

2024
Edition

Trend Compendium 2050

Megatrend 4

Economics
& Business



Roland
Berger

1048,00	6
1047,70	203
1045,12	117
1042,60	42
1042,56	387
1042,50	280
1042,48	13
1042,12	310
1040,83	
1040,37	
1040,29	
1040,23	

The Roland Berger Trend Compendium 2050 focuses on stable, long-term developments ...

- The **Roland Berger Trend Compendium 2050** is a global trend study compiled by **Roland Berger Institute (RBI)**, the think tank of Roland Berger. Our Trend Compendium 2050 describes the **most important megatrends** shaping the world between **now and 2050**
- Our **trend views are based on most recent studies, data and analyses.** We critically examine the results for relevance, plausibility and reliability
- We deliberately use **publicly available sources** to make our analyses verifiable
- To incorporate today's uncertainties into strategic planning, we recommend **combining the megatrends of the Roland Berger Trend Compendium 2050** with the **Roland Berger scenario planning approach**



Is it worth dealing with megatrends when globally impactful events such as the COVID-19 pandemic or the war in Ukraine are taking place?

Of course! The coronavirus pandemic and the war in Ukraine had far-reaching consequences and deeply affected people, economies, and politics but neither event has derailed the megatrends analyzed herein – such is the inherent nature of megatrends: climate change, societal aging, or technological innovations do not lose their momentum, their direction, or their importance. To cope with such challenges and to master resulting opportunities, our awareness and our understanding of megatrends is vital – not least to develop sustainable answers.

... and covers six megatrends that shape the future development of our world to 2050

1

People
& Society



Population

Migration

Education
& Labor

Values

2

Politics &
Governance



Global
Risks

Geopolitics

Future of
Democracy

3

Environment
& Resources



Climate Change
& Pollution

Biodiversity

Water

Resources & Raw
Materials

4

**Economics
& Business**



Global Economics

Power
Shifts

Energy
Transformation

Debt Challenge

5

Technology
& Innovation



Value of
Innovation

Frontier
Technologies

Humans &
Machines

6

Health &
Care



Global Health
Challenges

Healthcare of
the Future

Caregiving

Trends in economics & business need to be viewed through global lenses considering power shifts, the energy transformation and the debt challenge

Subtrends of megatrend "Economics & Business"

 **4.1**
Global Economics

 **4.2**
Power Shifts

 **4.3**
Energy Transformation

 **4.4**
Debt Challenge

1



Global Economics

2



Power Shifts

3



Energy Transformation

4



Debt Challenge

Trade, foreign direct investments, and global value chains are interconnected and influenced by politics, technology, society, and the environment

Global economics: Key elements and influencing factors



4.1 Global Economics



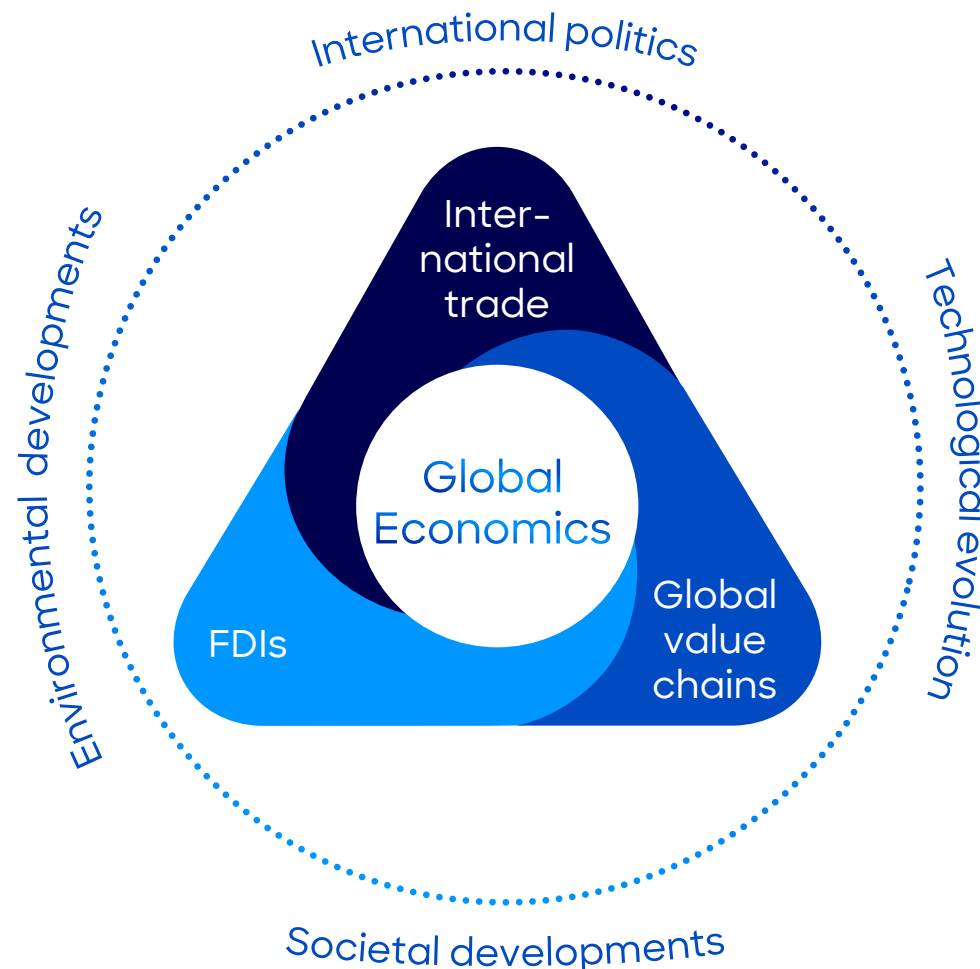
4.2 Power Shifts



4.3 Energy Transformation



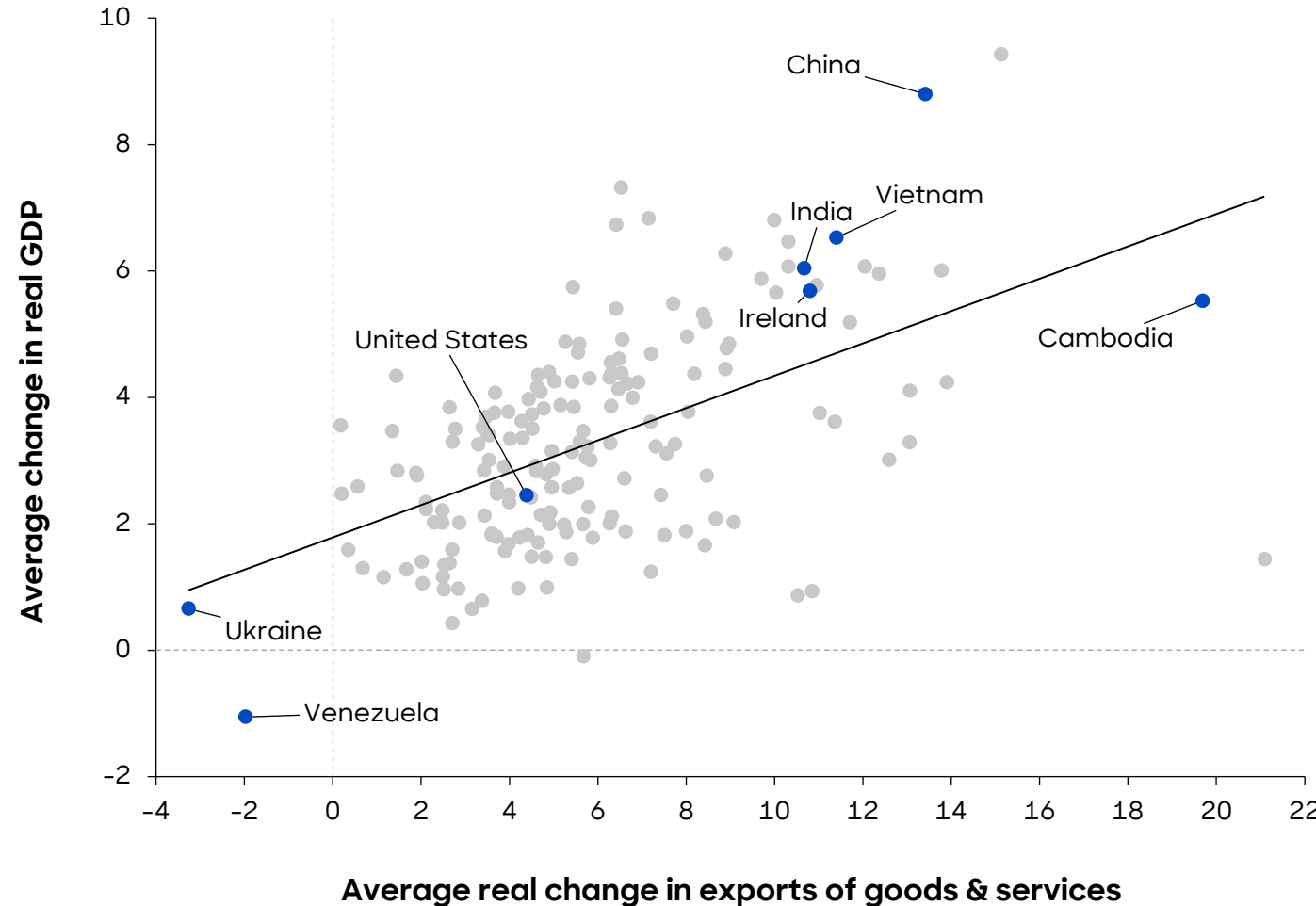
4.4 Debt Challenge



- Analyzing **trends in economics & business** needs to start by looking at **developments in global economics**
- Global economics are characterized by the interplay of **three key elements**, namely **international trade**, **foreign direct investments (FDIs)**, and **global value chains**
- **International trade** concerns the **cross-border exchange of goods and services** on all stages of processing, ranging from raw materials and intermediate products to end products. Functioning international trade is a prerequisite of efficient global value chains
- A **foreign direct investment** is defined as an investment reflecting a **lasting interest and control by a foreign direct investor**, resident in one economy, in an enterprise located in another economy (foreign affiliate). FDIs enable production abroad and are a common way to lower cost and/or be present in a key market, avoid certain transaction costs (e.g. import duties), and get access to technology and/or manpower
- **Global value chains** include **all activities of a company's value chain** that are distributed among multiple entities **across a variety of geographical locations** to bring a product from its inception to its end users
- These three key elements of global economics are driven by **fundamental factors of the economic sphere: international politics** (e.g. restricting trade through protectionism), **technological evolution** (e.g. digitalization), **societal developments** (e.g. changing values that increase demand for regional/local products), and **environmental developments** (e.g. climate change driving the need for FDIs in renewable energy)

Economic growth and trade display a clear correlation: Countries with high rates of export growth tend to have higher GDP growth rates

Average growth rate of real GDP and trade, 1990-2023 [%]



- Looking at more than three decades of country-level data, there is a **notable correlation between economic growth and trade**: countries with higher export growth rates also tend to have higher GDP growth rates
- Although correlations shown here do not establish causality, current economic opinion indicates that **trade has a positive impact on GDP growth**
- Research describes a **positive relationship between trade and growth via three mechanisms**. First, access to foreign markets enables countries to acquire **new technologies**. Second, openness to international trade provides opportunities to exploit **economies of scale** by expanding outputs, while innovations resulting from international trade allow workers to **acquire new skills**. This increases both **productivity growth** and the **variety of goods** produced and consumed. Third, the competitive pressures arising from trade encourage **innovation and factor reallocation**

4.1 Global Economics

4.2 Power Shifts

4.3 Energy Transformation

4.4 Debt Challenge

Since the global financial crisis, globalization appears to be slowing down on an uneven plateau - Its future direction is dividing expectations



