McKinsey & Company

A perspective on ESG: Decarbonization and Growth Dynamics

OVO Conference

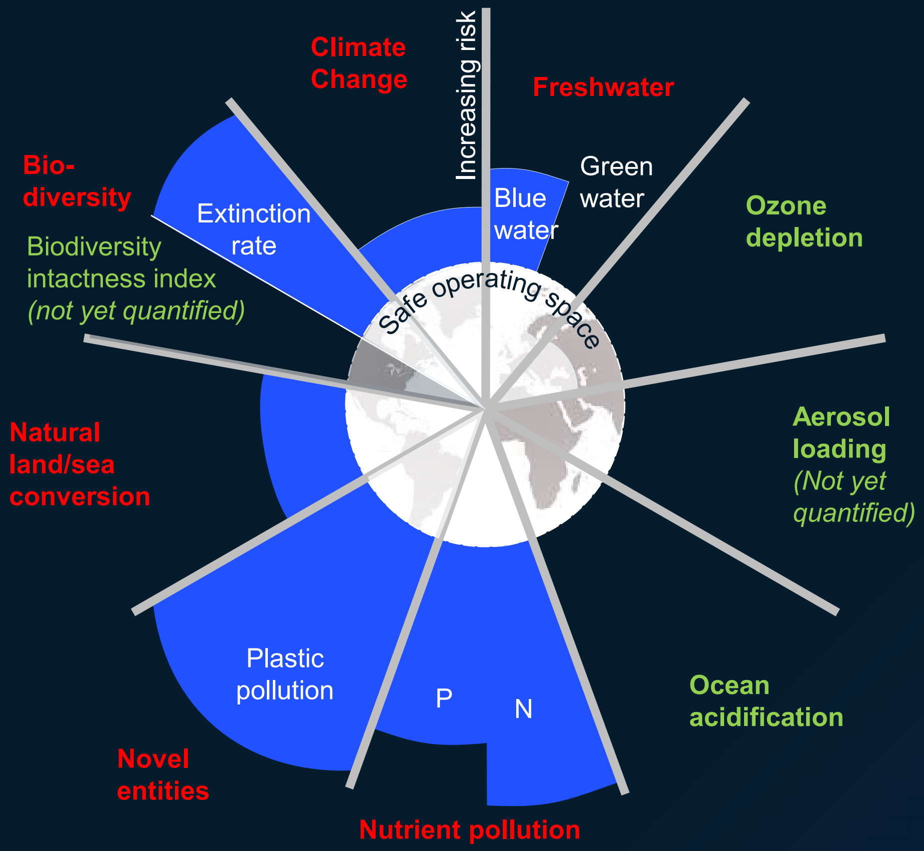
22 November 2023

entrepreneurs for entrepreneurs
Sustainable cooperation with Africa

ESG – Current momentum of loss of natural capital can deeply affect societies, the economy, and the world

Focus on Climate Change / Decarbonization in what follows

Human activities already crossed 6 out of 9 planet boundaries



Ecosystems and humankind can face unprecedented consequences

Nutrient pollution results in freshwater eutrophication: algal blooms, dead zones, water contamination

Accelerated biodiversity extinction rate can result in a 6th biological mass extinction

4 Bn people are projected to experience **water scarcity** and increased water insecurity

Novel entities[1] accumulation threatens the global equilibrium and could exceed other planetary limits

Long-term planetary worst case

Worst impacts possible:

Biodiversity loss, **plagues** and **massive extinctions**

Mega scale migrations for habitable **land and food**

Complete ice melt: **70 m sea** level **rise**

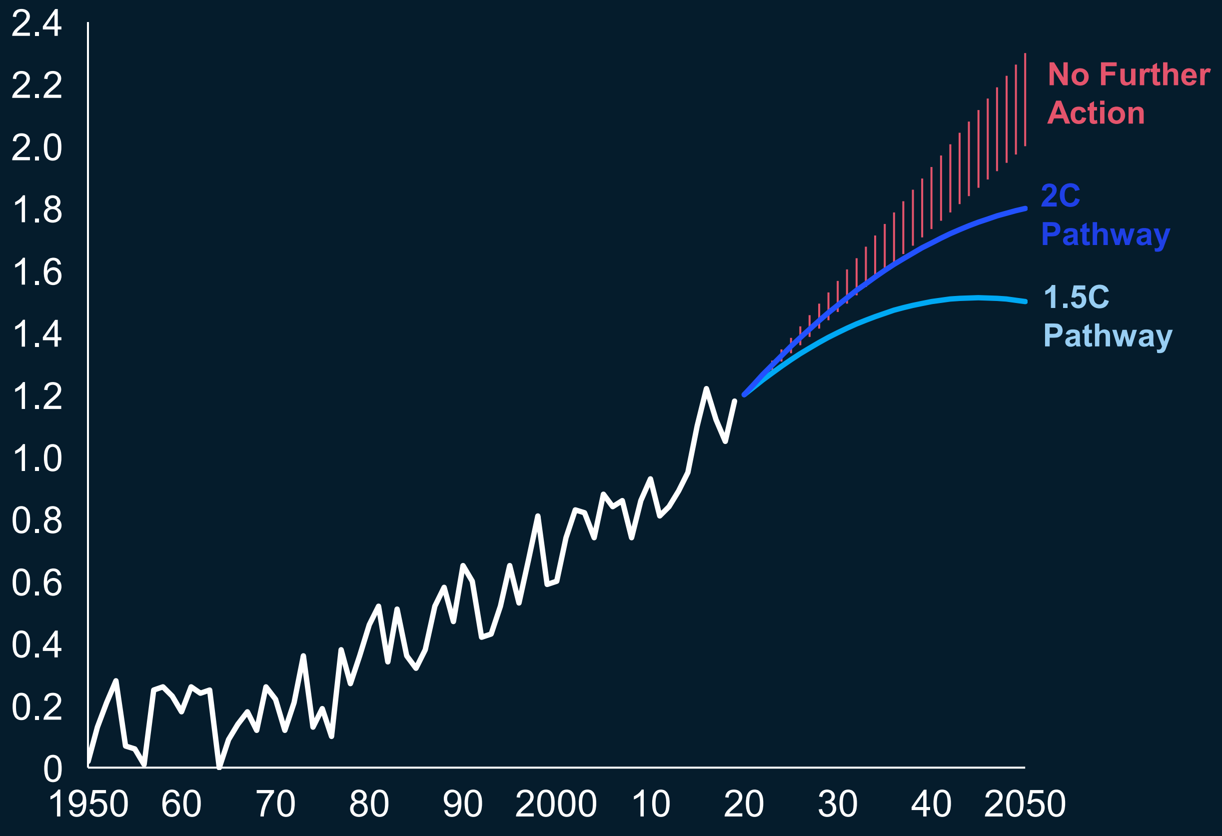
1. Plastics, additives, drugs, pesticides, persistent organic pollutants, endocrine disruptors, GMOs, heavy metals and nuclear waste

Source: McKinsey report: Nature in the balance: What companies can do to restore natural capital, IPCC 2022 report

