Climate Paths for Germany

Study conducted by BCG and Prognos for the BDI

Joachim Hein
Energy and Climate Policy Dept.

Brussels
September 18, 2018

BDI
Bundesverband der Deutschen Industrie e.V.

“Climate Paths for Germany

Unique fact basis

All sectors

Analysis level: individual GHG reduction measures

Optimized to minimize GHG abatement costs

Investments, costs, GDP-effects

Broad validation of results

68 associations and companies

~ 200 experts from Industry

~ 40 workshops

Scientific board

Current policies vs. target scenarios – how big are the gaps?

Current policies

Continuation of current and likely-to-see policies (Germany and internationally)

Economic and climate policy background: economic growth path, basically lack of enhanced climate policy coordination internationally

Global climate protection

States stick to **2°C-target**

Climate instruments are **coordinated internationally**

Economic growth and **open markets**

Investments in climate technologies speed up innovation

Low fossil fuel prices continue

Willingness to pay for climate protection

Lack of global ambition

Only some countries continue to pursue ambitious climate targets.

Various **national efforts** coexist next to each other

Economic growth and **open markets**

Less **innovation acceleration**

Fossil energy prices rise

Focus on **prosperity**. Less **willingness to pay** for climate protection

Climate paths

R	*Detailed current policies scenario, identification of gaps*	G80	*Detailed analysis 80 % path*	N80	*Detailed analysis 80 % path*
		G95	*Detailed analysis 95 % path*	N95	*Basic analysis 95 % path*

Scenario Analyses! Different Assumptions = Different Outcomes

These assumptions used for modelling:

Perfect carbon leakage protection

Energy and emissions-intensive industries will not have to face direct or indirect costs resulting from the EU ETS that exceed the current level

Electricity grid/infrastructure

Grid gets adapted to developing demand and supply structures, overhauled grids without structural bottle-necks, no cut-off of renewable feed-in due to insufficient grid infrastructure

Macro-economic abatement costs

German economy-wide 2050 climate goal achieved with priority on cross-sectoral cost-efficiency (macro-economic optimisation)

Perfect regulation

Right policy decisions are always taken at the right time. Cross-sectoral measures are implemented in an ideal way

Demand Side Management

All new consumers of power/energy (electric vehicles, heat pumps, PtX) are assumed to be able to contribute to overall system integrity/stability