4.1 Global Economics



4.2 Power Shifts

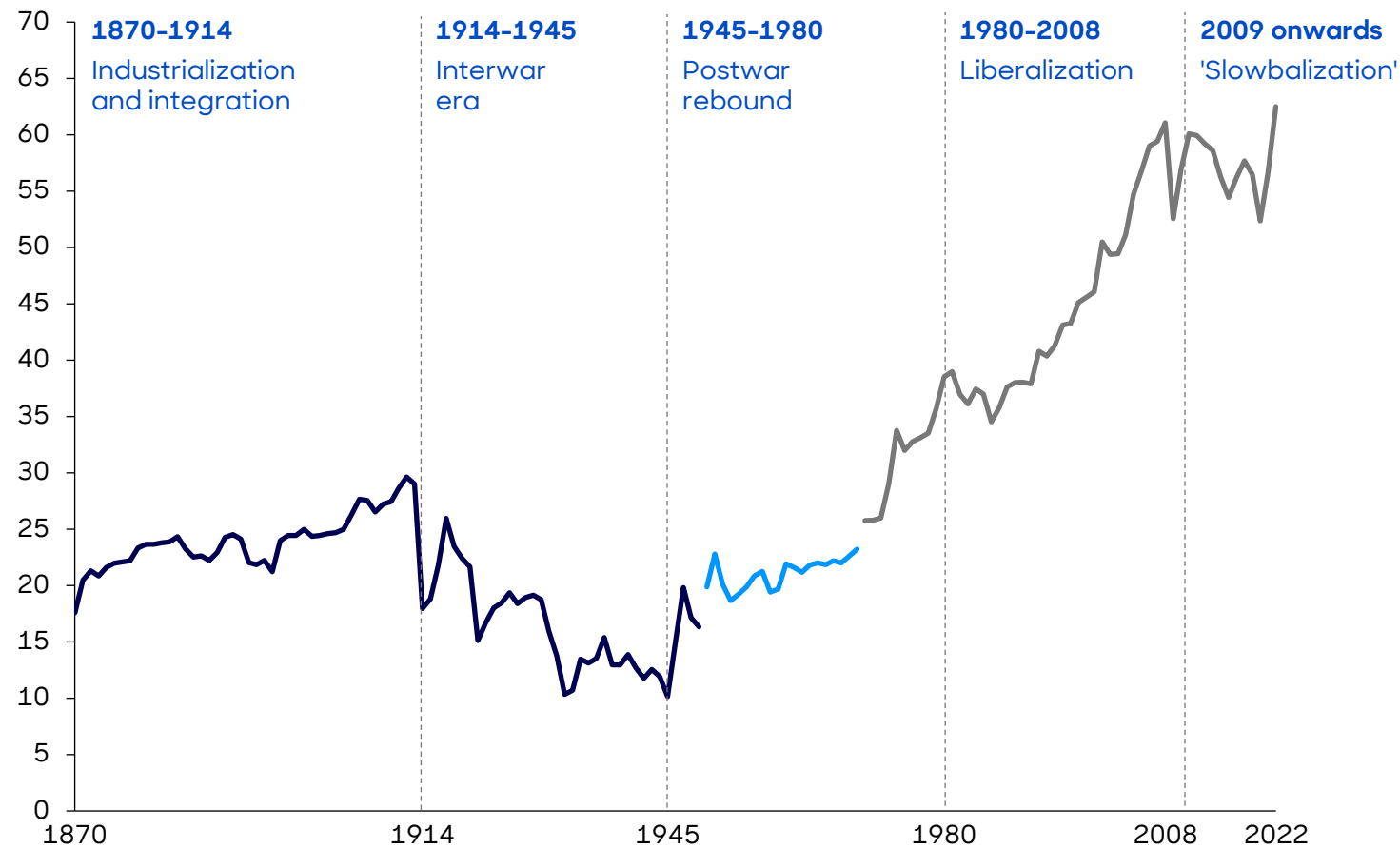


4.3 Energy Transformation



4.4 Debt Challenge

Global trade openness, 1870-2022¹⁾ [%]



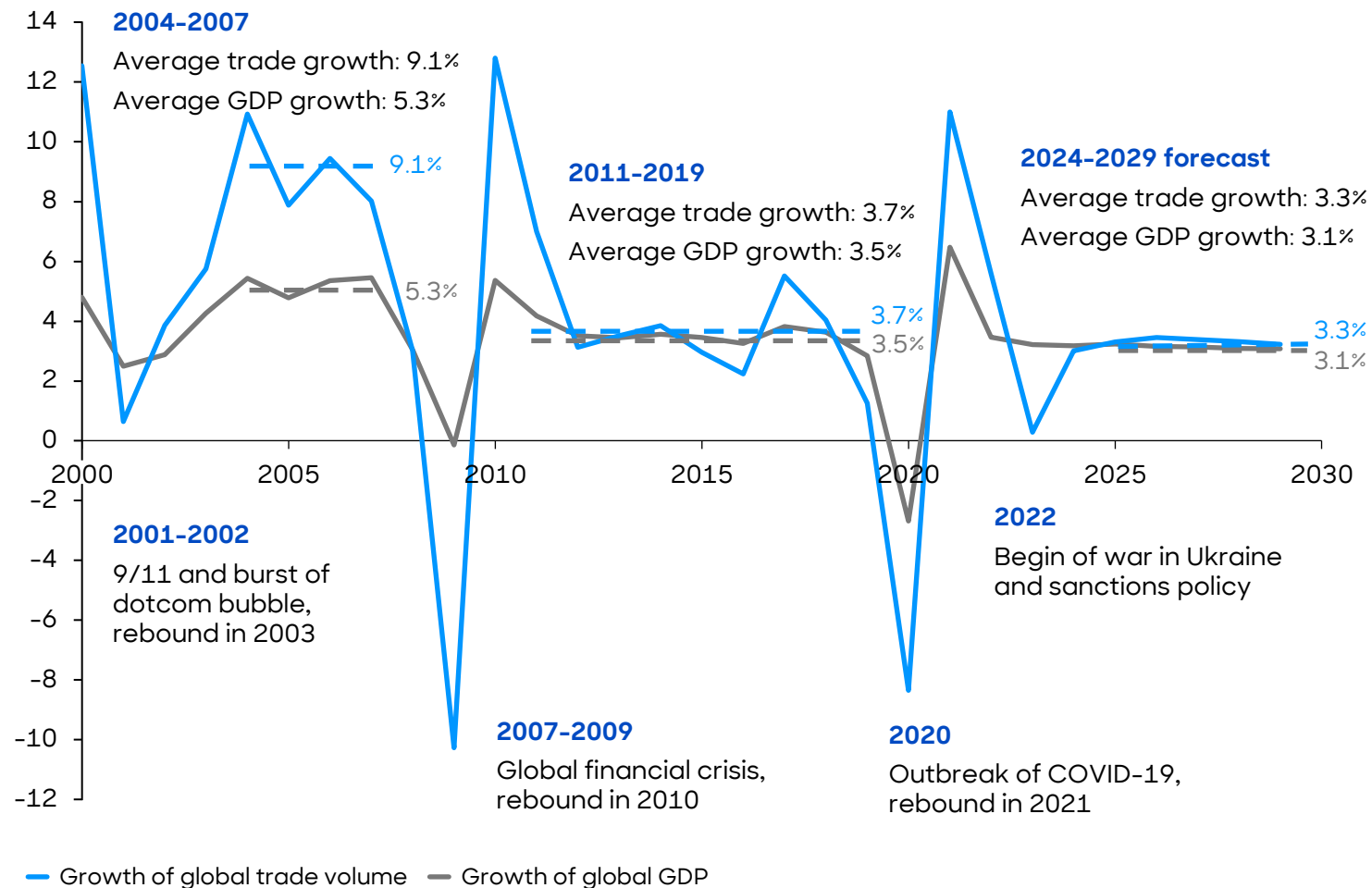
— Klasing and Milionis — Penn World Tables — World Bank

- The term globalization describes the **increasing interconnectedness** of the world's **economies, populations and cultures** caused by cross-border **trade** in goods and services, **technology** and **flows of investment, people, and information**
- The **status of globalization** is often measured by **global trade openness**, an indicator composed of the sum of global exports and imports as a percentage of global GDP
- Over the past 150 years, **globalization** has **mostly** gone through **burgeoning phases** - except for the interwar period, when globalization was in decline for several decades
- The **global financial crisis** of 2007-2009 marks a turning point for flourishing phases of **postwar rebound** followed by trade **liberalization**; since then, a period of so-called **slowbalization** can be observed. **Expectations** about its **future path** are **mixed**: globalization is expected to grow at a comparatively **subdued pace**, some even see a period of renewed **decline** in globalization

1) Sum of global exports and imports divided by global GDP
Source: Our World In Data; Klasing and Milionis; Penn World Tables; World Bank; Roland Berger

In the early 2000s global trade grew significantly faster than GDP but following the global financial crisis their growth rates have converged

Growth of global trade volume and global GDP (real), yoy, 2000-2029¹⁾ [%]



- The speed of **globalization** (measured as the difference between growth of GDP and trade) **reached its maximum in the mid-2000s**: between 2004 and 2007, global trade grew, on average, by 9.1% p.a. (compared to 4.6% between 1980-1989 and 6.7% between 1990-1999)
- **Since the global financial crisis (GFC) trade growth has declined.** Between 2011 and 2019, global trade - at 3.7% p.a. - grew only slightly stronger than GDP (3.5%). Forecasts for 2024-2029 expect global trade growth of 3.3% p.a. and global annual GDP growth of 3.1%
- One **reason** for this development is clear: **globalization is already at a high level.** Therefore, growth rates of global trade are closer to the growth rates of global GDP
- Other reasons include **China's** increased production of **intermediate goods** replacing imports, the slowdown of global economic activity following the GFC, and the increase in **trade barriers** and protectionist measures due to rising geopolitical tensions

1) Trade volume of goods and services (exports and imports)
Source: IMF; BBVA; ECB; Roland Berger

4.1 Global Economics

4.2 Power Shifts

4.3 Energy Transformation

4.4 Debt Challenge

Global trade is increasingly burdened by harmful trade interventions and policies, as countries seek to reduce dependencies

Cumulative number of harmful and liberalizing trade interventions, globally 2010-2023



4.1 Global Economics



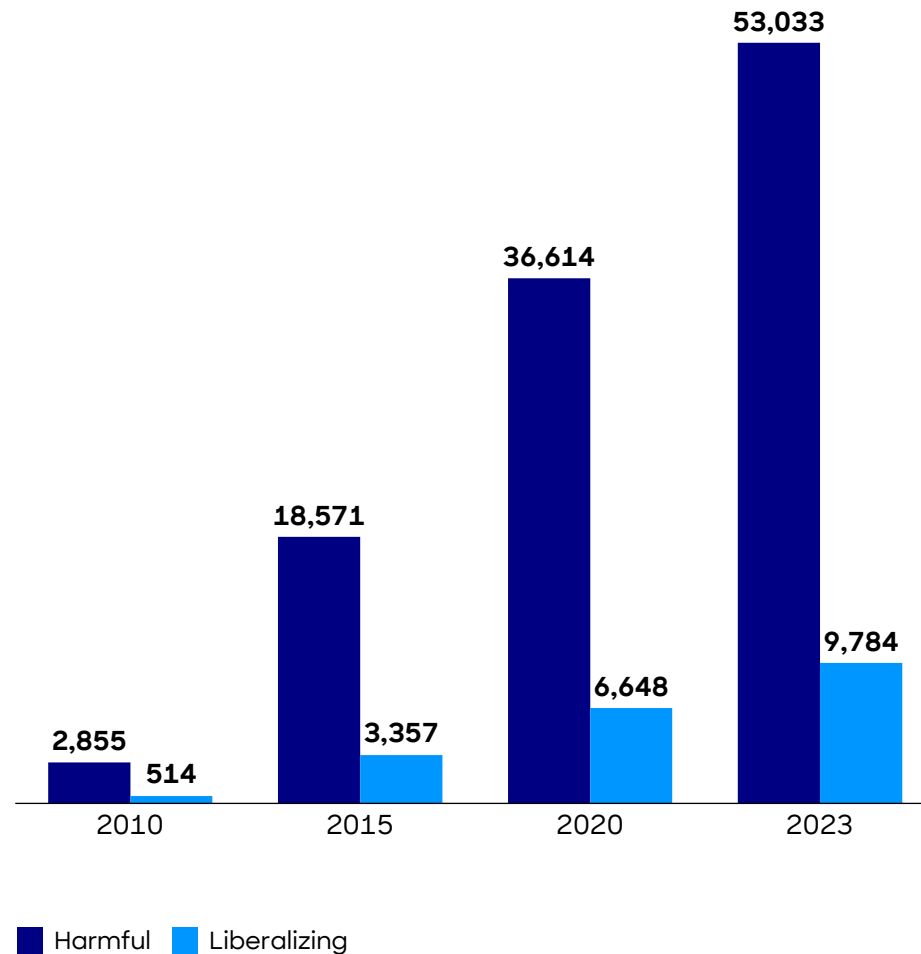
4.2 Power Shifts



4.3 Energy Transformation



4.4 Debt Challenge



Selected policies and interventions placing a burden on free global trade

Geopolitical tensions

Trade wars and sanction policies: impacting global trade. Former US President Trump started imposing steep tariffs on goods from the EU, Canada, Mexico, and China, prompting retaliatory tariffs from these countries. This trade war involved countries using taxes and quotas against each other, escalating tensions while harming economies. In addition, it led to strategic sovereignty policies and subsidies described below

Strategic sovereignty policies

- **China's Dual Circulation Strategy:** putting a stronger focus on domestic consumption. Building on the "Made in China 2025" strategy, China launched the "China Standards 2035" strategy in 2018, which aims to enable the Chinese government and leading tech companies to set global standards for emerging technologies such as 5G, IoT, and AI
- **US Chips & Science Act:** aimed at keeping manufacturing and research of semiconductors in the domestic market, lowering strategic dependence
- **EU Chips Act:** directed at strengthening domestic EU semiconductor market by reducing strategic vulnerabilities from third country imports

Race for green subsidies

- **EU carbon levy:** promoting greener industry by levying a carbon price tariff on polluting imports, disincentivizing imports from less developed countries
- **US Inflation Reduction Act:** promoting a greener economy by falling back on protectionist levers to boost domestic industry and energy transition

Multilateral economic agreements serve as a counterbalance to harmful trade interventions and increased protectionism