The next decade is decisive: adapt and decarbonize

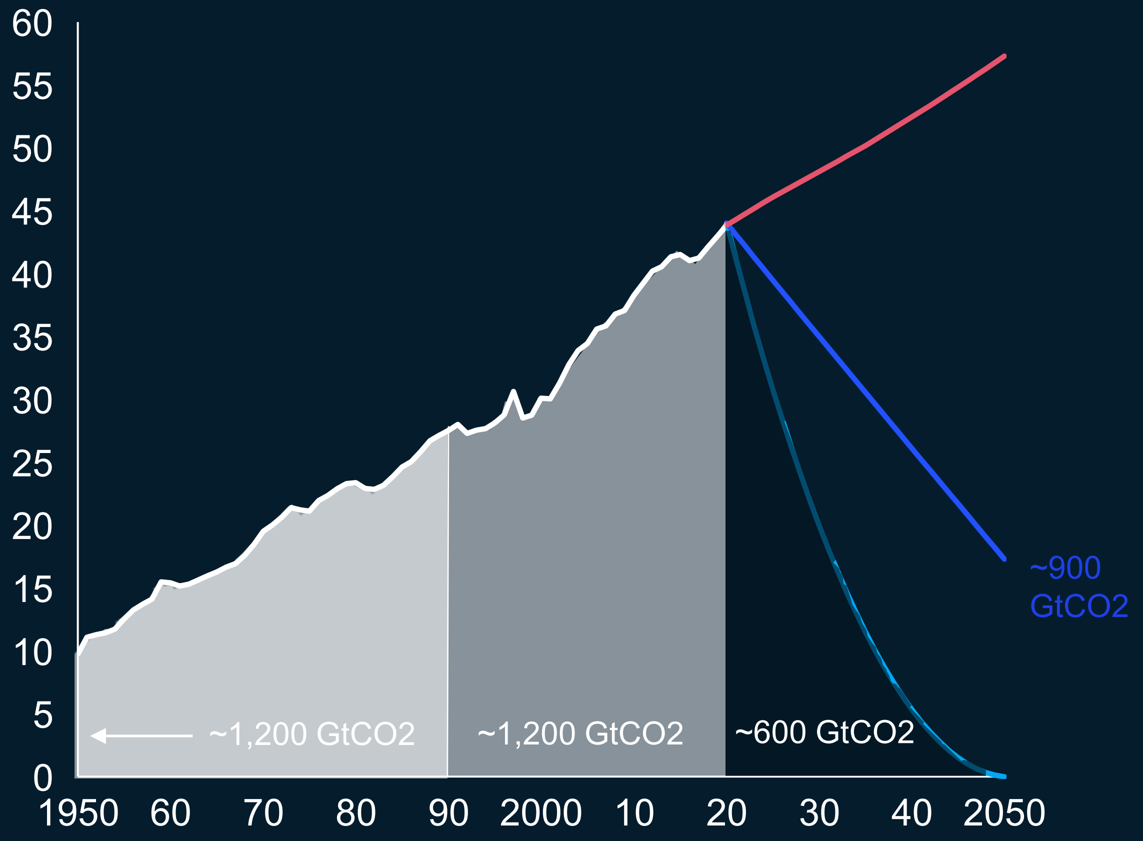
Resilience and adaptation

Rise in average global temperature (°C)



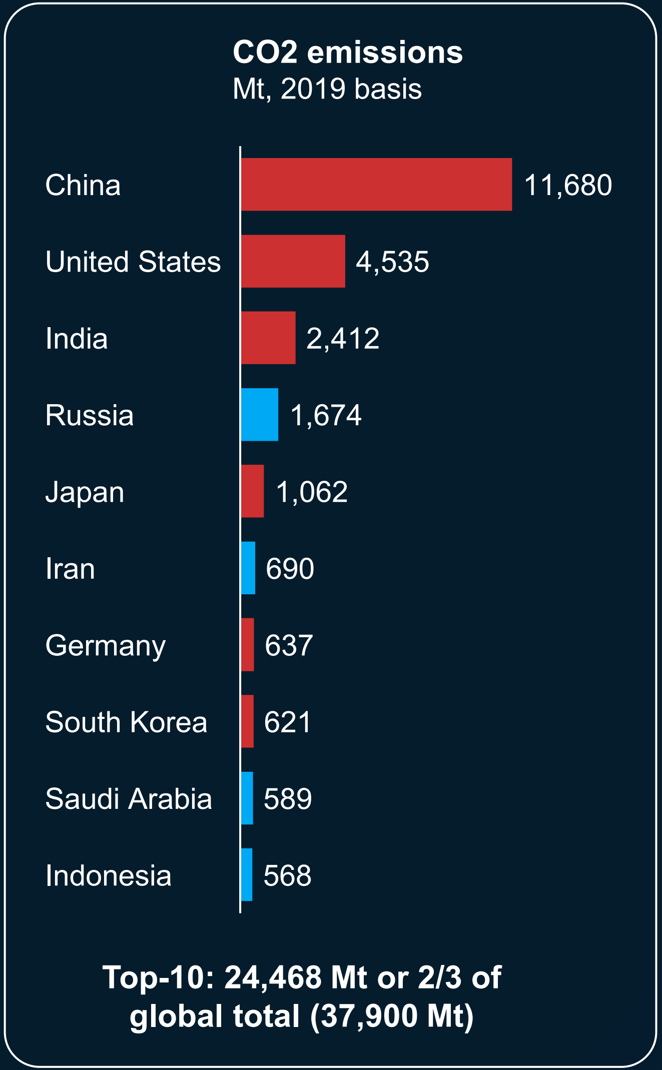
Mitigation

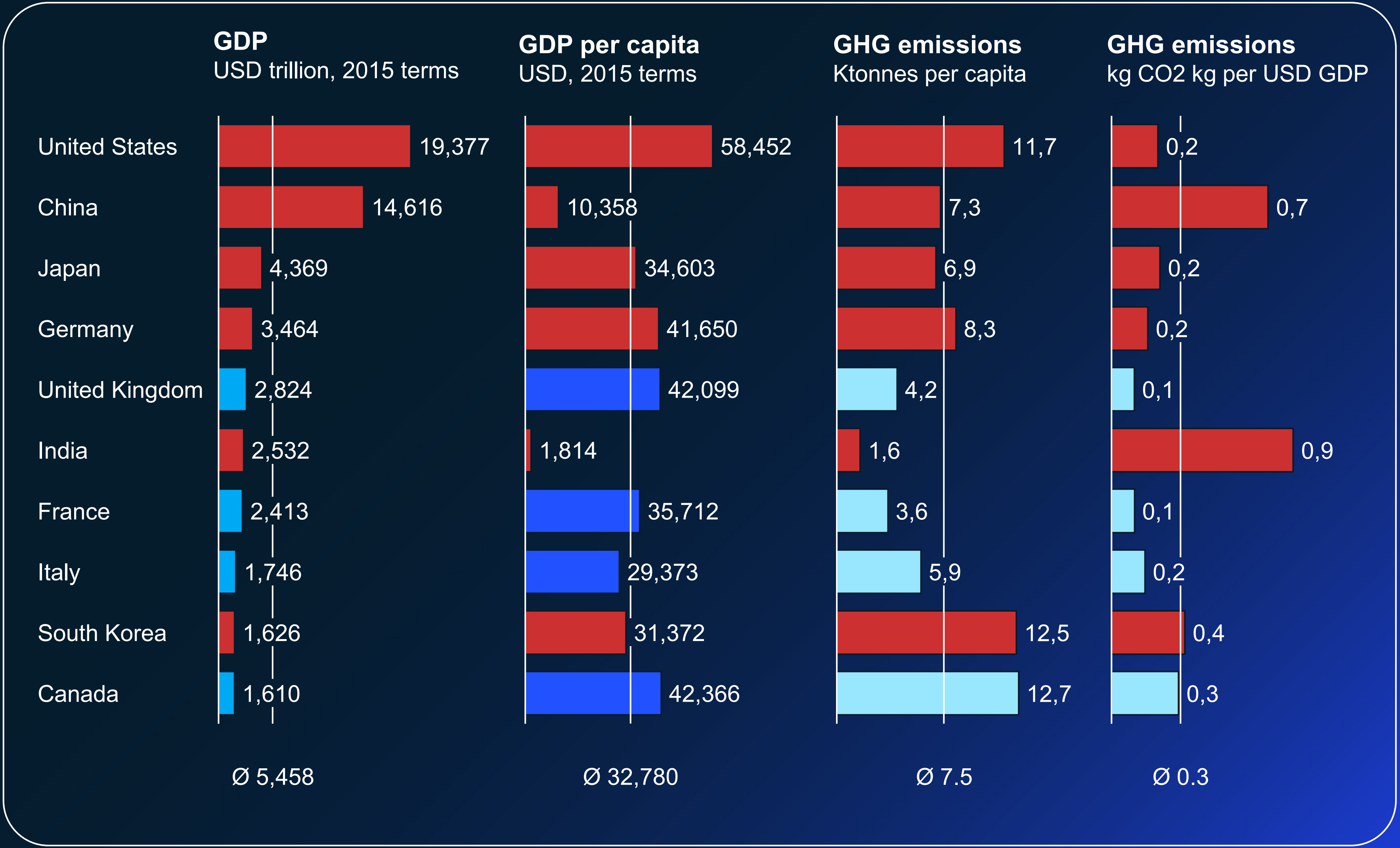
Annual CO_2 emissions (Gt CO_2)



Source: CO_2 emissions: Carbon Dioxide Information Analysis Centre, Oak Ridge National Laboratory. Friedlingstien et al. "Global Carbon Budget 2019." Earth Systems Science Data. (2019). Forward projections are illustrative, based on carbon budgets estimated from Rogelj et al (2019) and the IEA CP Scenario, following Hausfather and Peters (2020). Temperature Record: NASA Goddard Institute for Space Studies (GISTEMP –2019) . Warming for "No further action" is the range between RCP8.5 and RCP4.5 ranges, as IEA CPS plus estimates for non-energy emissions following Hausfather and Peters (2020) puts cumulative emissions roughly 3/4ths of the way between RCP8.5 and RCP4.5.