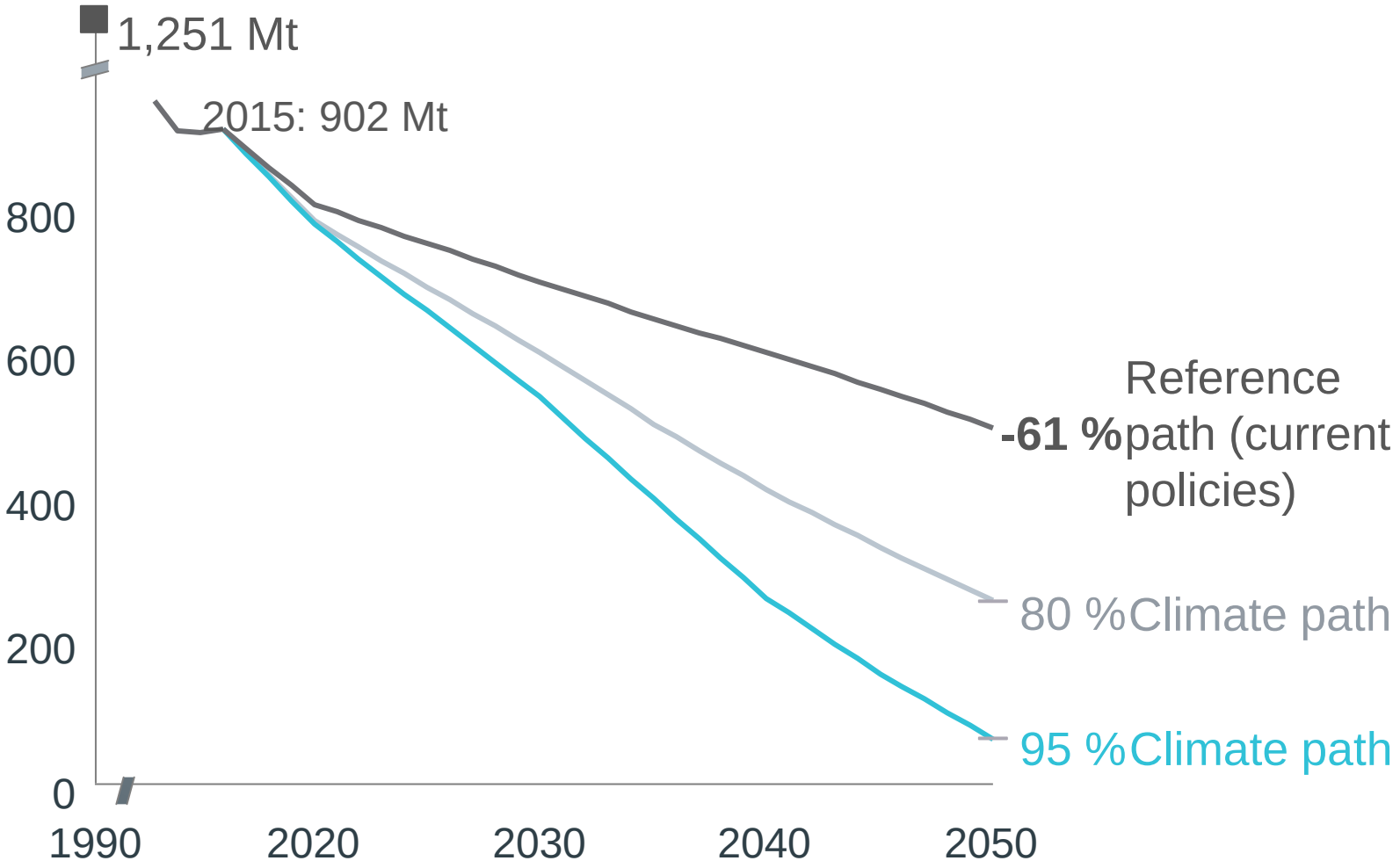
Technological Progress

Learning curves: expert roundtables estimated future technology costs and benefits. Results tested against current scientific estimates