Important multilateral economic agreements



4.1 Global Economics



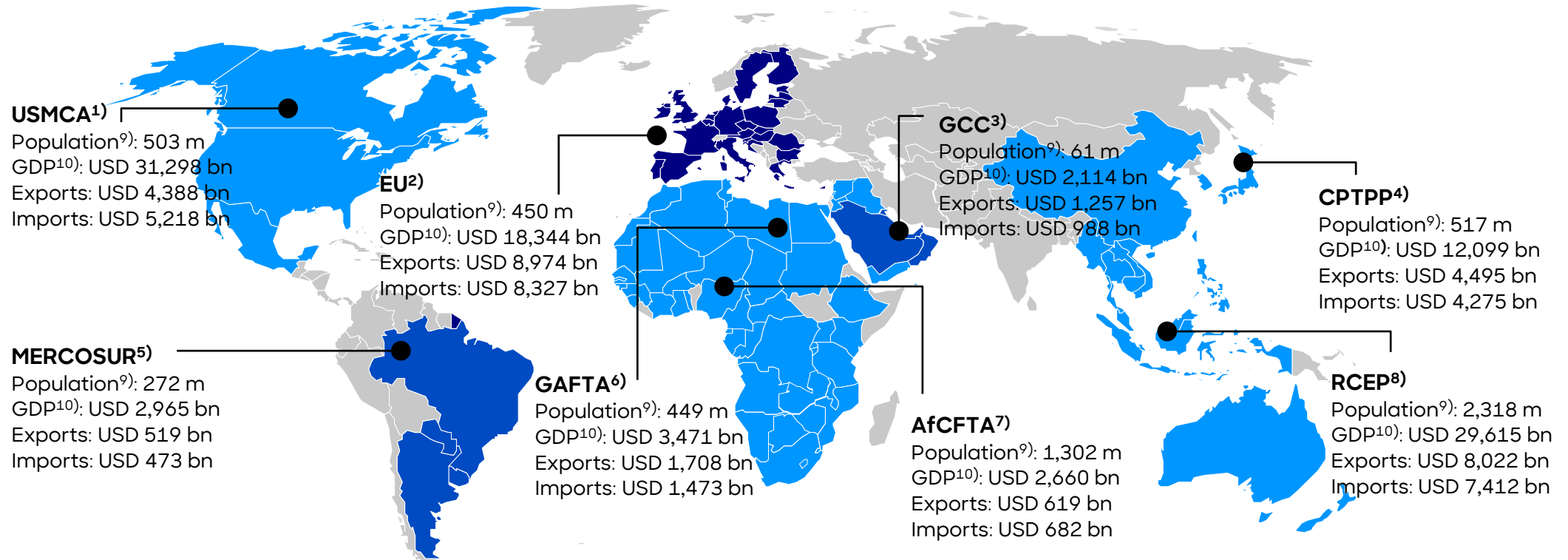
4.2 Power Shifts



4.3 Energy Transformation



4.4 Debt Challenge



■ Economic and political union
 ■ Custom union
 ■ Multilateral free trade area

1) United States-Mexico-Canada Agreement: Canada, Mexico, United States; 2) European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden; 3) Gulf Cooperation Council: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates; 4) Comprehensive and Progressive Agreement for Trans-Pacific Partnership: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, Viet Nam; 5) Mercado Común del Sur: Argentina, Brazil, Paraguay, Uruguay; 6) Greater Arab Free Trade Area: Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates, West Bank & Gaza, Yemen; 7) African Continental Free Trade Area (only countries having ratified the agreement as of July 2024): Algeria, Angola, Egypt, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Dem. Rep. of Congo, Djibouti, Equatorial Guinea, Eswatini, Ethiopia, Gabon, Ghana, Guinea, Kenya, Lesotho, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Sierra Leone, South Africa, Tanzania, Gambia, Togo, Tunisia, Uganda, Western Sahara, Zambia, Zimbabwe; 8) Regional Comprehensive Economic Partnership: Australia, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Myanmar, New Zealand, Philippines, Singapore, South Korea, Thailand, Viet Nam; 9) As of 2023; 10) Nominal GDP 2023

While multilateral economic agreements in Asia/Pacific and Africa cover more people, USMCA, RCEP, and EU lead in GDP and trade

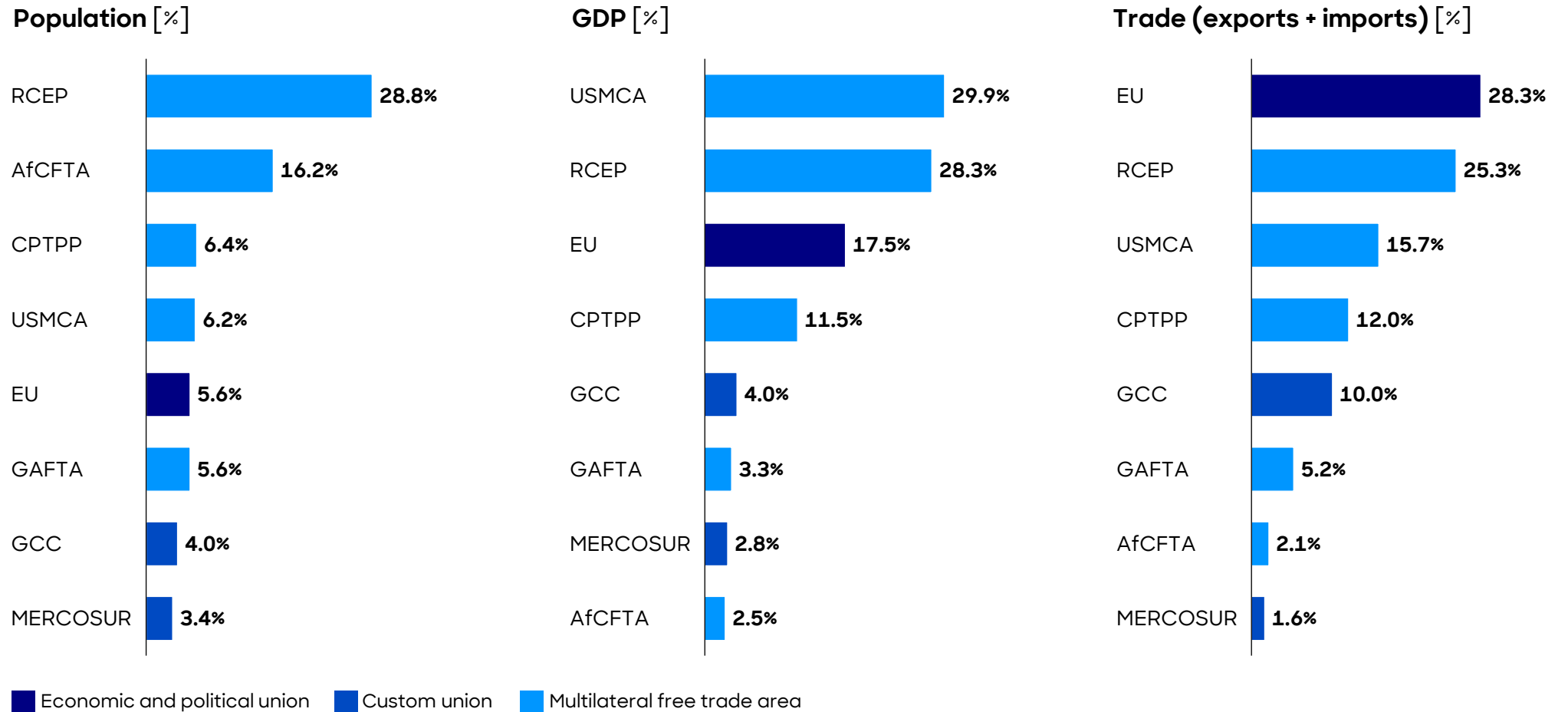
Global shares of selected multilateral economic agreements, 2023¹⁾ [%]

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge



1) RCEP: Regional Comprehensive Economic Partnership; AfCFTA: African Continental Free Trade Area (data includes only countries that ratified the agreement); CPTPP: Comprehensive and Progressive Agreement for Trans-Pacific Partnership; USMCA: United States-Mexico-Canada Agreement; EU: European Union, GAFTA: Greater Arab Free Trade Area; GCC: Gulf Cooperation Council; MERCOSUR: Mercado Común del Sur or Southern Common Market (data excluding Bolivia); overlapping countries between RCEP and CPTPP, CPTPP and USMCA, AfCFTA and GAFTA, and GAFTA and GCC

On January 1st, 2022, the Regional Comprehensive Economic Partnership (RCEP) came into force, creating the biggest trade bloc in history

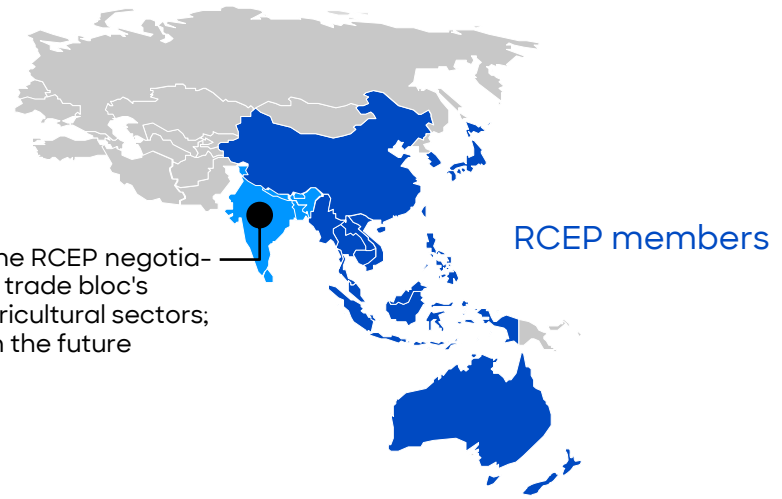
Summary of the RCEP trade agreement

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge



In 2019, India withdrew from the RCEP negotiations over concerns about the trade bloc's impact on its industrial and agricultural sectors; it still has the option to rejoin in the future

Implications

RCEP will establish common rules in areas of

- Investment
- Telecommunication
- Competition
- e-commerce
- Intellectual property

RCEP does not include

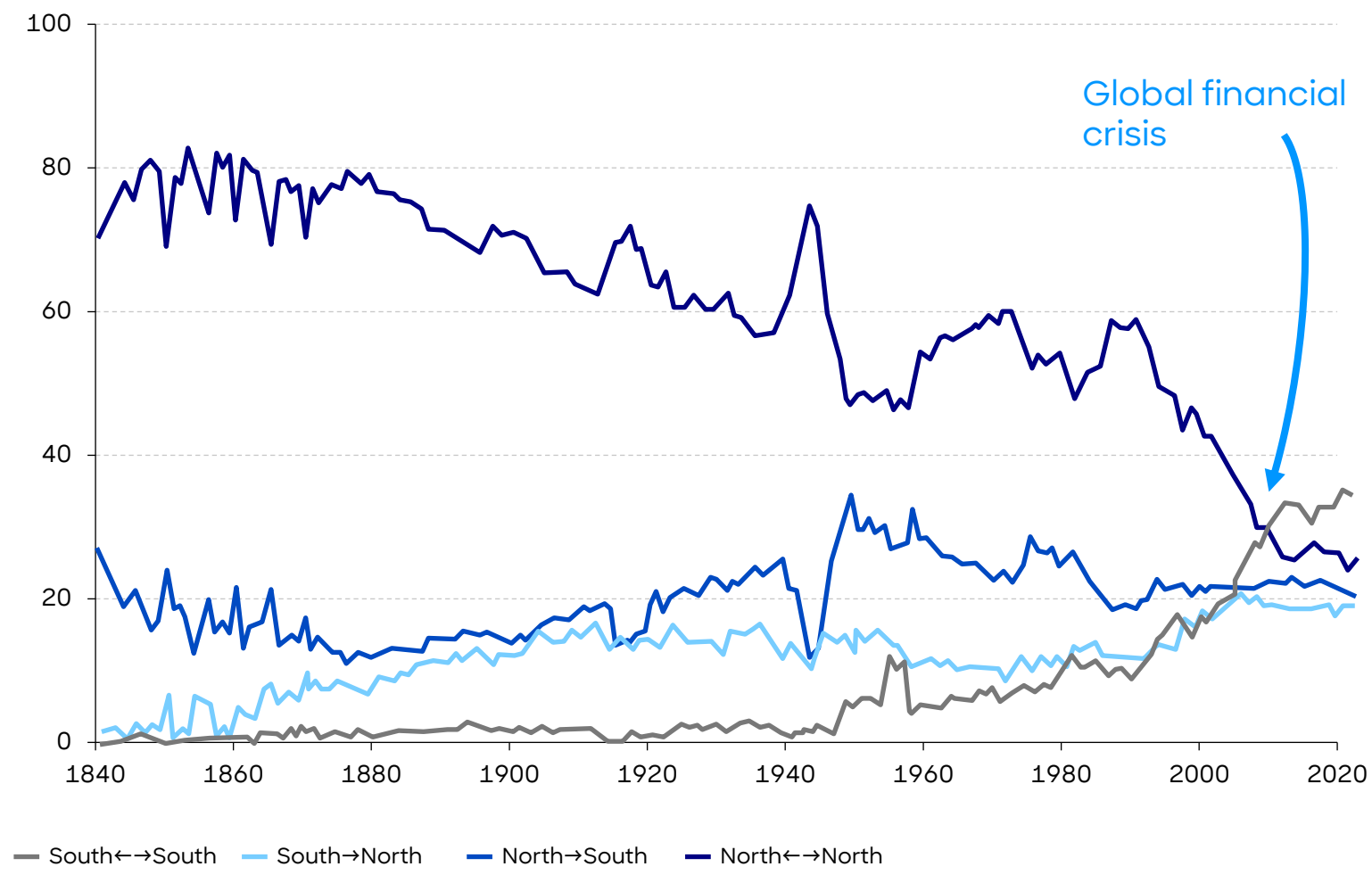
- Labor union provisions
- Government subsidies
- Environmental protection

What is RCEP?

