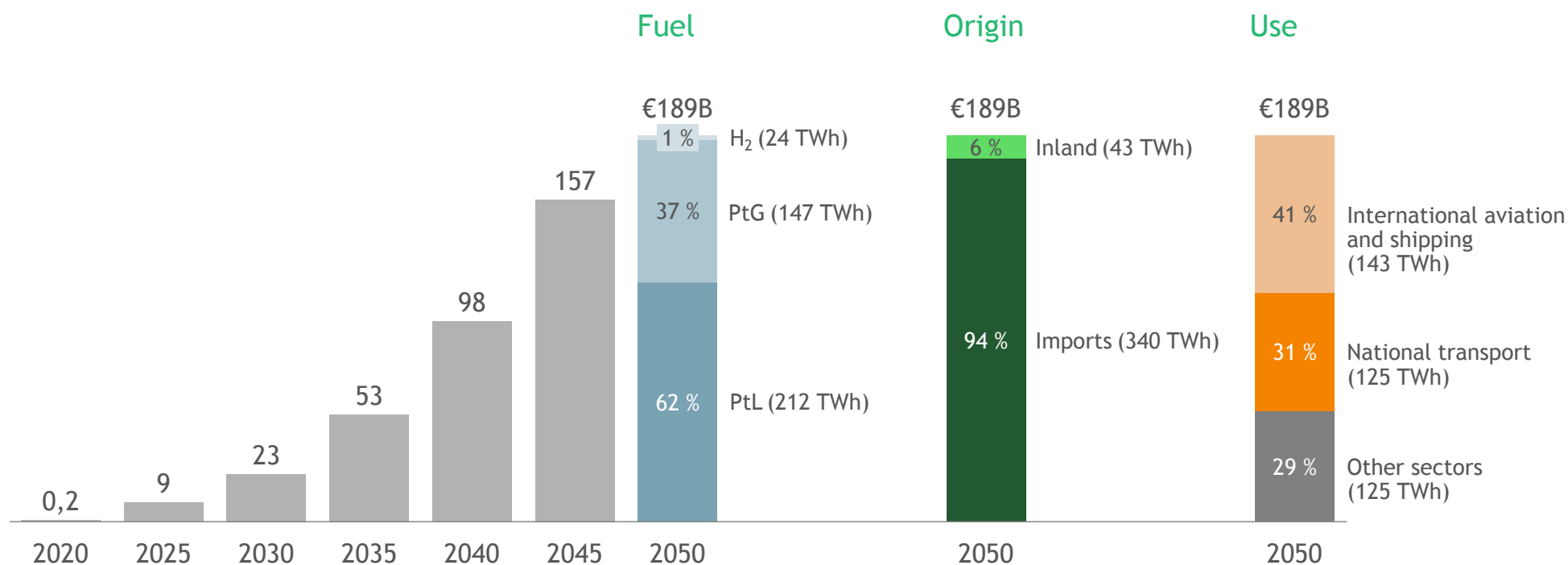
Energy consumption in the transport sector decreases significantly

Final energy consumption in the German transport sector (TWh)



95% path: €189B investments in synthetic fuel plants by 2050

Necessary investments in synthetic fuel plants to meet the German demand of 383 TWh in 2050 (€B, cumulated)

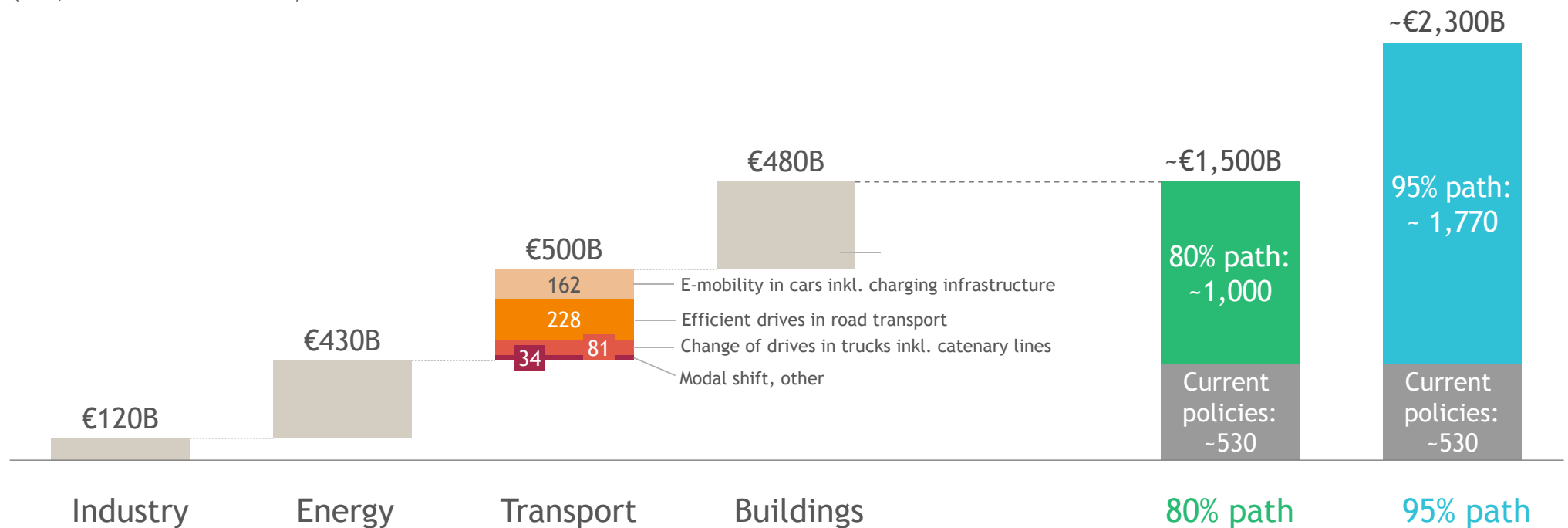


Investments, costs and macroeconomic implications



Largest part of the investments in the transport sector

Cumulative marginal investments until 2050 vs. scenario without GHG reduction efforts
(B€, not discounted)



80% macroeconomically viable - 95% only with international collaboration

80% climate path

95% climate path



Additional investments¹

€1,500B (transport €500B)

€2,300B (transport €620B)



Additional
macroeconomic costs¹

€470B (transport €240B)
Ø €15B/a

€960B (transport €410B)
Ø €30B/a



Impact on GDP

Slightly positive in all scenarios

Slightly positive only in case of global
cooperation

Investment effort
Macroeconomically viable



Significant social and technical effort
Only imaginable with international
consensus



1. Cumulated figures each for the years 2016 to 2050; including investments and additional costs of the current policies scenarios; at a macroeconomic discount rate of 2%; imports at cross-border prices



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