61 % reduction of greenhouse gases if current policies are continued…

Greenhouse gas (GHG) emissions in Germany

Million Tons CO_2 equivalents

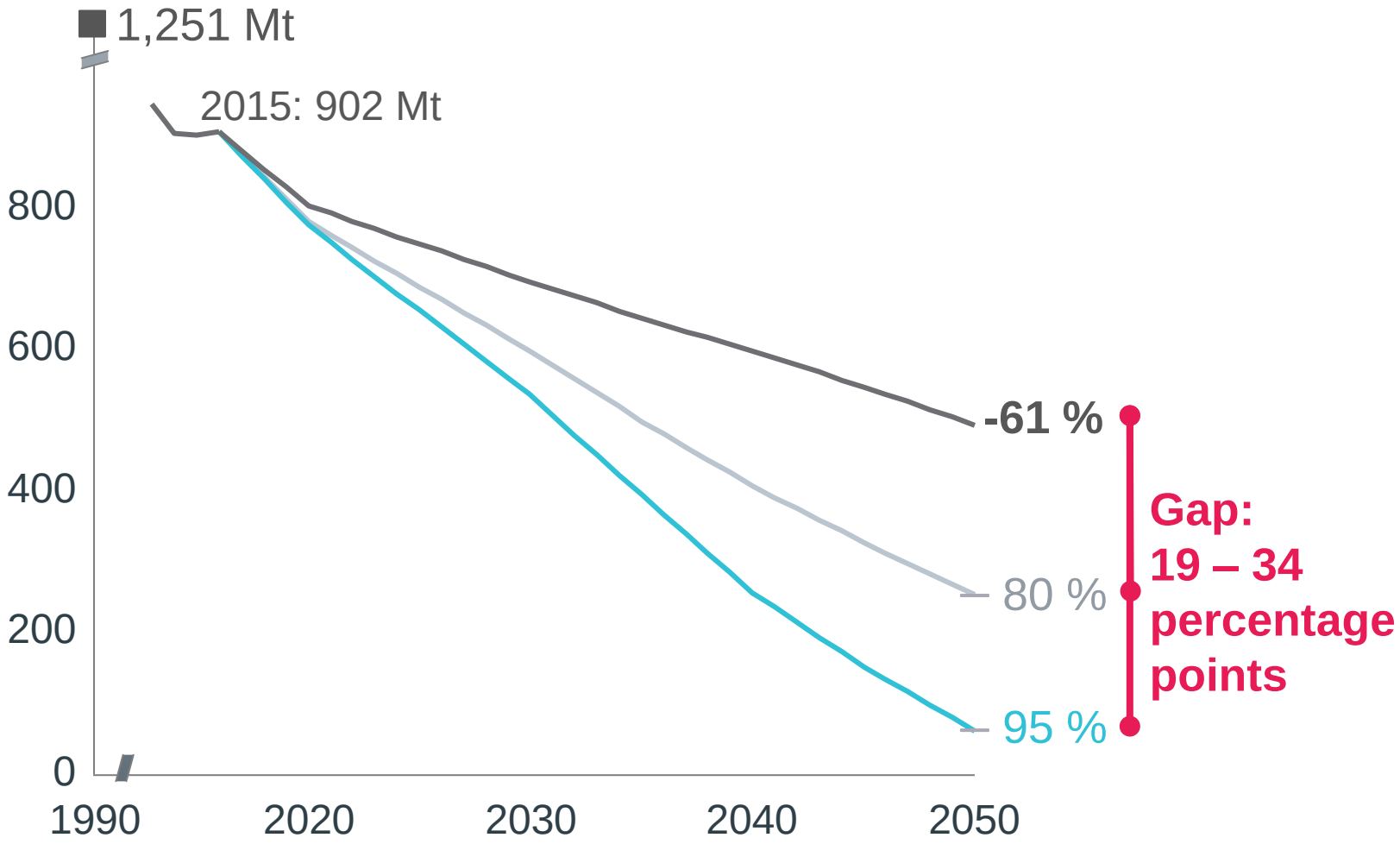


Sources: The Boston Consulting Group, Prognos 2017

… however, considerable gaps compared to political goals

Greenhouse gas (GHG) emissions in Germany

Million Tons CO_2 equivalents



Sources: The Boston Consulting Group, Prognos 2017

80 % path achievable with technologies known to us today

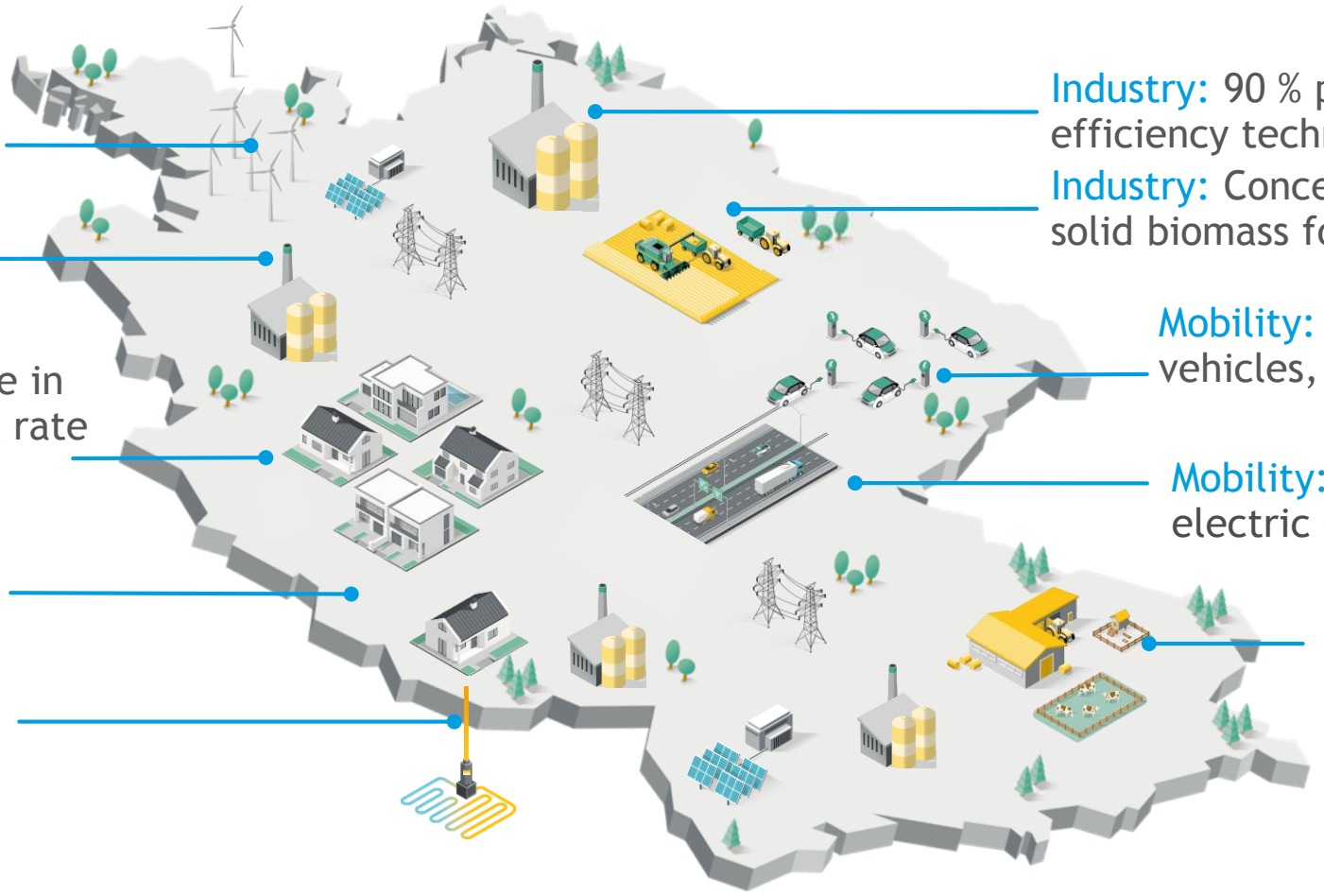
Energy: 240 GW wind and PV, grid extension

Energy: Gas gradually replaces coal in backup generation

Buildings: 50 % increase in building refurbishment rate (1.7 % p. a.)