Top-10 global emitting countries represent 2/3 of total emissions; 6 of these are in the top-10 global economies with very different profiles of wealth and emissions generation



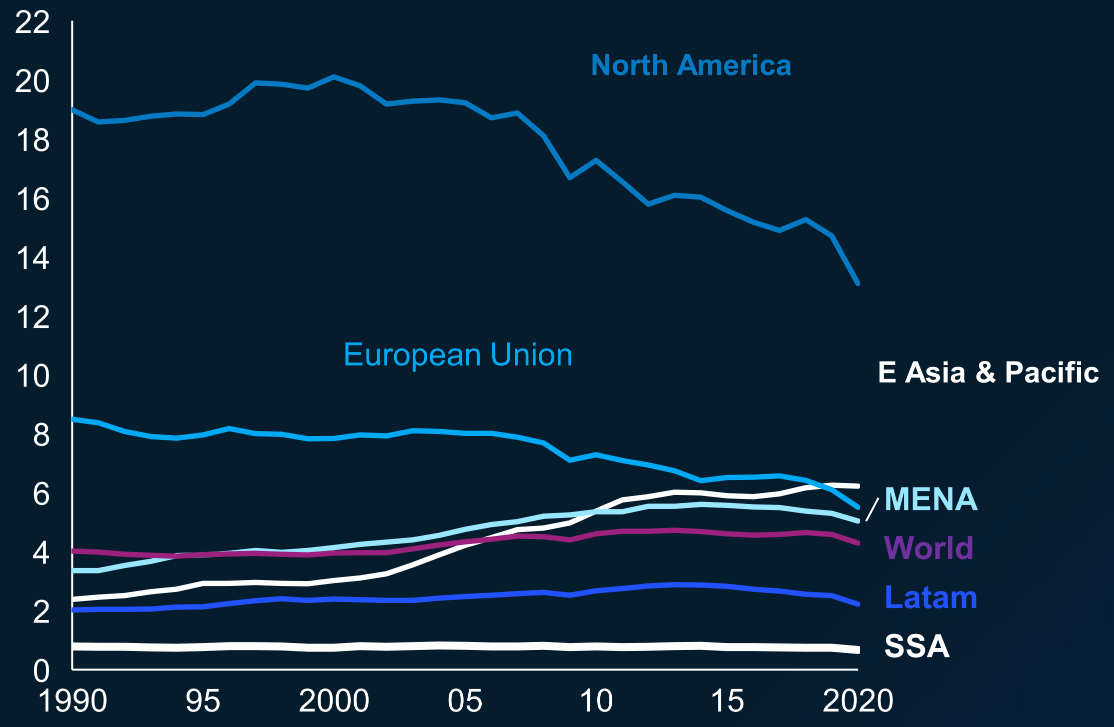


Source: World Bank

With less than 1 kt per capita, Sub-Saharan Africa is the lowest emitter of GHG globally

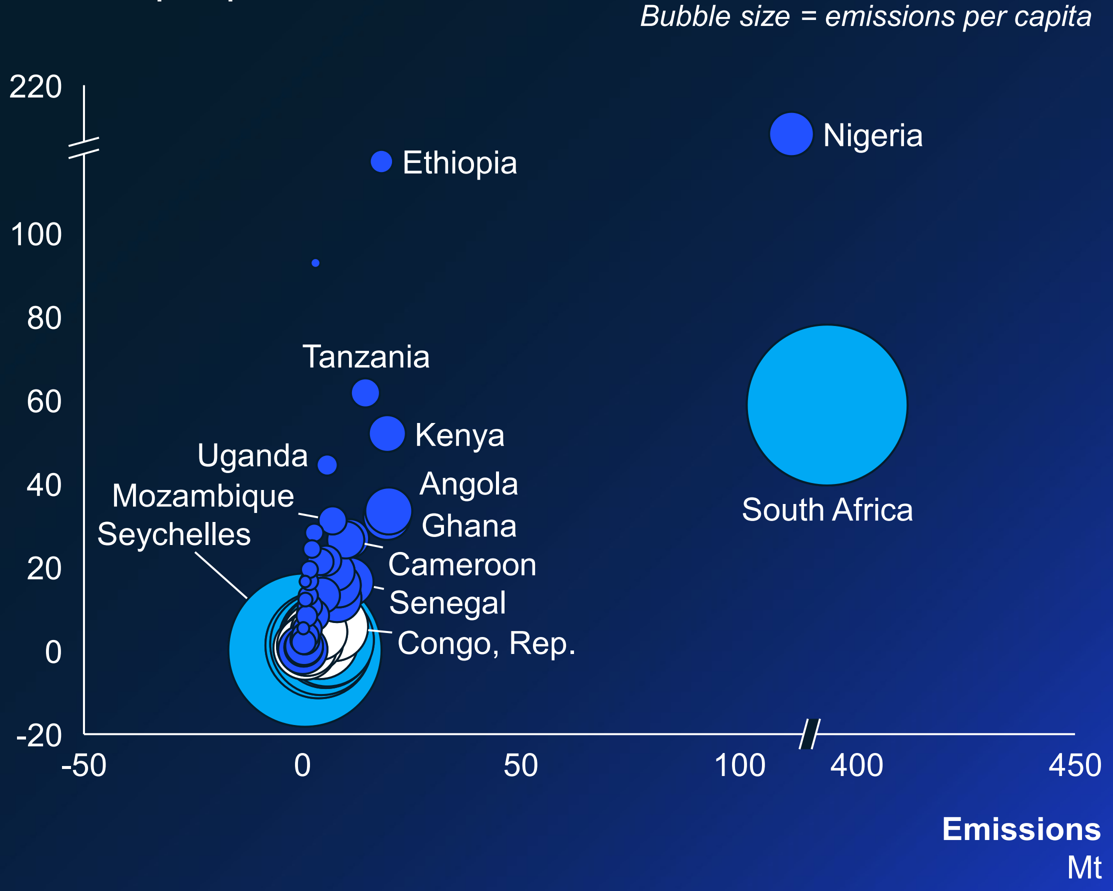
GHG emissions per capita

Ktonnes



Population in Sub-Sharan Africa

Million people

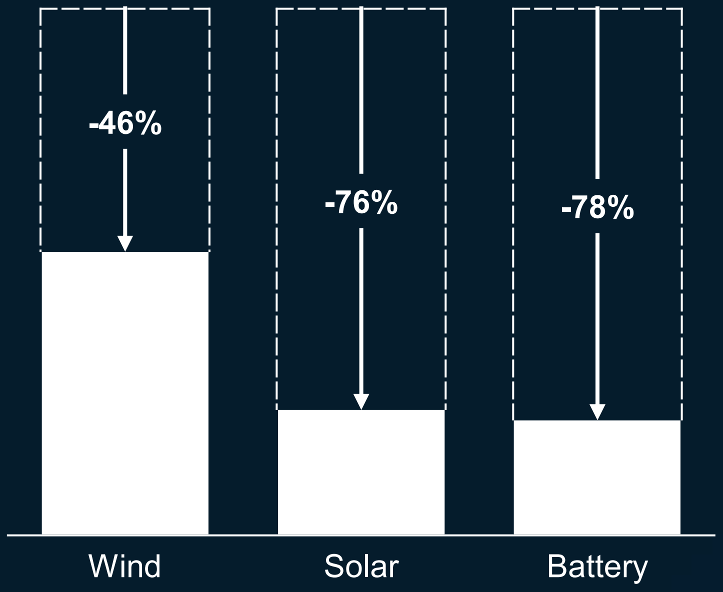


Source: World Bank

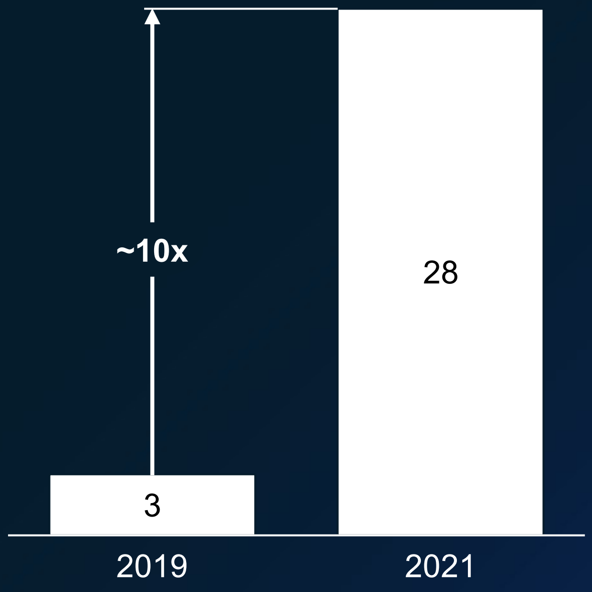
The global energy system has been tilting towards sustainability…