- RCEP is a free trade agreement between **15 Asia-Pacific nations** (including all ASEAN members): Australia, Brunei, Cambodia, China, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, New Zealand, Philippines, Singapore, South Korea, Thailand, Viet Nam
- Members aim to benefit from **lower or complete removal of tariffs** within the next 20 years
- RCEP **surpassed existing Asia-Pacific trade agreements** in population and economic numbers
- As a result of the tariff reduction**, Chinese companies saved about **USD 330 m** out of USD 13 bn of imports under the RCEP in 2023

Countries of the Global North have been trading with each other for a long time, while trading relationships of poorer countries began much later

Share of global exports by income level of trade partners, 1840-2022¹⁾ [%]



- Historically, world trade has displayed uneven relationships among trading partners: the graph shows the share of exports between **different groups of countries**, classified according to their **income levels**
- During the period of **industrialization**, **poorer countries were almost cut off from global trade** and were, at best, supplied by richer countries
- Now as globalization loses momentum, the **structure of global trade flows** also seems to change fundamentally
- While countries of the so-called Global North continue their decline in share of global exports, **South-South trade has surpassed North-North trade** around the time of the global financial crisis
- These developments indicate a **shift in the economic balance of power**: countries in the Global South are catching up, with China leading the way

4.1 Global Economics

4.2 Power Shifts

4.3 Energy Transformation

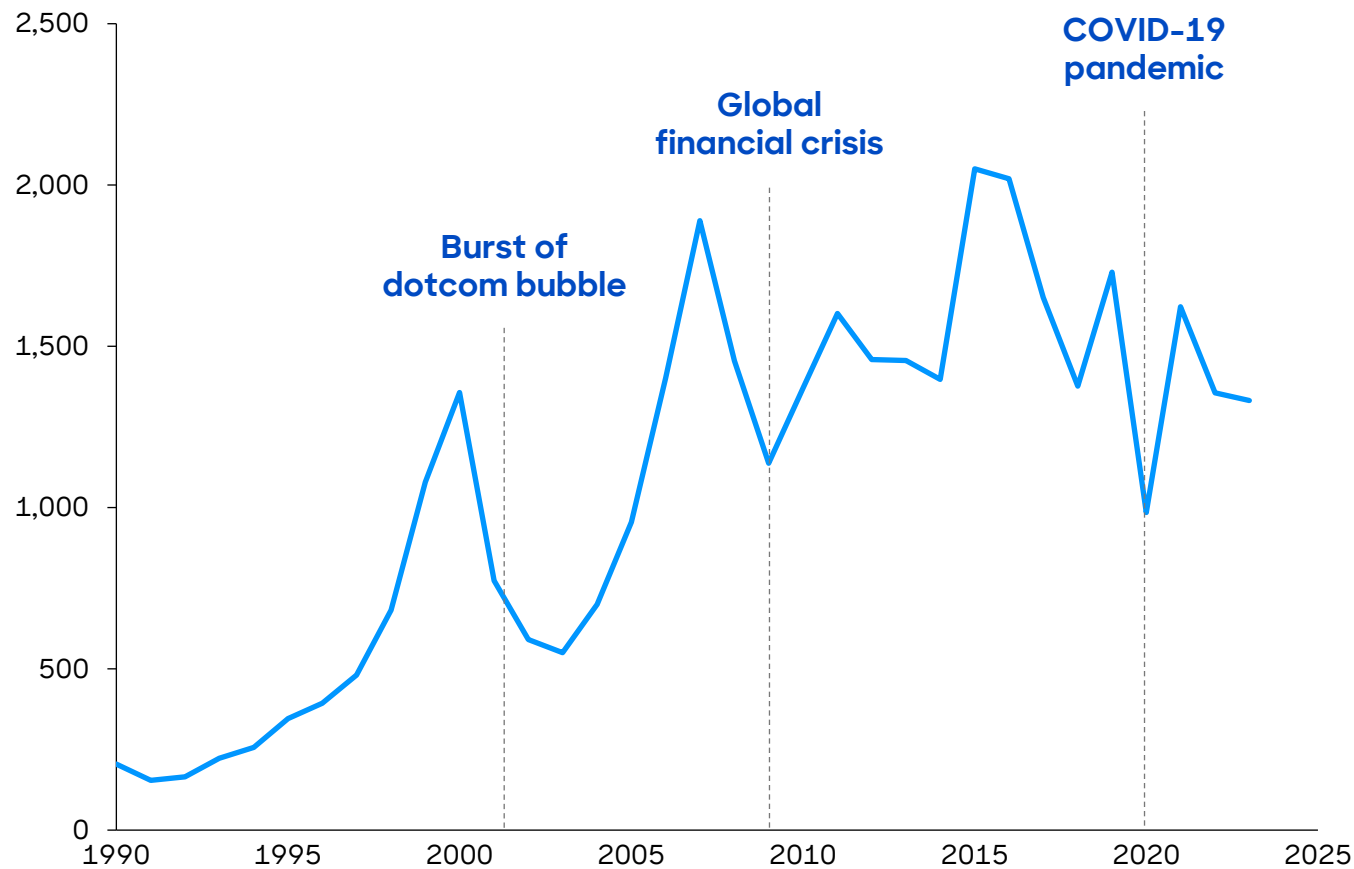
4.4 Debt Challenge

1) According to the source, 'rich countries' include Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. 'Non-rich countries' are all the other countries in the world for which data is available

Source: Brookings; Roland Berger

As global trade slows, so does foreign direct investment – A trend toward more regional value chains is emerging

Global foreign direct investment 1990-2023, inflows¹⁾ [USD bn]



— Global FDI inflows

- One facet of rising globalization is an **increase in foreign direct investment (FDI)**. FDIs are investments by **foreign firms abroad**, either through the establishment of new operations or the (partial) acquisition of an existing business. As such, FDIs are **long-term investments** and **involve elements of corporate control**
- During the **liberalization** period, global **FDI flows increased greatly**. After the **dotcom bubble** and the **global financial crisis**, sharp **declines in FDI followed**. Especially after the latter, FDI flows were much more volatile and settled at lower levels compared to the pre-crisis peak
- In 2023, global FDI flows reached USD 1.33 trillion, down 2% from 2022, but excluding the impact of European conduit economies, **inflows fell by more than 10%**. FDIs to developing economies declined by 7%, while flows to developed economies decreased by 15%
- The decline in FDIs to developed economies was driven by **corporate financial restructuring**, partly due to the imminent global minimum tax on multinationals, and a significant drop in the value of cross-border mergers and acquisitions

1) Due to different calculation methods, FDI data from different sources differ, sometimes considerably
Source: UNCTAD; Roland Berger

4.1
Global Economics

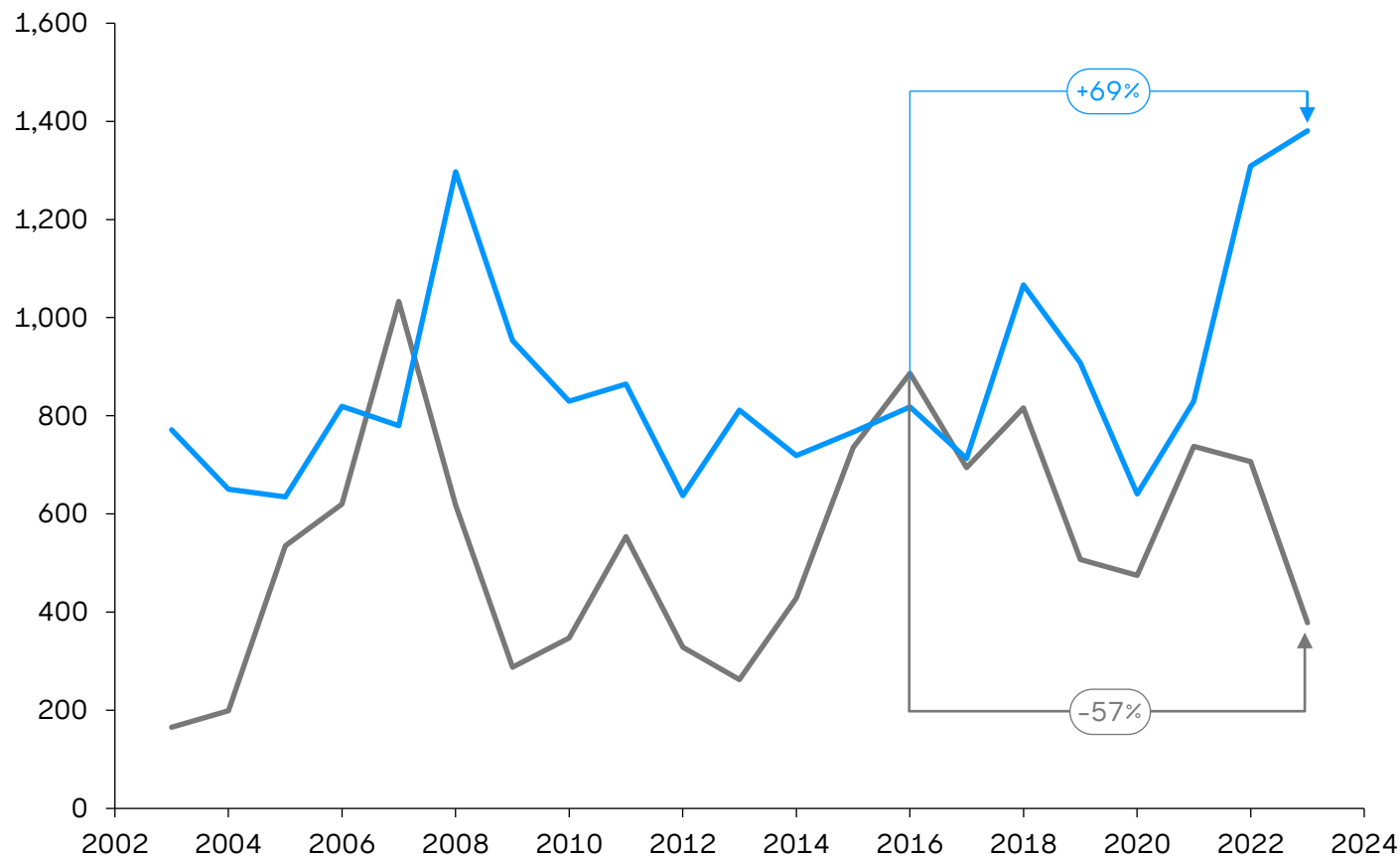
4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

Greenfield investments have surged, offsetting the decline in overall FDI and cross-border M&A amid rising geopolitical risks

Value of net cross-border M&A sales and announced greenfield FDI globally, 2003-2023 [USD bn]



- Overall, foreign direct investment (FDI) flows have seen a slight decrease, but **greenfield investments, a significant component of FDIs, have experienced a notable increase of 69%** from 2016 to 2023
- **Cross-border mergers and acquisitions (M&A) have dropped by 57%** due to increased geopolitical risks, regulatory scrutiny, and rising interest rates
- To **mitigate these risks** and to **diversify their supply chains**, companies are turning to greenfield investments
- **Chinese firms are increasingly investing in Southeast Asia and Mexico** to capitalize on lower labor costs and advantageous trade agreements - a strategy known as geopolitical arbitrage
- These underlying FDI trends show that **globalization is evolving, rather than reversing**, despite indications to the contrary based on global trade openness

— Net cross-border M&A sales¹⁾ — Greenfield projects²⁾

1) Net cross-border M&As are calculated considering sales of companies in a host economy to foreign MNEs. They exclude sales of foreign affiliates (already owned by foreign MNEs) to other foreign MNEs. Divestments (sales of foreign affiliates to domestic firms) are subtracted from the value (number). Totals exclude the financial centers in the Caribbean;

2) Greenfield investment projects refer to a form of FDI whereby a company establishes entirely new operational facilities in a foreign country from the ground up

Source: UNCTAD; Roland Berger



4.1
Global
Economics



4.2
Power
Shifts



4.3
Energy
Transformation



4.4
Debt
Challenge

Historically, FDI flows of the US and the EU have been highly volatile – China demonstrates a consistent pattern of growth in FDI inflows and outflows