Buildings: Expanded urban district heating

Buildings: 14 mn. heat pumps, mainly in residential buildings (1 – 2 families)



Industry: 90 % penetration of efficiency technologies

Industry: Concentration of national solid biomass for heat < 500°C

Mobility: 26 mn. electric vehicles, 2/3 of passenger cars

Mobility: 4.000 highway km with electric overhead lines for trucks

Farming: More efficient use of fertilizers

PV = photovoltaics
All figures refer to 2050

95 % path, huge problems with feasibility and acceptance

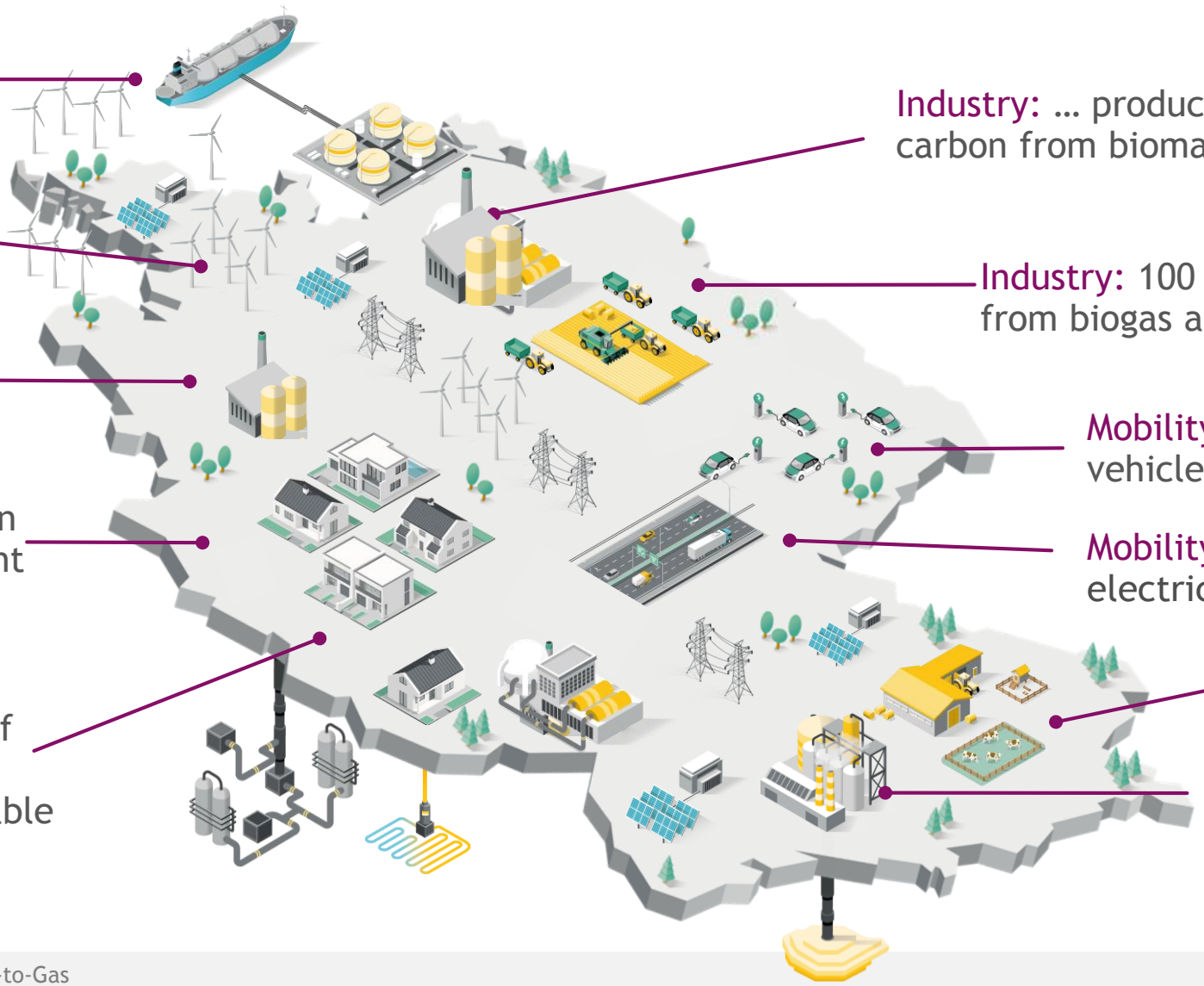
340 TWh Imports „renewable fuels“ (PtL, PtG)

Energy: 292 GW wind and PV, grid extension

Energy: 100 % renewable with PtG, gas-grid for seasonal storage

Buildings: 70 % increase in the building refurbishment rate (1.9 % p. a.)