Examples of shifts in the global energy system

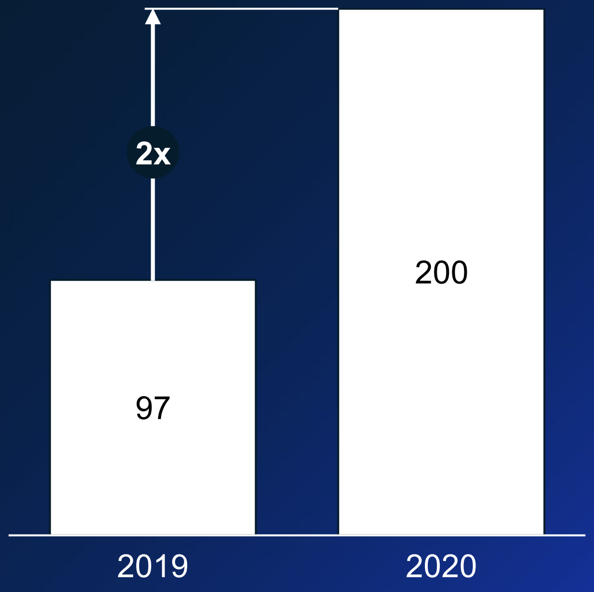
Technology cost[1],
indexed 2010 = 100



Announced expansions in electrolyzer capacity until 2030, GW



US stock market returns in fossil fuel vs. renewable portfolios[2] over 10 years,
%



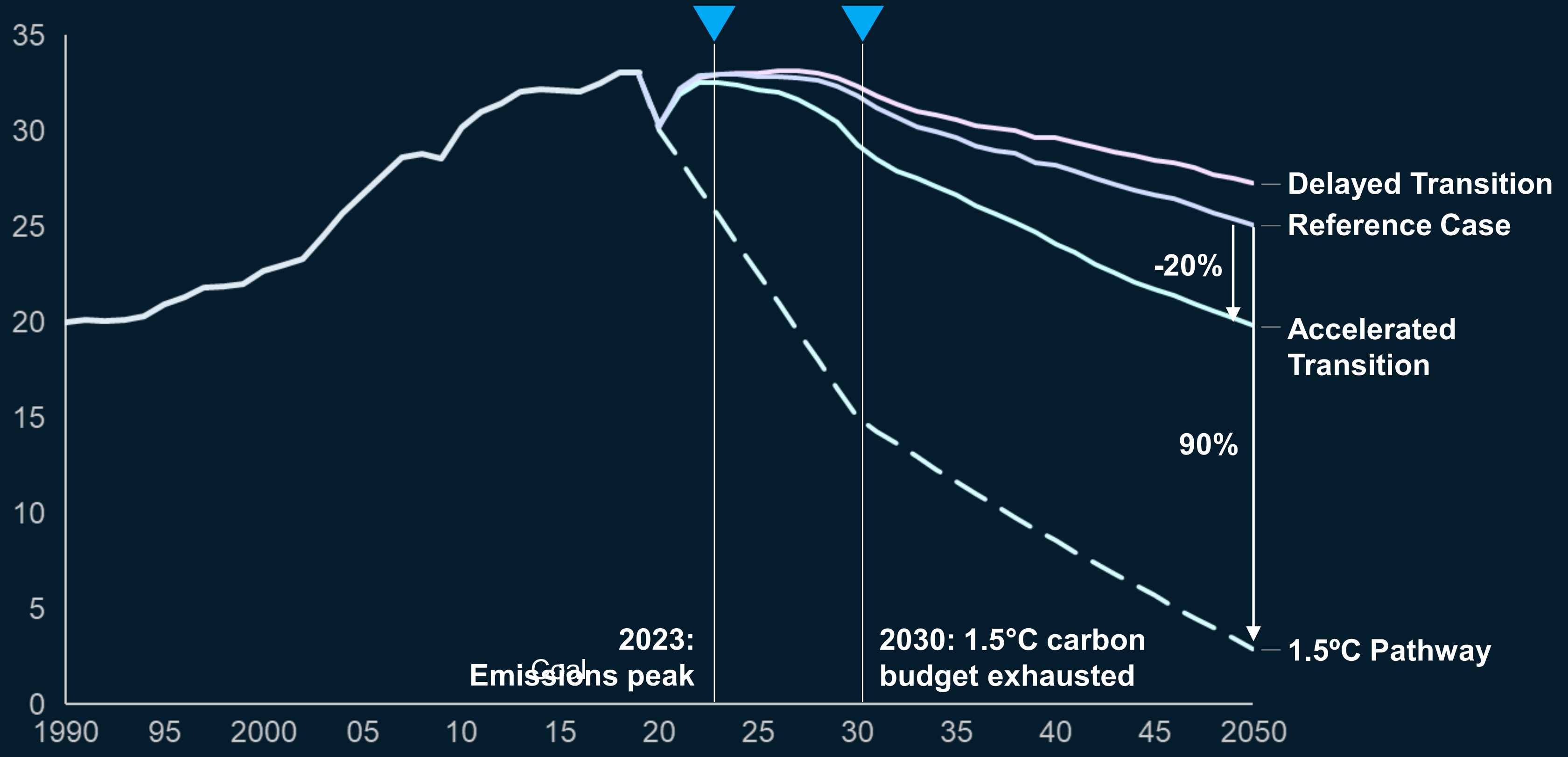
1. Numbers represent global average; 2. Based on trade in large US stock markets, the fossil fuel and renewable power portfolios are constructed based on BICS (Bloomberg Industry Classification System). In specific, the fossil fuel portfolio includes a diverse mix of companies in different parts of the value chain for fuel supply though does not include fossil fuel power generation; the renewable power portfolio includes renewable equipment manufacturers, project developers, green utilities and holding companies of operational projects.

Source: McKinsey Energy Insights Global Energy Perspective 2021, December 2020; Imperial College Business School, IEA, 2020

...but the Net Zero equation does not close today

In the Reference Case, global carbon budget for 1.5°C Pathway is exhausted by 2030

Global gross energy-related CO_2 emissions,
$GtCO_2$ p.a.