FDI in- and outflows in selected economies, 1990-2023

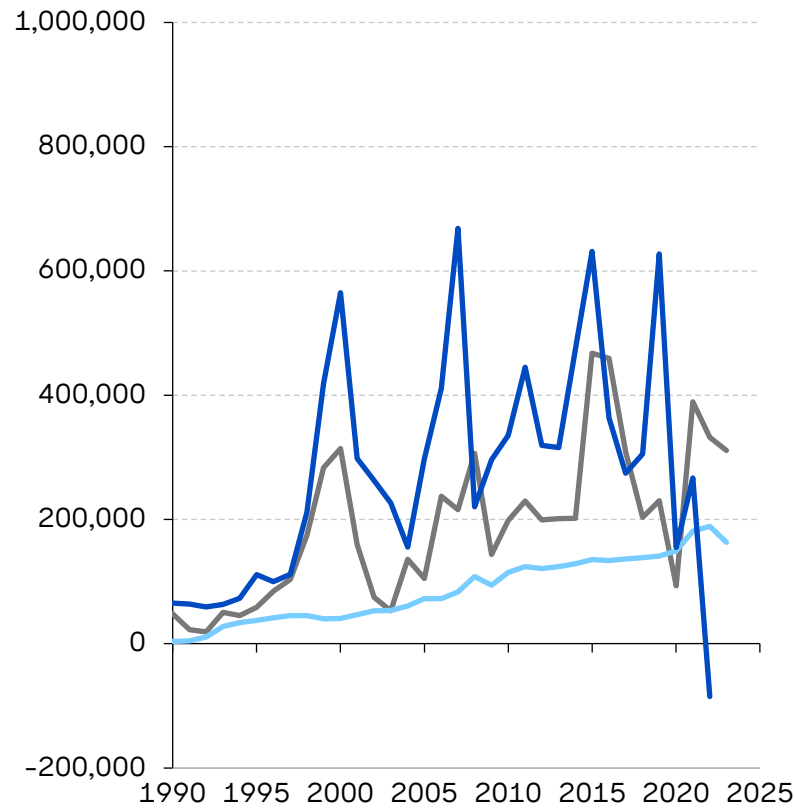
4.1
Global Economics

4.2
Power Shifts

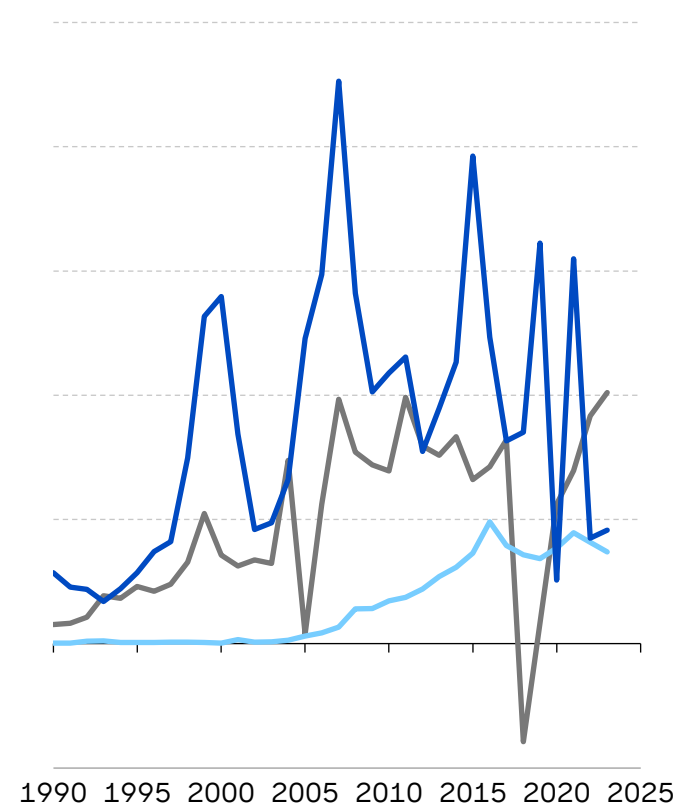
4.3
Energy Transformation

4.4
Debt Challenge

FDI inflows, 1990-2023 [USD bn]



FDI outflows, 1990-2023 [USD bn]



— United States — China — EU

- It is not uncommon for FDI flows to experience **notable fluctuations**. Inflows and outflows are subject to significant volatility, with the potential for negative values. For example, **investors in the EU have demonstrated caution** due to **geopolitical instability, weak economic performance, and high inflation** in the wake of the pandemic and the war in Ukraine
- However, on average over past decades, FDI inflows remain at a **much higher level in developed countries** compared to developing countries
- Starting from a low level, **China has seen a significant and continuous increase in FDI inflows and outflows** since 2005. The rise in outflows has been supported by investments related to the Belt and Road Initiative. Increased investment by Chinese MNEs in overseas production facilities to circumvent trade barriers could **further accelerate this trend in the future**

UNCTAD identifies five major FDI trends – Factors other than economic determinants are playing a more important role in investment decisions

Five major FDI trends according to UNCTAD



4.1 Global Economics



4.2 Power Shifts



4.3 Energy Trans- formation



4.4 Debt Challenge

01

Foreign investment struggles to keep up with production and trade

- The growth of foreign direct investment (FDI) and global value chains (GVC) is **no longer in sync** with GDP and trade expansion
- This divergence points to **a substantial transformation** in the global economic landscape

02

Services increase their weight in foreign direct investment

- In the period of 2004 to 2023, cross-border greenfield projects in **services rose from 66% to 81%**
- Investment in **services within the manufacturing** sector **almost doubled**, reaching approximately 70%, a development fueled by technological progress

03

Geopolitics plays a growing role in investment decisions

- Due to rising geopolitical tensions, greenfield investments are **shifting away from geopolitically distant to more aligned countries**
- Trade wars have reduced cross-border greenfield projects between geopolitically distant countries **from 23% in 2013 to 13% in 2022**

04

Seeing green: Foreign investment in environmental technologies soars

- **Cross-border greenfield environmental technology projects** in non-service sectors as a percentage of total greenfield projects **increased from 1% to 20% over the past 20 years**
- FDI in manufacturing electric vehicles and batteries has grown by **27% per year** from 2016 to 2023

05

Foreign investments in LDCs are being marginalized

- The share of greenfield FDI projects in least developed countries (LDCs), measured as a percentage of all greenfield FDI projects in developing countries, has fallen from **3% in the mid-2010s to 1%**
- Over the past two decades, FDI in LDCs and lower-middle-income developing countries has decreased by **13 percentage points**

FDI growth is trailing behind production and trade, indicating a major shift in the global economic landscape

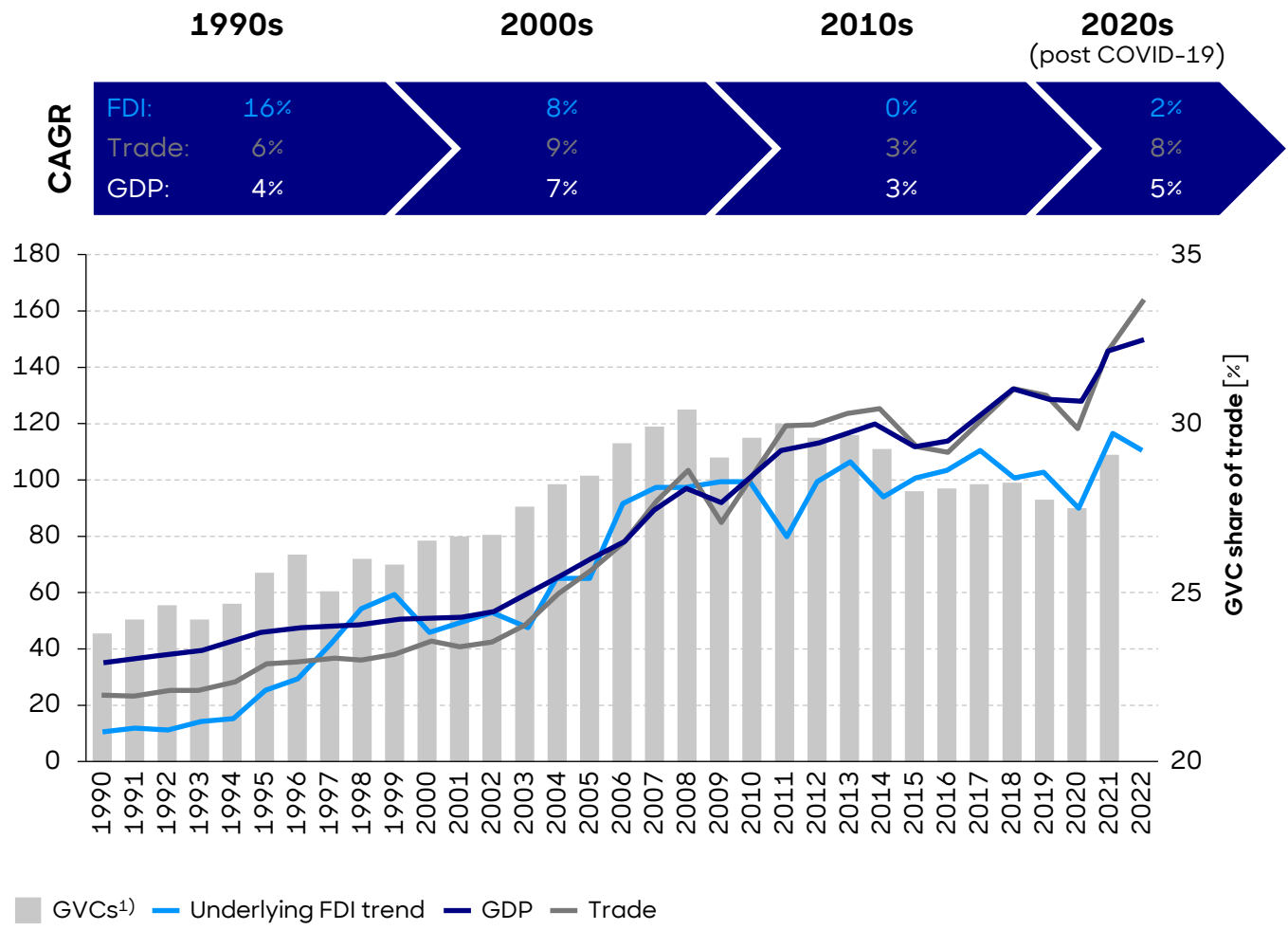
FDI, GDP, and trade trends (index, 2010=100)

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

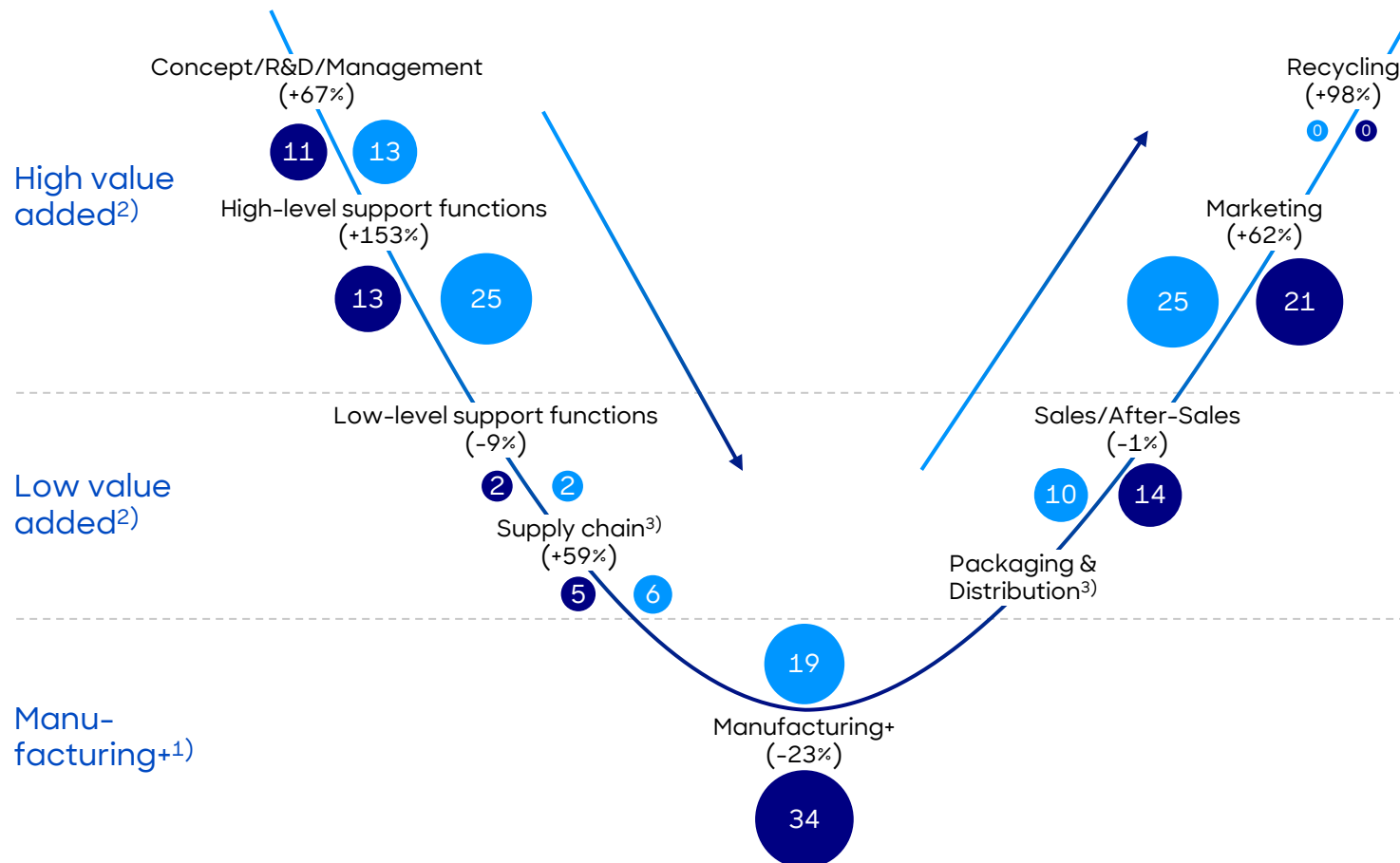


- Foreign direct investment (FDI) and global value chain (GVC) growth are **no longer in sync** with GDP growth and trade expansion - signaling a **substantial transformation** of the global economic landscape
- This trend shows that investors are becoming **more cautious** due to the interconnected shifts in global production and supply chains, the increase in **protectionist policies**, and **heightened geopolitical conflicts**
- GVCs have seen significant changes, moving away from offshoring and fragmentation trends toward **more localized production** and **reintegration** of previously outsourced processes
- This shift is driven by **technological advancements** such as robotics, supply chain digitalization, and additive manufacturing, alongside **policy changes** and sustainability concerns
- These technologies are reshaping production, while new policies, including **protectionism and sustainability initiatives**, are adding to the transformation of the FDI landscape
- In the future, **developing countries** are especially **at risk of falling further behind** due to their heavy reliance on FDIs for economic growth