Buildings: Heating free of fossil fuels (16 mn. heat pumps and 100 % renewable district heating)



Industry: … produces with recycled carbon from biomass incineration

Industry: 100 % renewable heat/steam from biogas and PtG …

Mobility: 33 mn. electric vehicles, 4/5 of passenger cars

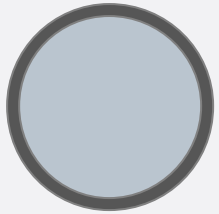
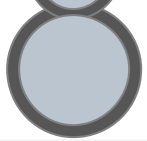
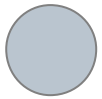
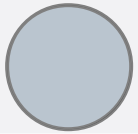
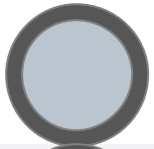
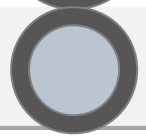
Mobility: 8.000 highway km of electric overhead lines for trucks

Farming: „methane pill“ for cattle population

Carbon Capture and Storage for steel, cement, ammonia, refineries, waste combustion

PtL = Power-to-Liquid, PtG = Power-to-Gas
All figures refer to 2050

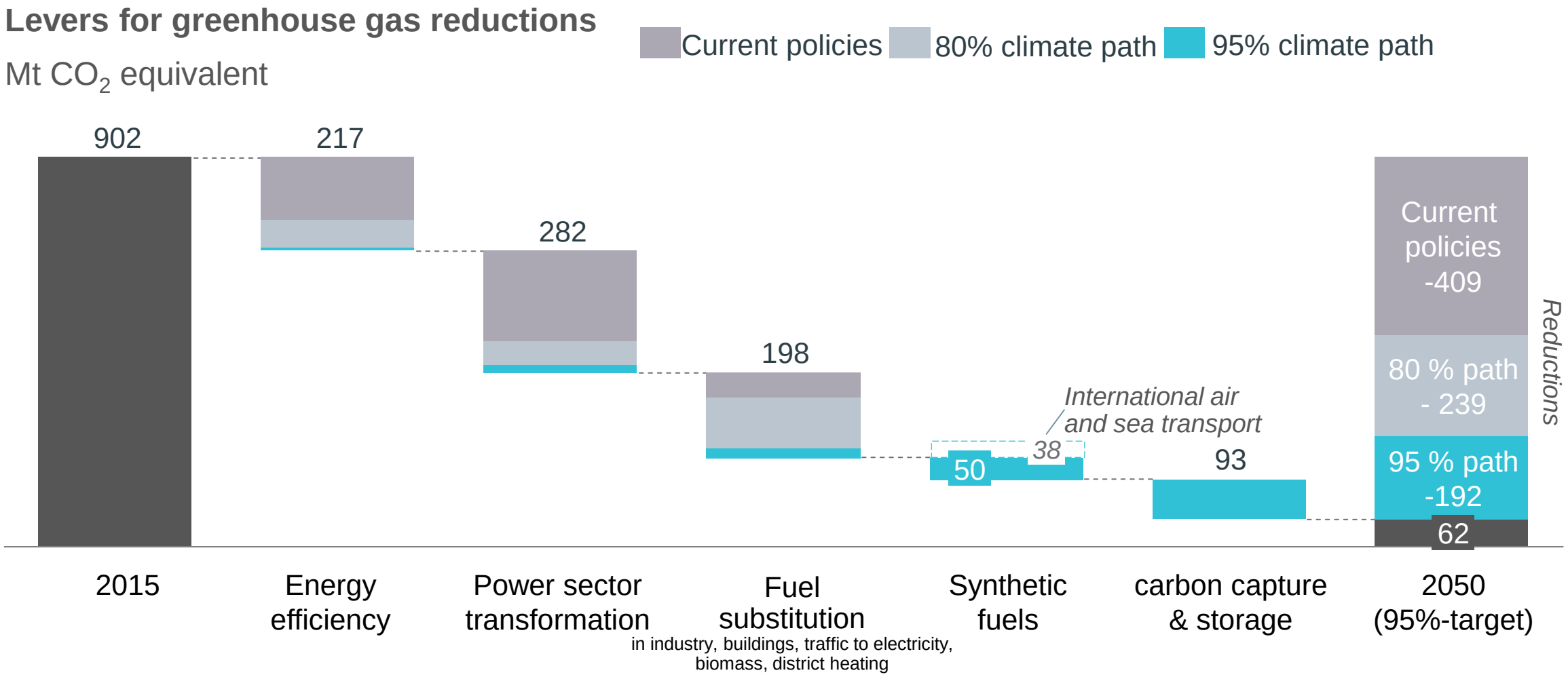
80 % path: buildings and power sectors reduce most