Source: McKinsey Energy Insights Global Energy Perspective 2021, January 2021

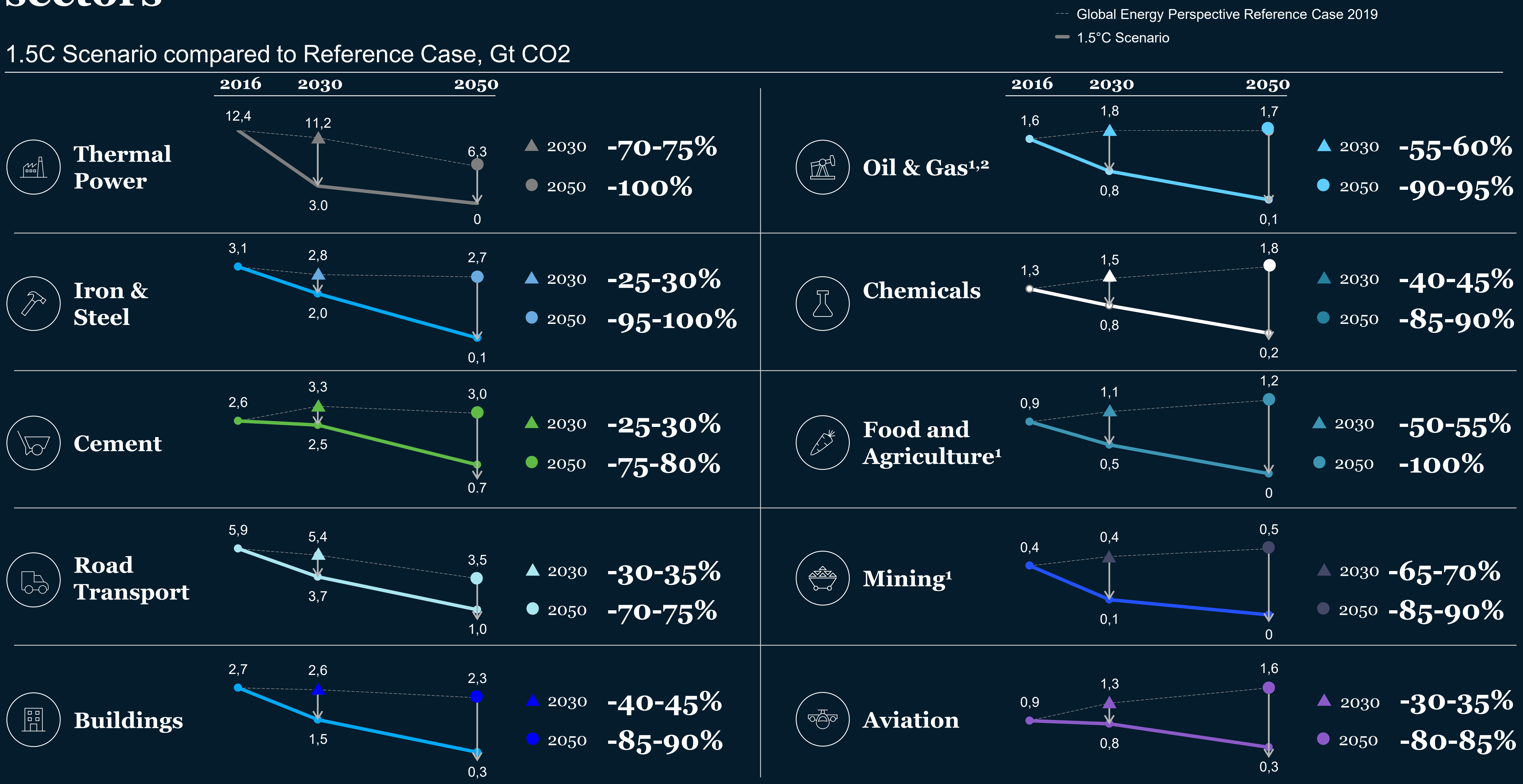
-90%

emissions reduction required to comply with 1.5ºC Pathway

Even though our Reference Case is forward-leaning and progressive compared with other similar Base Case scenarios, this scenario remains far from the 1.5°C pathway

The 1.5C pathway is still possible, but requires stark change across sectors

1.5C Scenario compared to Reference Case, Gt CO2



1. In addition to CO_2 emissions, oil & gas, food & agriculture, and mining sectors are responsible for a significant amount of other greenhouse gases, including methane and nitrous oxide. For more information, see the 1.5°C Sector Infographics in Appendix
2. Includes the emissions related to the production of oil & gas products; does not include the emissions associated with end use combustion Source: Global Energy Perspective – Reference Case 2019; McKinsey 1.5°C Scenario Analysis

Requirements for solving the net-zero equation through an orderly transition

Physical building blocks

1. Technological innovation
2. Ability to create at-scale supply chains and support infrastructure
3. Availability of necessary natural resources

Economic & societal adjustments

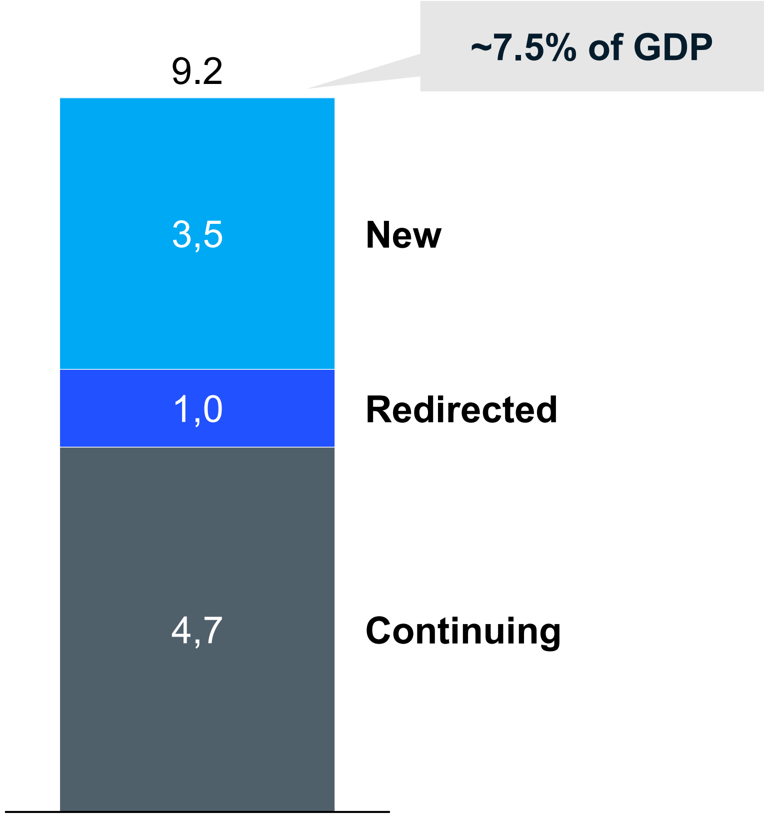
4. Effective capital reallocation and financing structures
5. Management of demand shifts and near-term unit cost increases
6. Compensating mechanisms to address socio-economic impacts

Commitment and enabling mechanisms

7. Governing standards, tracking and pricing mechanisms, and effective institutions
8. Conviction, collaboration, and concerted action by public and private sector leaders globally
9. Support from citizens and consumers

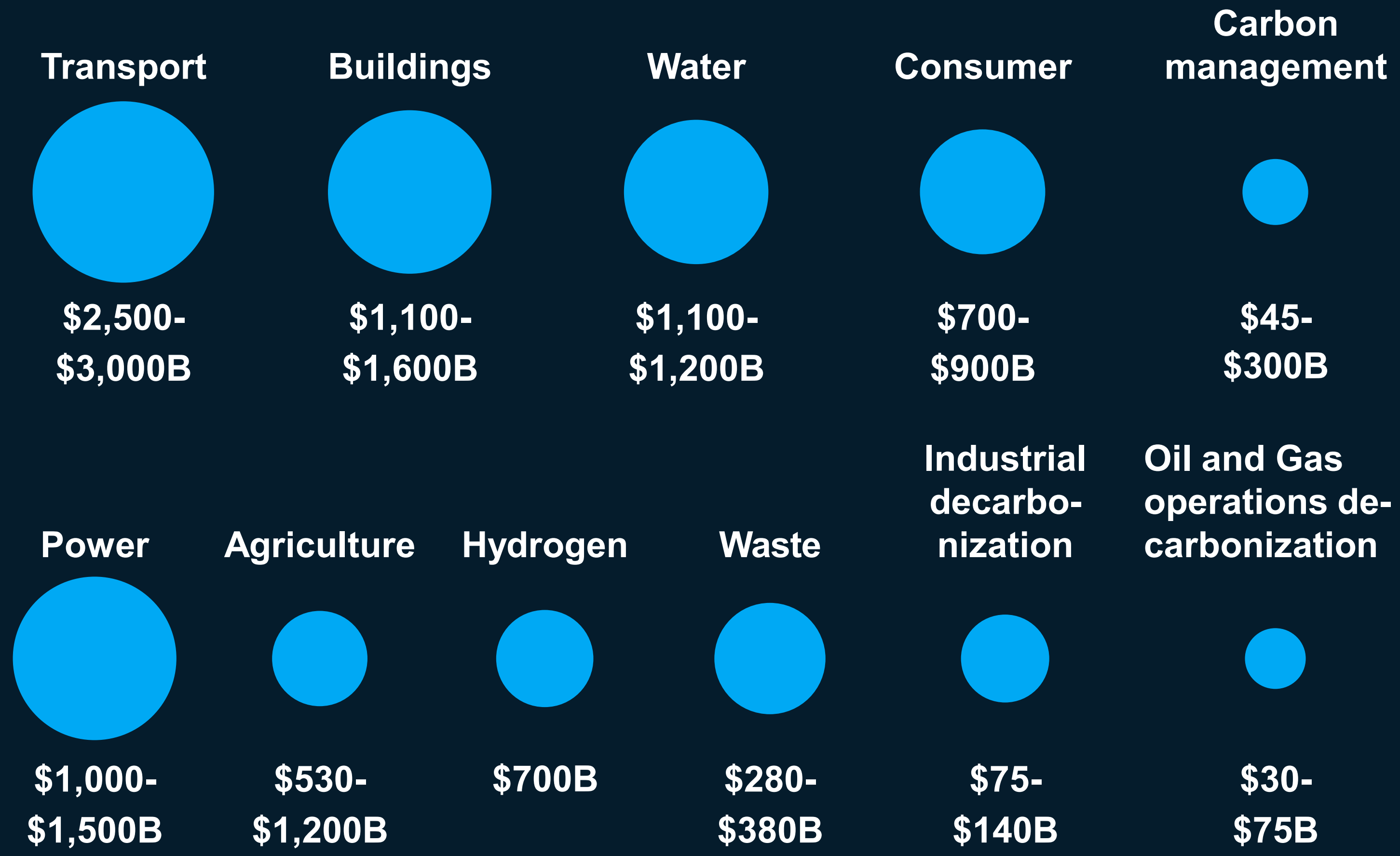
Sustainability transition will require >9 TUSD annual investment…

Global annual investment under a Net Zero 2050 scenario
2020-2050 average in $ trillion