1) The GVC share of trade is proxied by the share of foreign value added in exports
Source: UNCTAD; Roland Berger

While greenfield investments have traditionally focused on manufacturing sites, investment abroad is now also aimed at service functions

Distribution of cross-border greenfield projects across stages of production [%]



● Share in total number of projects 2004-2007
 ● Share in total number of projects 2020-2023
 (%) Growth rate, number of projects

1) "Manufacturing+" includes "Manufacturing" and "Other non-services" activities. The latter group comprises the following categories: construction, electricity, extraction, and infrastructure;
 2) Value added in non-manufacturing stages; 3) Figures for "Supply chain" also cover "Packaging & Distribution"

- The smile curve depicts the **shift in global investments from manufacturing to services** with increasing focus on high value activities at either end of the curve - both upstream (pre-production) and downstream (post-production)
- **Low-value, efficiency-seeking FDI projects**, which used to serve as common entry points for developing countries into global value chains (GVCs), are **now on the decline**
- **Higher-value, service-oriented**, and more **knowledge-intensive** stages of production at the upper ends of the smile curve are becoming the **focus** of investment, with **access largely limited to advanced and emerging economies**
- Due to this shift, low-income countries - still at an early point in their global value chain development - face **significant challenges**

4.1 Global Economics

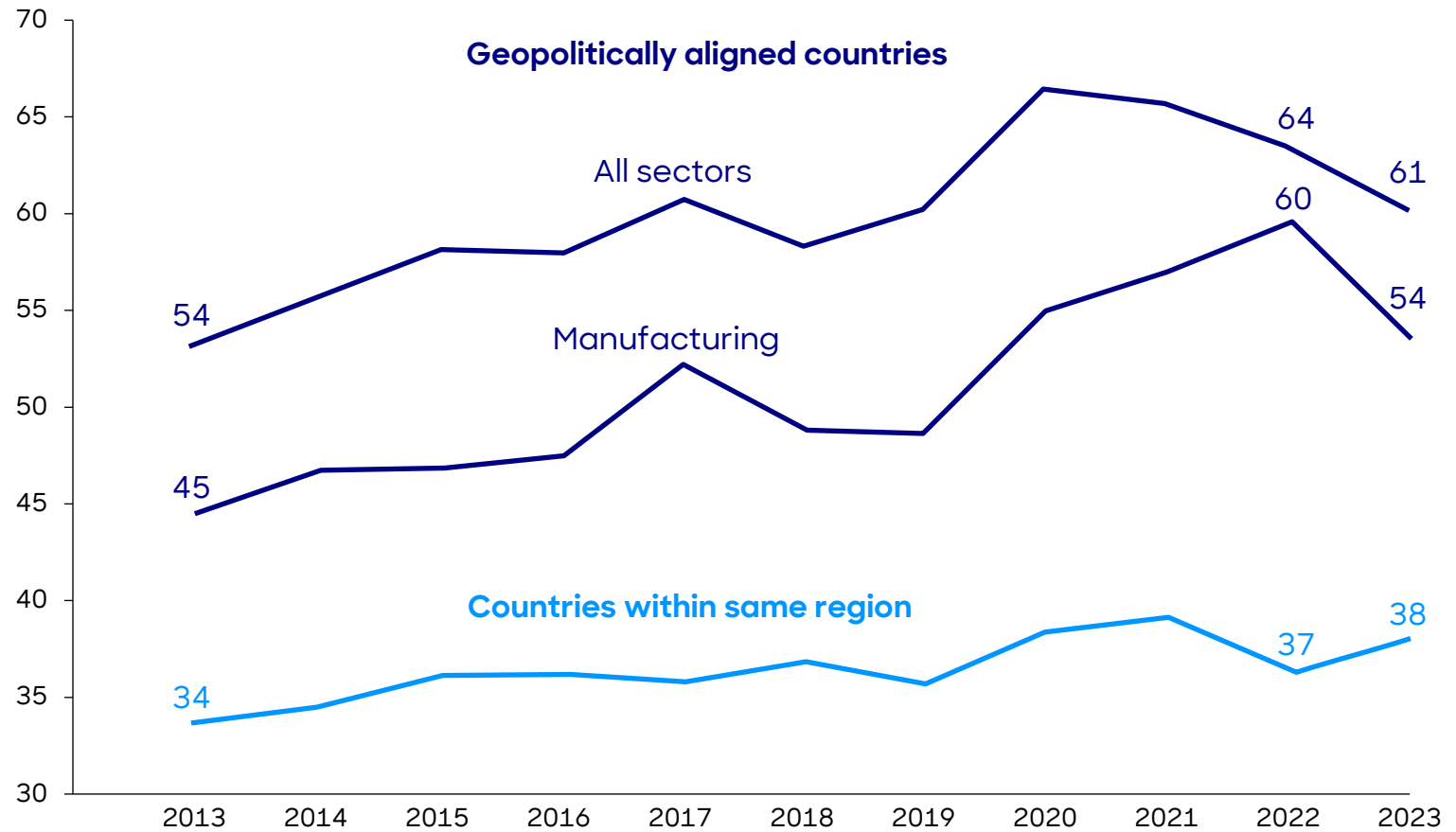
4.2 Power Shifts

4.3 Energy Transformation

4.4 Debt Challenge

Geopolitics is increasingly important in FDI decision making, as the share of investment between geopolitically aligned countries appears to be a trend

Cross-border greenfield projects between countries that are "geopolitically aligned" vs countries within the same region, 2013-2023¹⁾ [%]



- Over the past decade, with the increase in global conflicts and political crises, **traditional investment patterns** began to weaken, resulting in unsteady investment relationships and **reduced opportunities for strategic diversification today**
- According to UNCTAD data, geopolitical alignment is becoming ever more important compared to physical proximity when it comes to FDI decision making: the **share of greenfield investment flows between geopolitically aligned countries increased** from 54% in 2013 to 64% in 2022 - distinctly **outpacing the increase between geographically close countries**
- Data for 2023, although lower regarding the former, still **supports this decade-long trend overall**
- Manufacturing investment projects were particularly affected in the late 2010s, when **trade tensions between China and the US escalated** during the Trump administration

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge


1) The assessment of geopolitical alignment is based on United Nations voting patterns
Source: UNCTAD; Roland Berger

As concerns about climate change increase, FDI in environmental technologies are growing, particularly in battery and vehicle manufacturing

Number of cross-border greenfield projects in environmental technologies and manufacturing of batteries and EVs, 2016 and 2023¹⁾

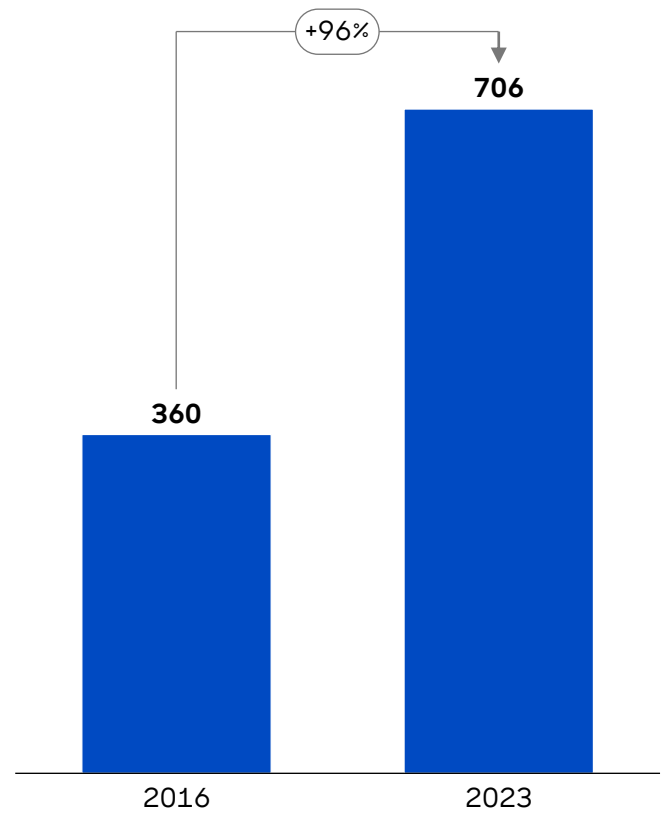
 **4.1**
Global Economics

 **4.2**
Power Shifts

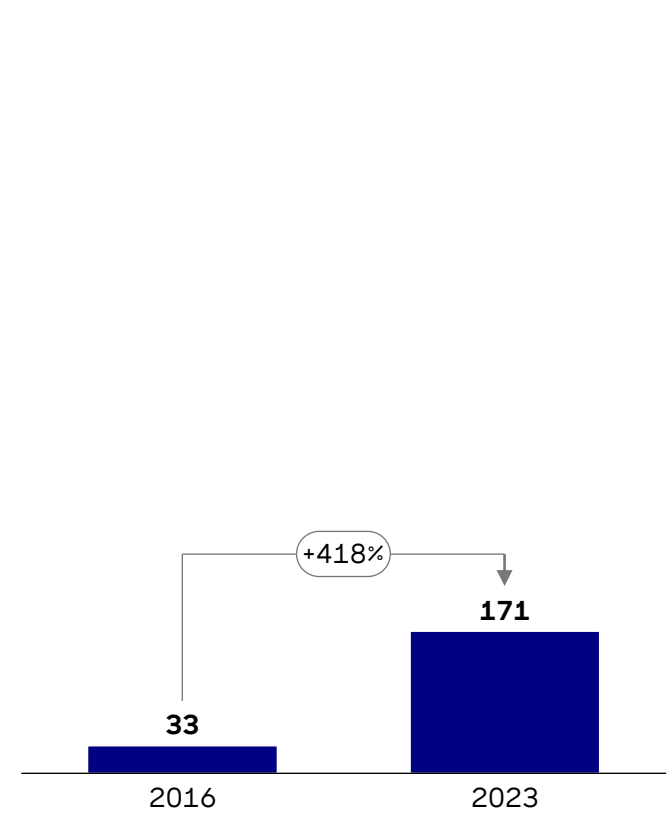
 **4.3**
Energy Transformation

 **4.4**
Debt Challenge

Environmental technologies



Batteries and electrical vehicles



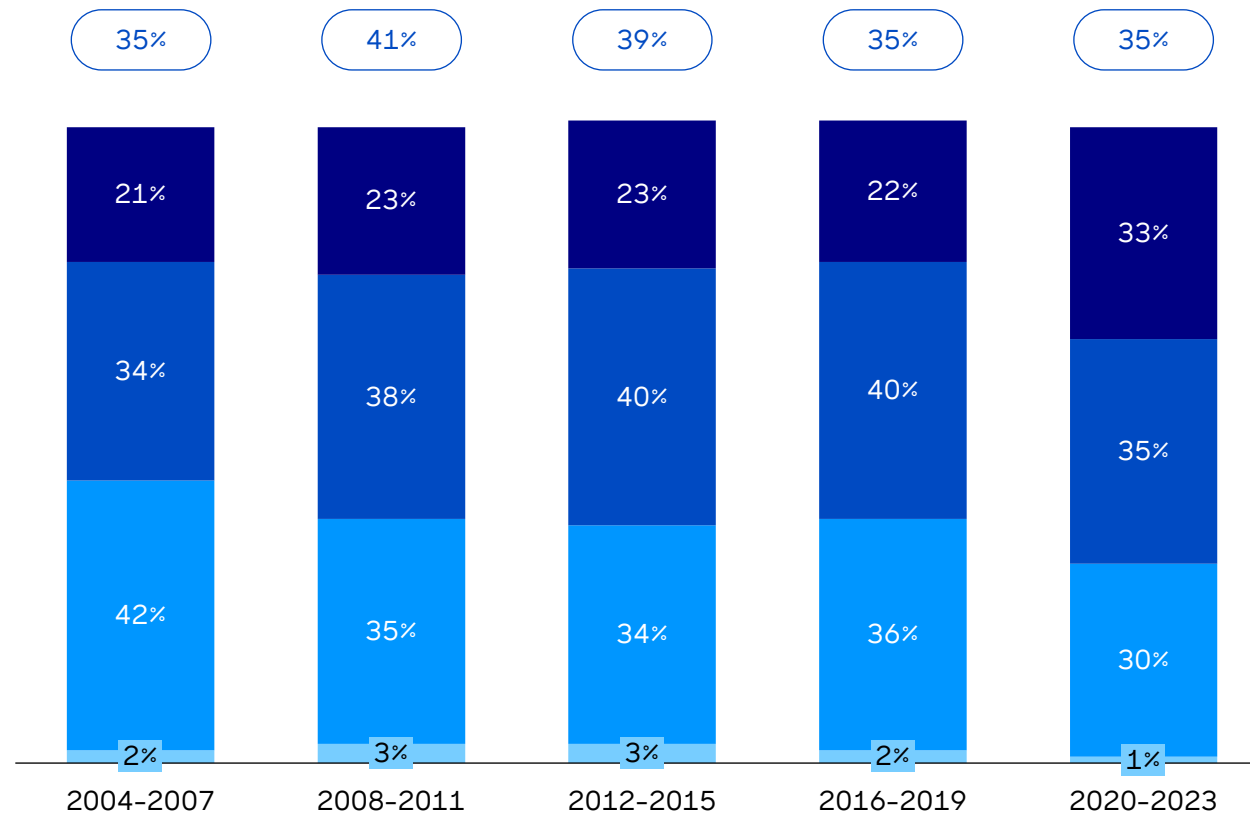
- With concerns about climate change on the rise, foreign direct investment (FDI) in environmental technologies has become the fastest-growing sector outside of services, **almost doubling** in the short period from 2016 to 2023
- Over the past two decades, the share of greenfield projects in non-services sectors involving these technologies has risen from **1% to 20%**
- Cross-border greenfield investment projects in manufacturing of **batteries and electrical vehicles** rose **more than 400%** from 2016 to 2023
- But increasing FDIs in environmental technologies only **partially compensates for the decline in other manufacturing sectors**
- The emphasis on high-tech industries **primarily advantages developed economies** while smaller and less-developed economies face ongoing challenges with **declining FDI in traditional sectors**