Bubbles: Mt CO_2e % change vs. 1990	1990 (dark) vs. 2015 (bright)		2050 current policies		2050 80 % climate path	
Power sector		-22 %		-71 %		-89 %
Industrial processes		-36 %		-41 %		-51 %
Industrial heat/steam		-32 %		-52 %		-72 %
Mobility		-2 %		-44 %		-73 %
Buildings		-39 %		-70 %		-92 %
Agriculture, other		-46 %		58 %		-70 %
∑	1990: 1,251 2015: 902 (-28 %)		493	-61 %	254	-80 %

95 % path: zero emissions required in virtually all sectors

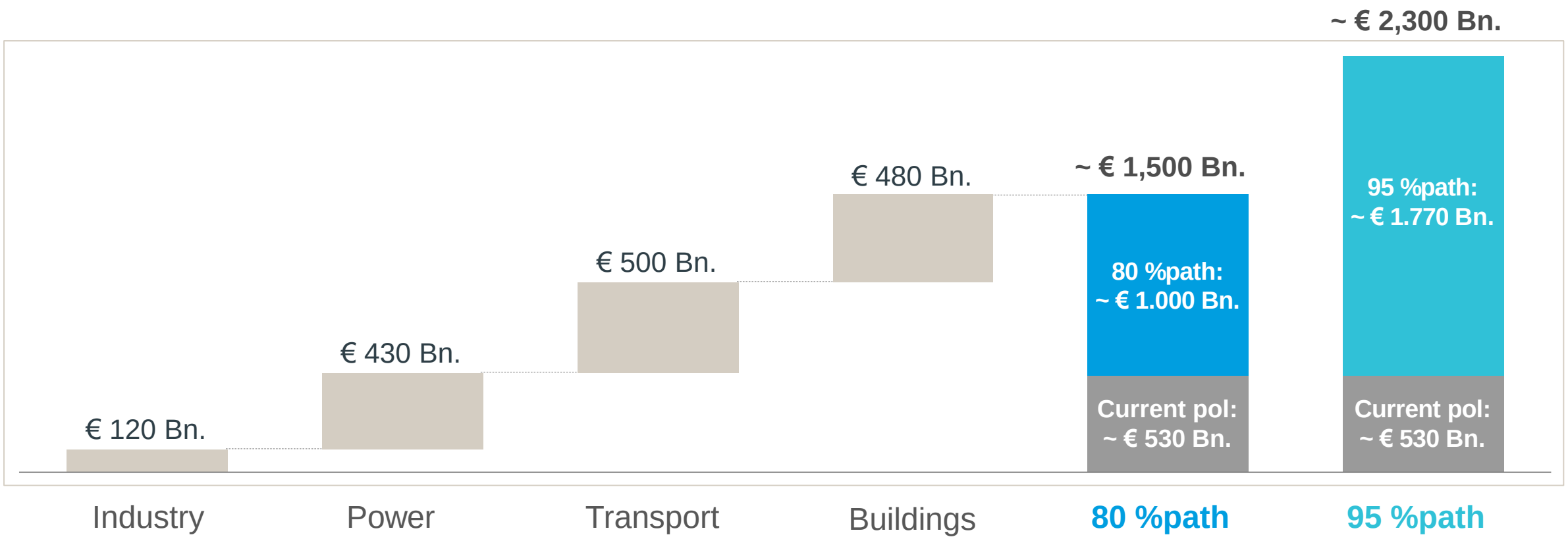
Bubbles: Mt CO_2e % change vs. 1990	1990 (dark) vs. 2015 (bright)	2050 current policies	2050 80 % climate path	2050 95 % climate path
Power sector	-22 %	-71 %	-89 %	-100 %
Industrial processes	-36 %	-41 %	-51 %	-87 %
Industrial heat/steam	-32 %	-52 %	-72 %	-99 %
Mobility	-2 %	-44 %	-73 %	-100 %
Buildings	-39 %	-70 %	-92 %	- 100 %
Agriculture, other	-46 %	58 %	-70 %	-74 %
∑	1990: 1,251 2015: 902 (-28 %)	493 -61 %	254 -80 %	62 -95 %