…but also create a 8-11 TUSD sustainable markets opportunity

11 sustainability investment sectors with $8-11 trillion in addressable market value; by 2030, Bn USD



…and is translating into a Materials transition: US example

Example critical materials: Medium-term 2023 DOE US Critical Materials List

2023 DOE medium-term

(currently applies to IRA 48C)

Rare Earths

- Dy
- Nd
- Pr
- Tb

Battery Metals

- Co
- Ni
- Li
- Cu

Other

- Al
- Ga
- Graphite
- Pt
- Ir
- Mg
- Steel (electrical)
- Fl
- SiC
- U
- Si

Source: DOE Critical Materials Strategy and Assessment Documents 2023

Materials transition: EU example – proposals to reach the Critical Raw Materials Act (CRMA) benchmarks

Benchmarks[1]

EU production share of consumption 2030

Extraction
≥ 10%

Processing
≥ 50%

Recycling
≥ 20%

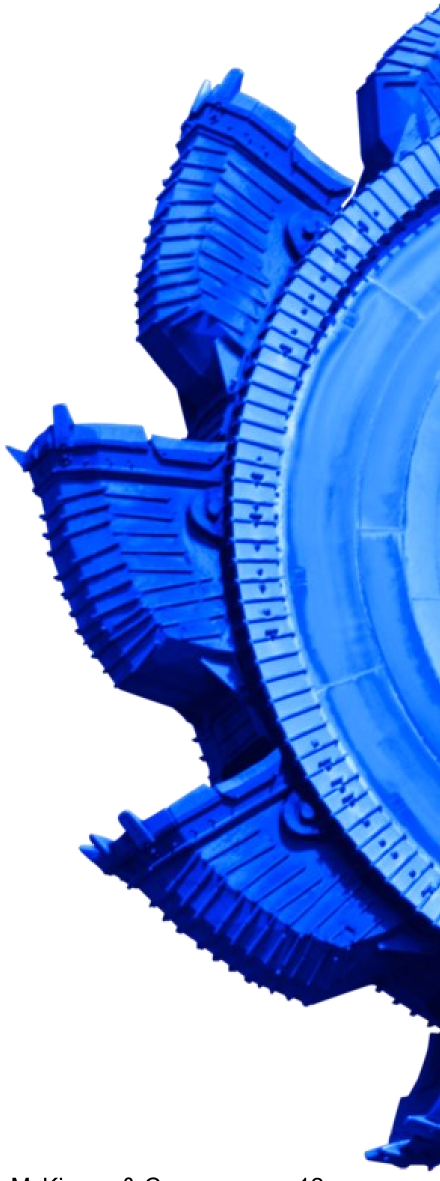
Single country dependency
≤ 65%

Internal actions[2]

Simplify the permitting procedures	Reduce administrative burden and simplify permitting procedures for critical raw materials projects For selected strategic projects (SP)[3], the permit granting process will not exceed: • **24 months** for SP involving extraction • **12 months** for SP only involving processing or recycling
Monitor critical raw material supply chains	Coordinate strategic raw material stocks among Member States Supply chain audits for selected large companies and stress tests for raw materials supply chains
Secure funding	Work with the European Investment Bank (EIB) and other InvestEU-implementing partners to scale up support for investment in the critical raw materials supply chain
Invest in research, innovation and skills	Strengthen the uptake and deployment of breakthrough technologies Establish large-scale skills partnerships and a Raw Materials Academy

International engagement

Diversify the Union's imports of critical raw materials	Engagement in beneficial partnerships with emerging markets and developing economies, notably in the framework of its Global Gateway strategy
Develop trade actions	Establishment of a Critical Materials Club with like-minded countries Strengthening of the World Trade Organization
Develop strategic partnerships	Engagement with reliable partners to promote economic development in a sustainable manner through value chain creation in their own countries



1. Benchmarks apply to the aggregate of strategic raw materials. Determination of aggregate average currently not specified, e.g., simple vs. volume weighted vs. value weighted
2. The proposed measures do not involve new financing rules or resources, but rather aim at coordinating existing financing mechanisms.
3. Projects contributing to build strategic raw materials capacities across all value chain stages, both within and outside of the EU, can apply for the status of “Strategic Project”

Source: Press research

In summary…

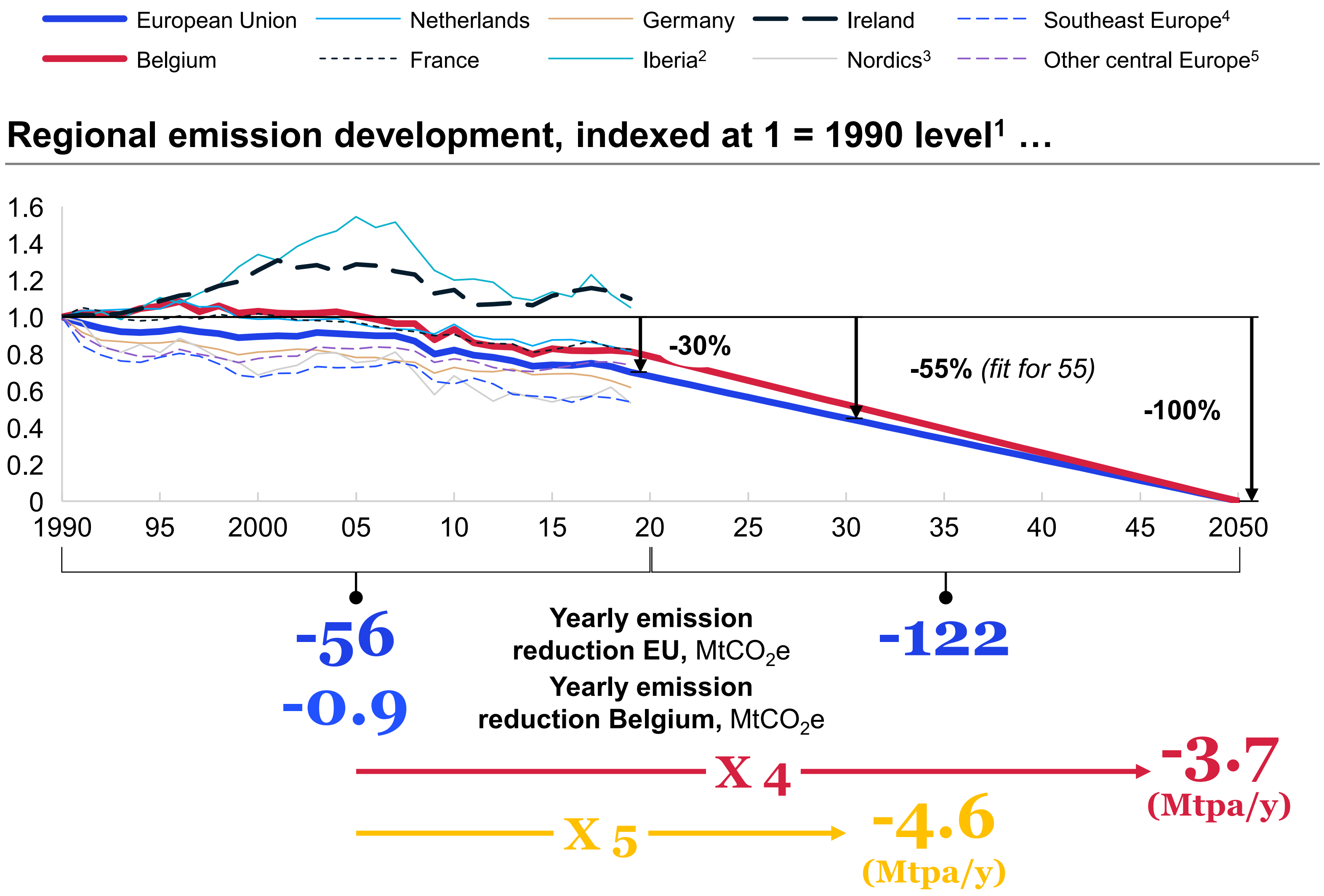
- **Africa is not part of the problem (lowest GHG emissions of all regions globally)**

- **Africa is a key part of the solution**
  - **Enormous potential for Renewable Energy, Green H2 and other Energy carriers**
  - **Key source of critical raw materials to overcome the needed Materials transition**

Backup: EU/ Belgium example

EU and Belgium example – To reach 2050 targets in line with the Paris Agreement, we need to accelerate CO2e reductions 4X faster than in recent history ('90-'19); some promising accelerations however over the last years

Regional emission development, indexed at 1 = 1990 level[1] …



… experiencing promising acceleration over the past years (Belgium example)

+15% Increase in **renewable energy** production, wind and solar, in Belgium between 2021 to 2022