1) Excluding service activities
Source: UNCTAD; Roland Berger

As global investment flows in developing countries favor high income nations, foreign investment in low income countries is being sidelined

Share of cross-border greenfield investments in developing countries by income level of recipient nations, 2004-2023¹⁾ [%]

Projects in developing countries as share of total (excl. China)



■ High income ■ Upper-middle income ■ Lower-middle income ■ Low income

1) Due to rounding, sum of shares does not always total 100%; income categories based on World Bank classification. Analysis excludes cross-border greenfield projects in China to net the effects of the declining share of China as FDI recipient

Source: UNCTAD; Roland Berger

- Global investment flows to developing countries are gradually **directed more toward high income developing countries**
- The proportion of overall greenfield foreign direct investment (FDI) projects in least developed countries (LDCs, i.e. the lowest income segment of developing countries) has **declined from 3% in the mid-2010s to just 1%**
- FDI in low income and lower-middle income countries have decreased **by roughly a third over the past two decades**
- The focus of FDI on high income developing countries leaves less developed countries more vulnerable, **impeding their growth and development goals**

4.1 Global Economics

4.2 Power Shifts

4.3 Energy Transformation

4.4 Debt Challenge

Trade and investment trends unfold in three key dimensions of international production

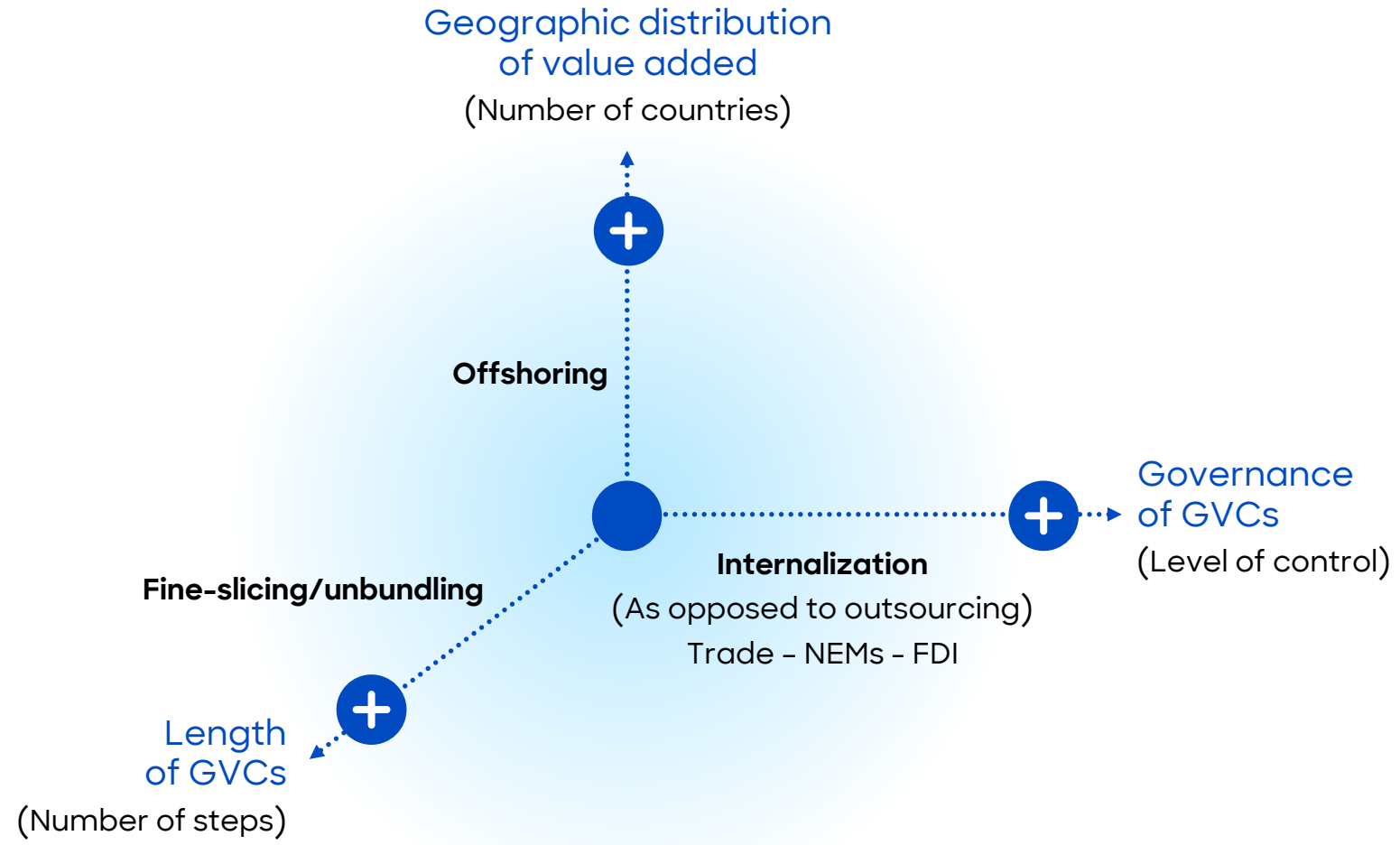
Key dimensions of international production

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

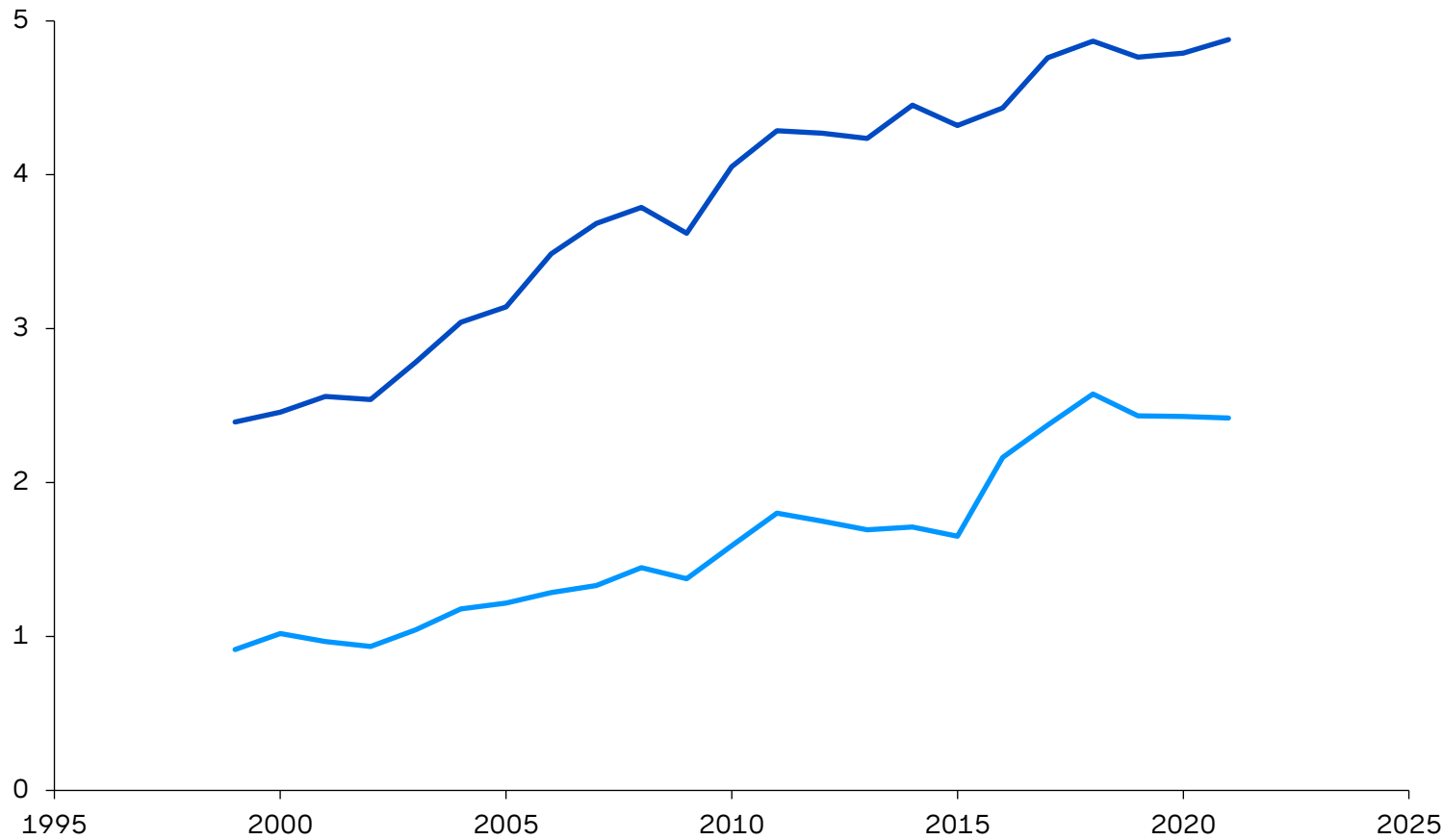
4.4
Debt Challenge



- The term **international production** refers to the global production **networks of multinational enterprises** (MNEs) which generate and coordinate global value chain (GVC) trade
- Multinational enterprises lead the coordination of GVCs as **80% of global trade** is linked to international production networks of MNEs
- The key dimensions include the **length of GVCs** (number of production stages), the **geographical spread** of value added (number of countries involved), and the **governance structure** (control and management of GVCs)
- The length of GVCs is dependent on the **ease of dividing production stages** and the benefits of specialization while the geographical spread indicates **how value is distributed across countries**

G20 emerging markets have expanded their role in global value chains, both as producers and consumers

G20 emerging markets in- and output linkages, 1999-2021¹⁾²⁾ [%, median across countries]



— Input linkages — Output linkages

- As G20 emerging markets **become more integrated** into global value chains, their development increasingly impacts businesses elsewhere
- Increased demand from emerging G20 countries can **drive revenue growth for foreign firms** in sectors like electrical equipment, machinery, and metal products
- Accelerated growth in such emerging markets can also provide foreign firms with **cheaper inputs** for production
- However, this growth can also lead to **increased competition**, as these emerging markets expand their productive capacity downstream and export goods that directly compete with those from foreign firms

1) Input linkages = share of total inputs supplied by G20 EMs industries; Output linkages = share of global demand from G20 EMs consumer and firms;

2) The G20 emerging market countries include Argentina, Brazil, China, India, Indonesia, Mexico, Russia, Saudi Arabia, South Africa, and Türkiye

Source: IMF; Roland Berger



4.1
Global
Economics



4.2
Power
Shifts



4.3
Energy
Trans-
formation



4.4
Debt
Challenge

Three megatrends shape the future of international production




Megatrends shaping the future of international production

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

	Trends	Key elements
 <p>Technology/ New Industrial Revolution</p>	<ul style="list-style-type: none"> • Advanced robotics and AI • Digitalization in the supply chain • Additive manufacturing (3D printing) 	<ul style="list-style-type: none"> • Industrial automation, AI-enabled systems ("white collar" robots) • Platforms, cloud, IoT, blockchain • Distributed manufacturing, mass customization, commodification of production
 <p>Sustainability</p>	<ul style="list-style-type: none"> • Sustainability policies and regulations • Market-driven changes in products and processes • Physical supply chain impacts 	<ul style="list-style-type: none"> • Major green plans (and varying implementation timelines), carbon border adjustments • Increased reputational risks and demand for sustainably produced goods and services • Supply chain resilience measures, changing sources of agricultural inputs
 <p>Policy and economic governance</p>	<ul style="list-style-type: none"> • More interventionism in national policies • More protectionism in trade and investment • More regional, bilateral and ad hoc economic cooperation 	<ul style="list-style-type: none"> • Industrial policies, competition policy, fiscal policy • Tariffs and non-tariff measures, shielding of strategic/sensitive industries • Trade deals among select groups and on common-ground issues • De-risking strategies or friend- and reshoring attempts

Mirroring global trade developments, global supply chains also weakened while domestic production gained prominence