Different technologies needed to achieve the climate targets

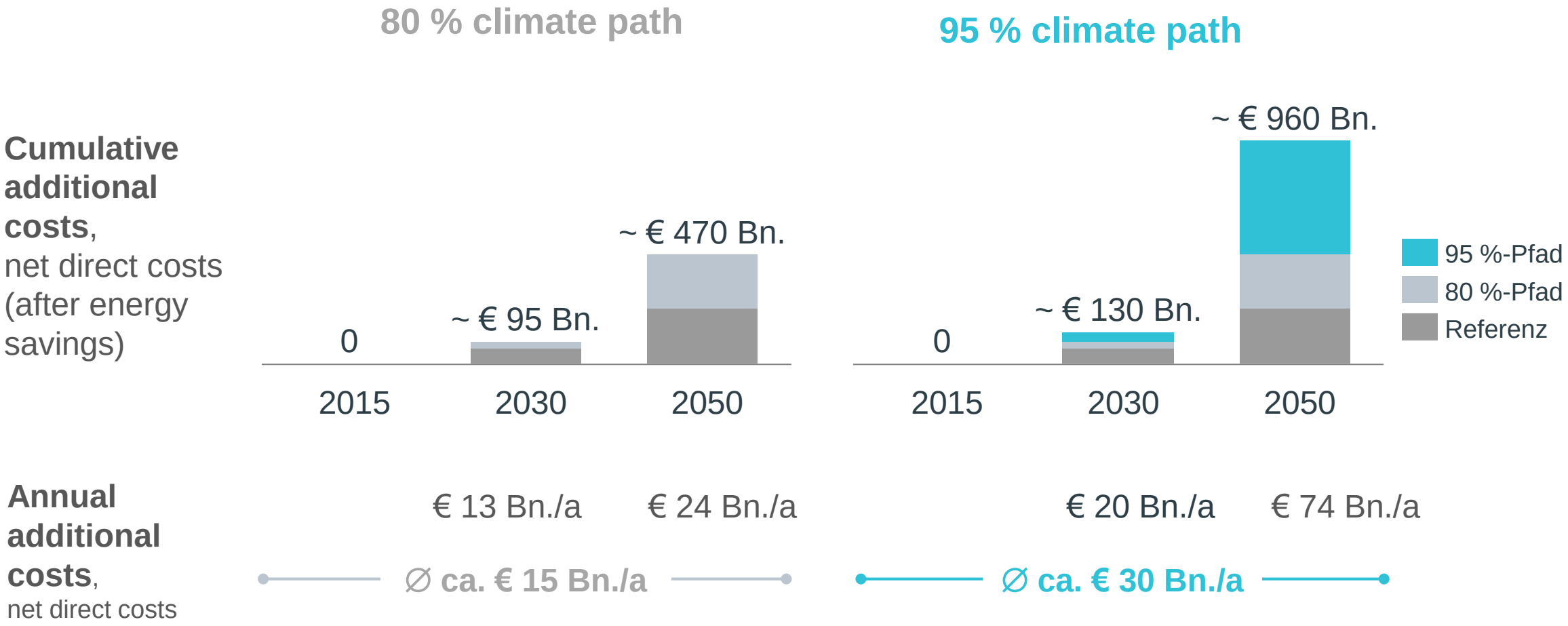


Additional investments of € 1,500 to € 2,300 bn. until 2050

Cumulative additional investments until 2050 (vs. scenario without GHG reduction efforts)



Additional cost to the German overall economy: 470 to 960 billion Euro



80% path with overall marginal effect on GDP, …

	„Lack of global ambition" scenario GDP effect compared to „current policies"	*„Global climate protection" scenario* GDP effect compared to „current policies"
80 % climate path: Technically feasible, without negative GDP effect	+0.6[1]% to +0.4[2]% GDP 2050 (with protection against carbon leakage)	+0.9[1]% GDP in 2050
95 % climate path: Only imaginable in case other G20 countries align	**Not plausible**	+0.9[1]% GDP in 2050

GDP impact in the year 2050 (*not: annual GDP-growth rate*!)

Remark: 1) All GDP figures without crowding-out effect of climate investments, all investments are modeled as additional investments
2) Sensitivity given full crowding-out of climate investments (except energy sector), investments are not additional.
% figures denote relative effect in 2050, not annual GDP-growth rates

Climate protection policy demands a systemic approach and economically optimised steps.