+75% Growth in **electric vehicle** adoption in Belgium between 2021 and 2022

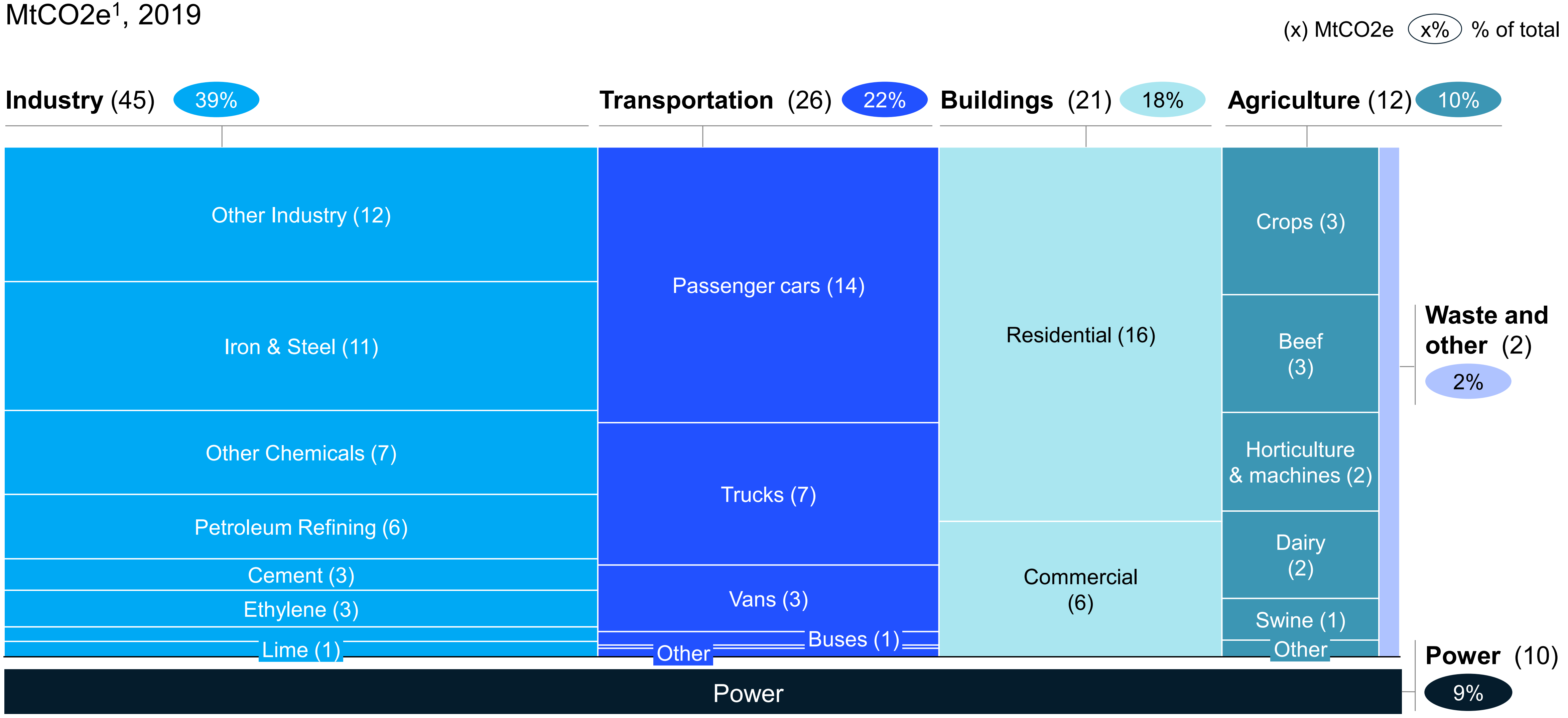
x2 Number of **buildings achieving the highest energy performance certification**, A-label, since 2019

1. Total GHG emissions development as reported by UNFCCC, including LULUCF, excluding international maritime and aviation
2. Spain & Portugal
3. Denmark, Estonia, Finland, Latvia, Lithuania, Sweden
4. Bulgaria, Greece, Romania
5. Austria, Croatia Czech Republic, Hungary, Slovakia, Slovenia

Source: UNFCCC, Statbel, Elia, De Standaard

Belgium example – Industry, transportation and buildings are the major contributors to Belgium's baseline emissions of 116 MtCO2

MtCO2e[1], 2019



1. Excluding International Bunkering (32.5 MtCO2 p.a.) | 2. Land Use, Land Use Change and Forestry

Note: LULUCF effect is not displayed here but has a negative emission (absorption) of 0.3Mt CO2

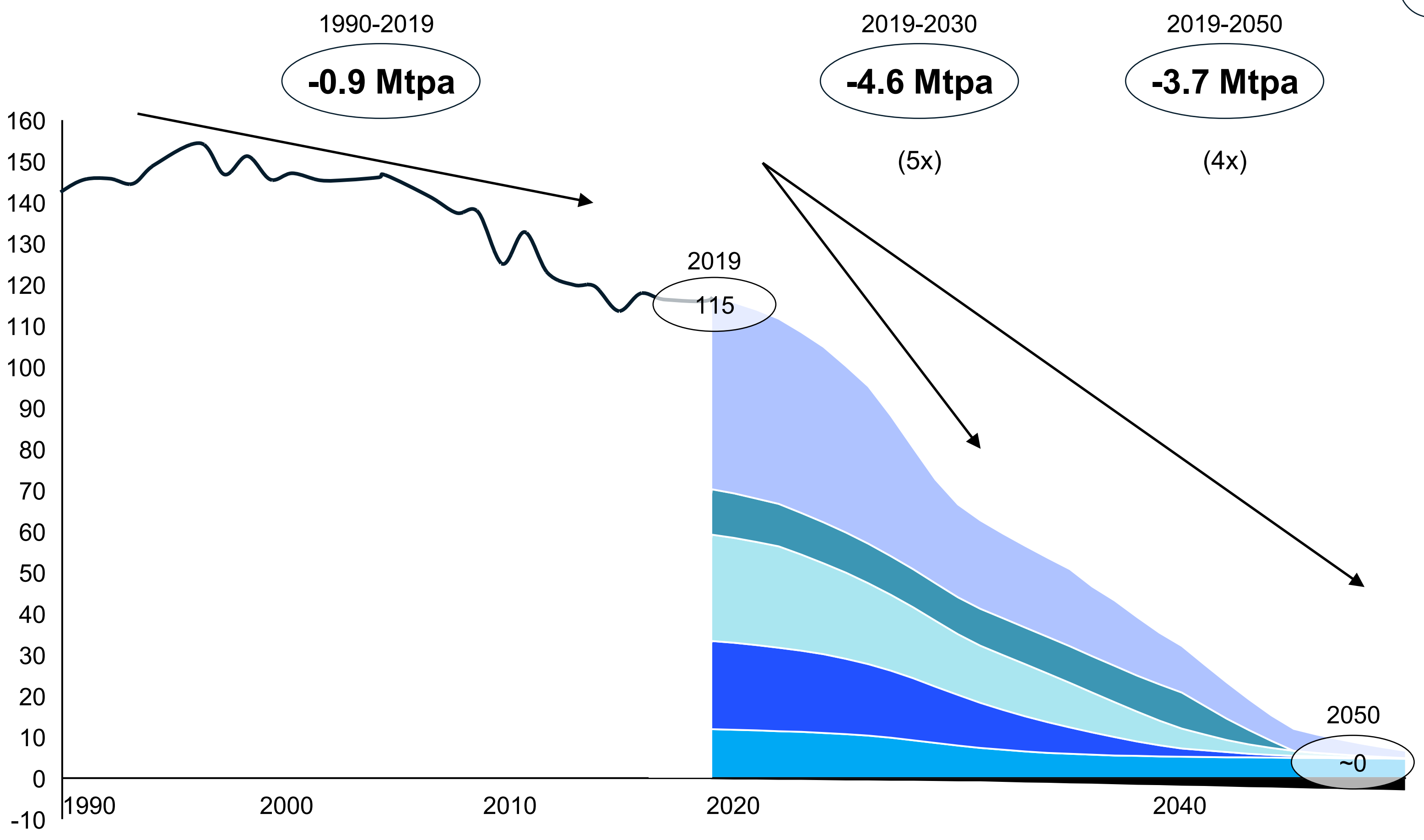
Source: EU DPO Emission Baseline Database

Belgium example – All levers need to be pulled to reach net zero – electrification & technology innovation account for 60% of abatement potential

Illustrated pathway

Industry | Power | Transport | Buildings | Agriculture | LULUCF | Indicative abatement potential vs 2019 baseline, %