80 % can be done **if** …; 95 % only in a global context

Climate policy if „properly done“ can strengthen the economy, „tactical focus“ on individual projects will escalate costs

Government needs to safeguard an integrated approach:

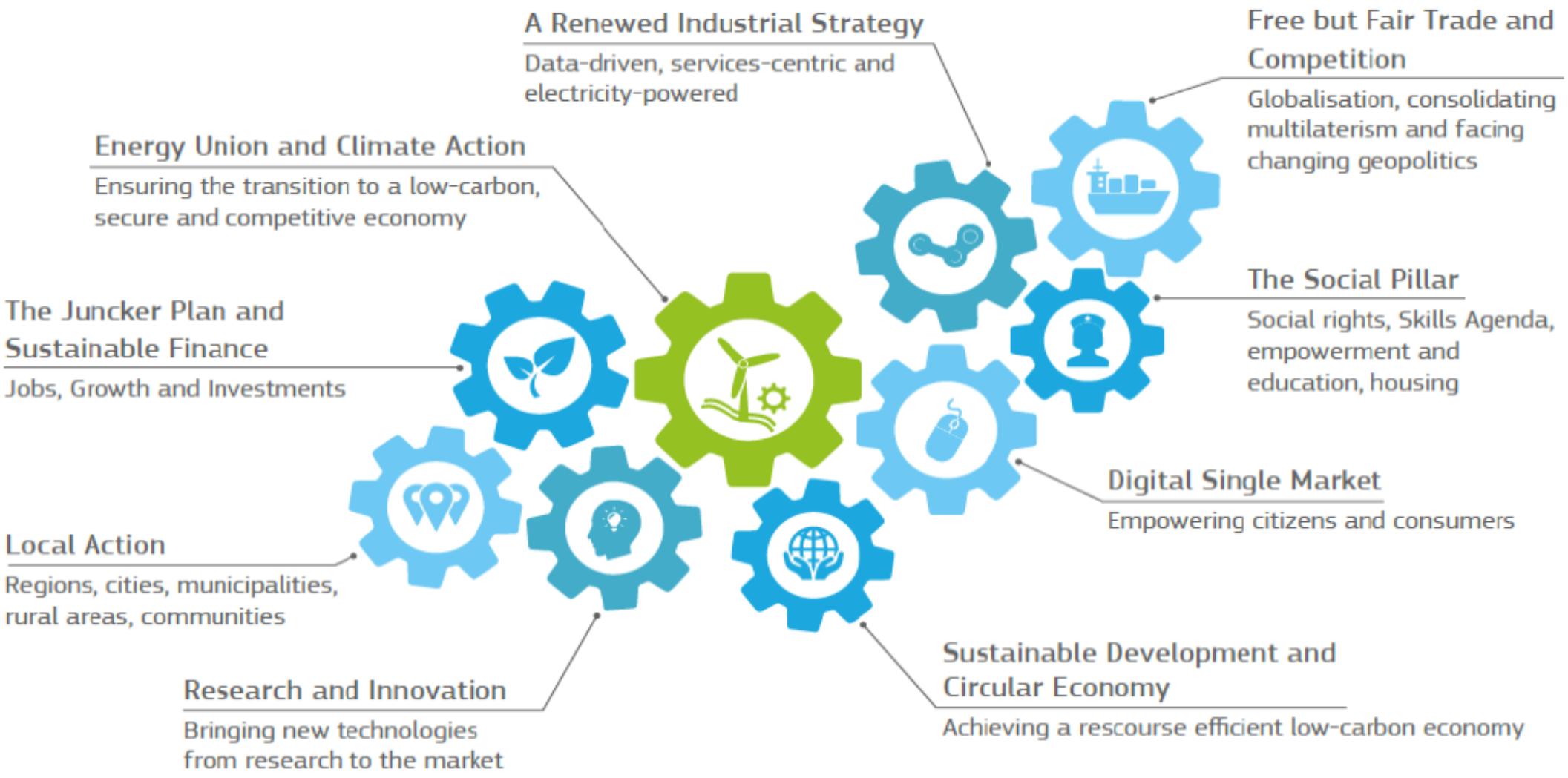
- climate and industrial policy need to be linked
- critical infrastructure needs to be secured
- „catalysts” necessary to bring about the huge investments needed (> 1.5 trillion €)
- continuous and effective monitoring and corrections to path if needed

International „multiplication“ crucial – but „emulation“ will only happen if competitiveness can be preserved

Many open questions … Here are some:

- Global Action – utopia? Alternative(s)?
- Go it alone, as EU or even as a MS? Cross-border cooperation essential!
- E-fuels – where will they come from? Where will the infrastructure come from?
- CCS etc. – how can acceptance be achieved? Timely action – when?
- Sectors are different, one-size-fits-all not sensible – bespoke regulation vs. inefficient micro-management, how?
- Sector-specific reduction targets? Cross-sectoral picture essential!
- Macro- vs. micro-economics – how can investments be incentivised?
- What about „game changers“? …

European Energy Union – cogwheels vs. gearbox



Thank you for your attention!

https://english.bdi.eu/search/?id=684&L=0&q=climate+paths#/article/news/climate-protection-needs-massive-investment-drive-according-to-new-bdi-study/