Net Zero Pathway Belgium 2019-2050, $MtCO_2$



Key levers

Electrification ~40%
(e.g., indust. heating, transport)

Technology innovations ~20%
(e.g., H2-DRI steel, fertilizers, fuel cells)

Shift to renewable power ~10%

Carbon capture, transport and storage ~10%

Increased efficiency ~10%
(e.g., insulation, district heat)

Reduced activities and demand side measures[3] <10%

1. Incl. waste management and other emissions, 2. Land Use, Land Use Change and Forest, 3. Wind, solar, biomass 3. Including circularity
2.Note: 4Mt CO2 are still left based on our assumptions in 2050; a further analysis will be completed later

Belgium example – Cumulative incremental investment of ~415 b€ , mostly to decarbonize buildings and power

Illustrated pathway - Cumulative incremental investment vs. BAU to reach NetZero incl. infrastructure capital expenditure[2], 2019 – 2050

Neutral
Higher — Lower

Sector	Total abatement 2019 vs 2050, MtCO2	Incremental investment[2], cumulative, b€	Abatement invest.[2] m€ / MtCO2 capacity	OPEX impact of the net zero pathway versus BAU scenario, share of projects
Industry	45	30-45 + 64 = 94-109	650 – 1,000	
Transport	26	48 + 19 = 67	1,850	
Buildings	21	210 + 30 = 240	10,000	
Power	10	112 (64 Industry[5]; 19 Transport[5]; 30 Buildings[5])	11,200	
Agriculture	7	3	430	
LULUCF	3	10	3,300	
Total	116	~415	3,700	

1. Based on ~120 b€ Industrial GDP; **2.** Cumulative CAPEX 2019 – 2050 (includes infrastructure capex for grid, H2, carbon, district heating, EV charging – except for power balancing.); **3.** Increase compared to current ICE car and truck cost weighted average period 2019 – 2025; **4.** Average cost to install 1 GWp of RES (solar, wind), weighted average period 2019 – 2050; **5.** Split of power capex across sectors based on 2050 electricity demand **6.** Incremental OPEX vs BAU for industry highly uncertain - Additional OPEX through CCS technologies, alternative fuels etc. is expected to be compensated by lower energy costs through electrification - Uncertain whether net effect will be positive or negative vs BAU

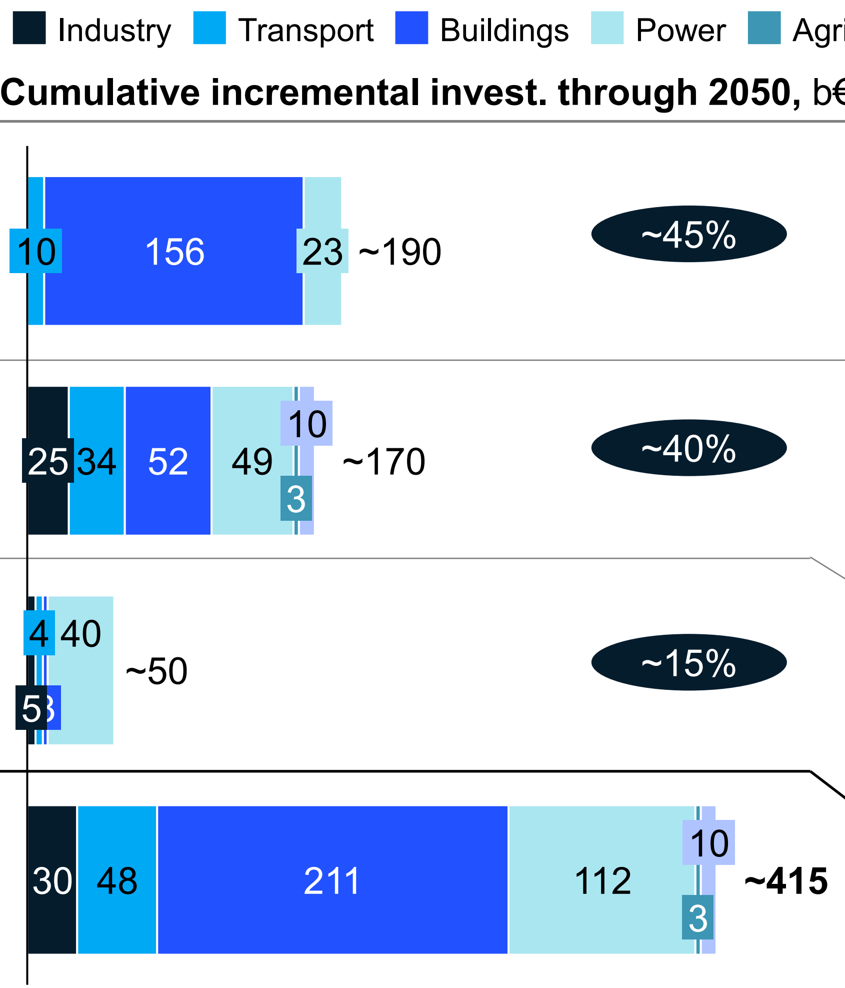
Source: McKinsey Decarbonization Scenario Explorer

Belgium example – Businesses and households will bear the majority of the required incremental investment to achieve net-zero goals

Illustrated pathway (Based on principle that asset owner invests and not including any subsidies)

X% % of total

Investment category | **Cumulative incremental invest. through 2050,** b€ | **Key incremental investment insights & figures**



Households

- Buildings: Installation and other services, heat pumps and ventilation, windows and doors (~156 b€ total)
- Power: Solar system 4.5k€ (~23 b€ total)
- Transport 2k€ EV infrastructure and new cars (~10 b€)

Businesses[1]

- Industry: process updates and equipment (~25b€)
- Transport: fleet decarbonization and charging (~34 b€)
- Buildings: decarbonization of office spaces (~52 b€)
- Agriculture: equipment & machines (~3 b€)
- Power: Wind, solar (~49 b€)
- LULUCF (~10b€)

Central Infrastructure providers[2]

- Power: Power grid (~40b€)
- Transport: Public charging for cars, vans, buses and trucks (~4b€)
- Industry: Hydrogen (~2b€) and CCUS transport (~3b€)
- Buildings: District heating network set up (~3b€)

Total

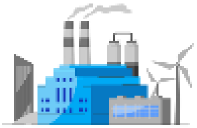
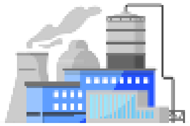
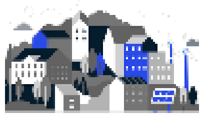
Average investment corresponds to ~2 to 3% of GDP yearly (based on baseline year 2019)

1. Including real estate portfolio of government
2. Power balancing excluded given the high uncertainty of the technology to be used along with its cost.
3. Based on the number of households from 2019 published by Statbel

Costs are mentioned as a range, but the upper limit is used in this analysis

Source: McKinsey Decarbonization Scenario Explorer, Team Analysis, McKinsey Center for Future Mobility

Belgium example – Net zero challenges…

Belgium's key advantages	Net zero challenges
 **Geographic location as a gateway to Europe**	New global flows of **renewable energy, CO_2, hydrogen and green molecules** are emerging, requiring import and transit hubs **36 Mtpa** H2eq. demand by 2050 (~70 €b value pool) in **Western European countries**
 **A strong base of productive industry**	**95% of EU energy demand** by 2050 supplied by renewable energy sources, including hydrogen **Value chain scale-up** depends on materials science innovation and EPC capabilities
 **Infrastructure backbone**	Materials contribute **20%** of GHG emissions Circularity reduces emissions and virgin material demand with EU ambition of **50%** material footprint **reduction** by 2030
	Buildings represent 18% of global GHG emissions **200+ m buildings** in EU need an energy retrofit by 2050
 **Knowledge and talent base**	**Food and ag sector represent ~24%** of global GHG emissions Ag & food **technology innovation** needed to achieve sustainbility transition

…feed into five concrete growth opportunities

5 opportunities for green growth			Opportunity size	
	1	**Establish Belgium as the green gateway to Europe (via infra backbone and green processing hub)**	+6b€	Upside potential for profits from transmission fees, fees, from distributing electricity and from processing green chemicals
	2	**Become a leading provider for clean tech solutions for RES and H2**	~1.1t€	Revenue pool for equipment and EPC services in the RES & H2 value chain, by 2040
	3	**Strengthen and scale leadership position on materials recycling**	1-2b€	Profit pool potential for Belgian players in 9 core materials through maintaining market share by 2040
	4	**Develop service models for Deep Energy Retrofits of buildings**	400b€	Belgian energy retrofit market, cumulative between 2023 and 2050
	5	**Become leader in Ag & Food tech by driving innovation in biotech**	up to 560b€	Addressable market value for food & ag. tech. by 2030