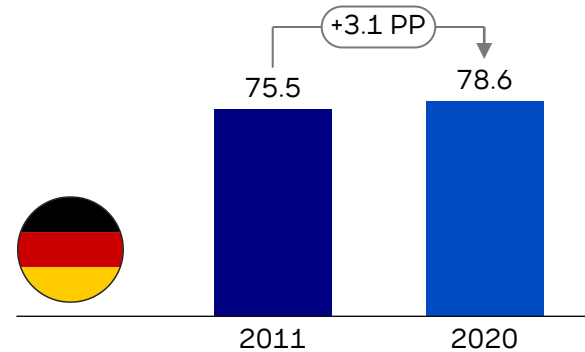
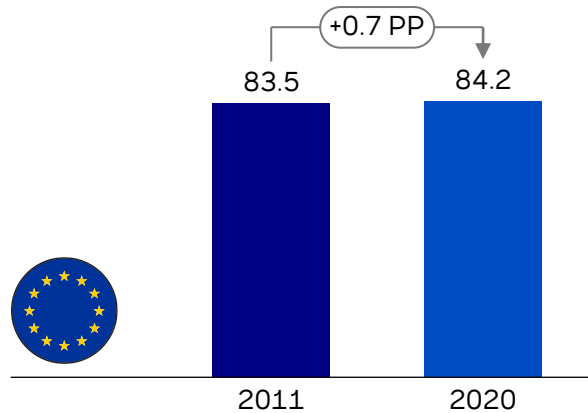
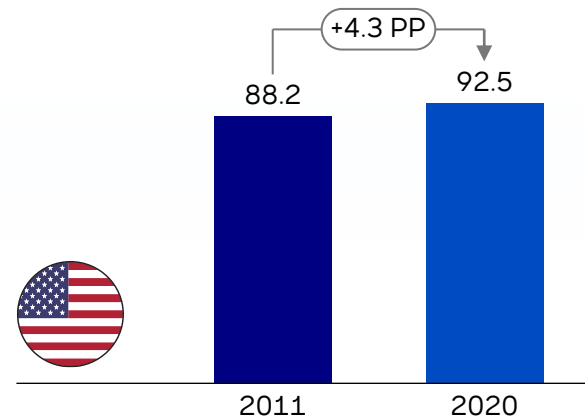
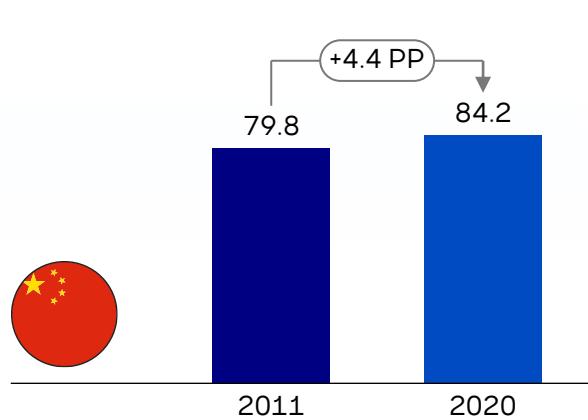
Domestic share of value added as a proportion of a country's/region's total exports, 2011 and 2020 [%]

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

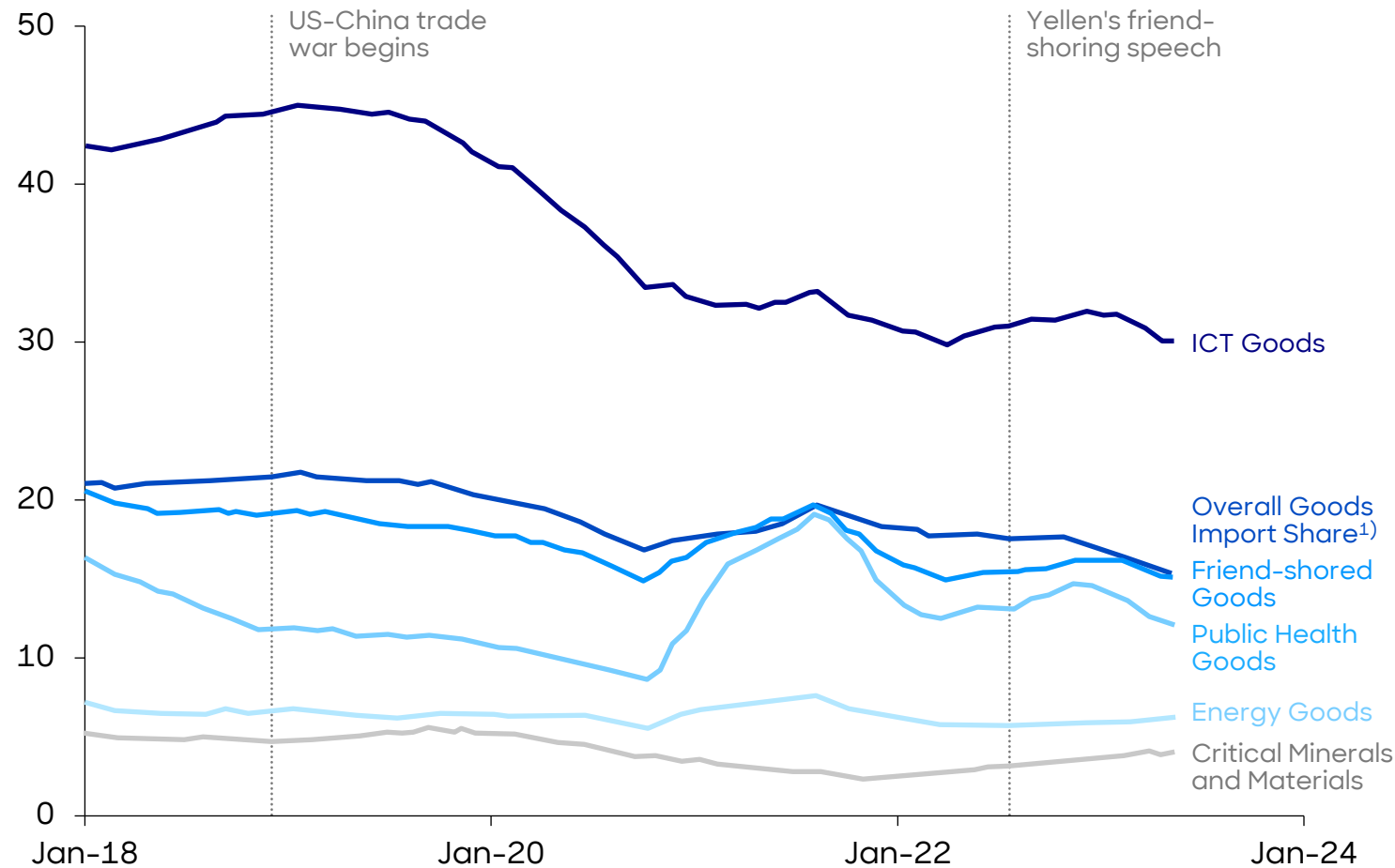
4.4
Debt Challenge



- The COVID-19 crisis has exposed key **weaknesses** in the principles of the **international division of labor**: a massive supply and demand shock at the beginning of 2020 brought many economies to a standstill
- However, the **decline of the importance of global value chains** had already begun a **decade earlier**
- **China's economy moved up the value chain** and replaced imports of intermediate products with domestic production
- In **the US, the EU, and Germany**, this kind of substitutional shift is also **evident** – although less pronounced in the EU
- The trend **toward regionalization** – or even reshoring – of production is due to **different factors** including the **reduction of wage differentials**, a higher importance of **transport cost**, the pursuit of domestic production for **essential goods**, and/or the aim of a more **sustainable production** with shorter transport routes

Early results of friend-shoring strategy reveal complex transition as US seeks to shift supply chains from China to trusted partners

China's share of US imports (12 month rolling average) [%]



- In April 2022, the US Secretary of the Treasury, Janet Yellen, emphasized her country's strategic objective of **free but secure trade** - termed "**friend-shoring**" - to **shift supply chains from China** to "trusted partners" such as Taiwan, India, Vietnam, and Mexico
- **Progress** in reducing China's share of US imports **has been slow**, with some sectors again experiencing slightly increased imports from China, for example regarding energy goods
- **Early effects of friend-shoring are visible**, but **challenges remain** for the US, particularly in **green energy and critical minerals**
- While the strategy is starting to have an impact, the **transition is complex and ongoing**

1) Overall Goods Import Share tracks China's share of all goods the US imports
Source: Atlantic Council; Roland Berger

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

Friend- and reshoring strategies negatively impact global economic performance and value chains in the long term

Real GDP, percent deviation from baseline [%]

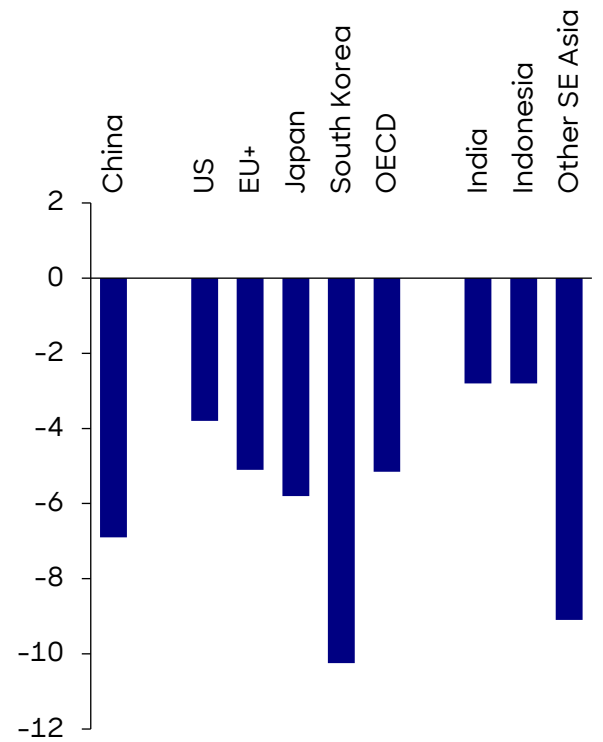
4.1
Global Economics

4.2
Power Shifts

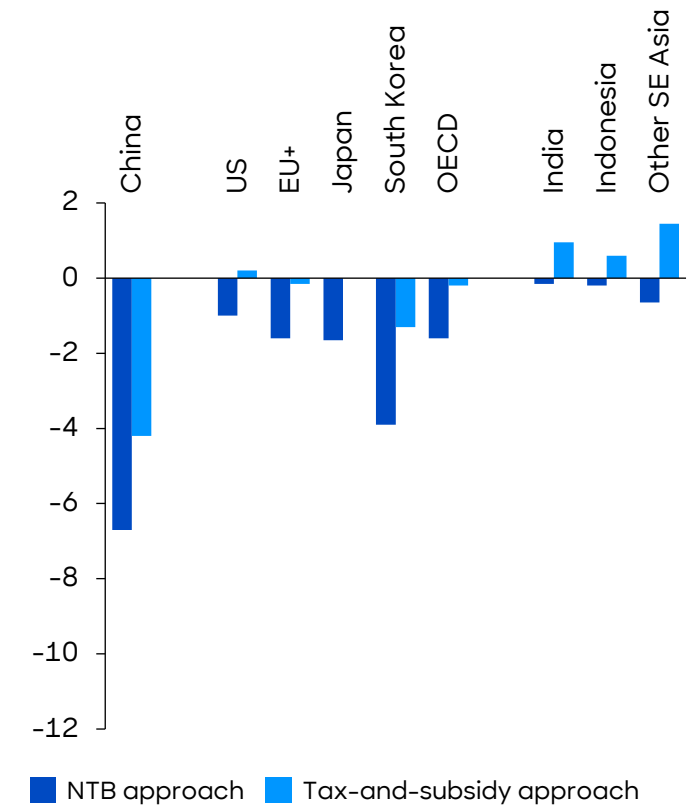
4.3
Energy Transformation

4.4
Debt Challenge

Long-term GDP losses from reshoring¹⁾²⁾



Long-term GDP changes from friend-shoring¹⁾²⁾



- In a **reshoring scenario**, in which countries focus on increasing domestic production and decreasing imports **from both allied and rivaling countries**, China faces a **6.9% long-term GDP loss** due to reduced demand from OECD regions. Other Southeast Asian countries, particularly those with strong trade links to China and the OECD, experience significant losses **exceeding 9% of GDP**
- OECD regions see GDP losses ranging from 3.8% to 10.2%, with larger losses in **open economies with strong connections to China**, such as South Korea
- The **friend-shoring** scenario involves **shifting imports from rivals to allies** without reducing overall foreign dependence. In this approach, China and OECD members impose non-tariff barriers (NTBs)³⁾ on each other, **China and South Korea face the largest GDP losses**, while the rest of the world experiences minor effects due to trade diversion
- Under the tax-and-subsidy approach⁴⁾, China incurs significant losses, while Southeast Asia sees gains through subsidies, and the **US benefits slightly from improved trade terms**

1) EU+ = European Union plus Switzerland; 2) SE = southeast; 3) Non-tariff barriers (just like tariffs) affect trade decisions but generate deadweight losses for exporters rather than fiscal revenues for importers; 4) In the tax-and-subsidy approach, two countries that tax each other's exports use the tax revenue to boost exports from other regions

The evolution of global economics led to a power shift from developed to developing countries

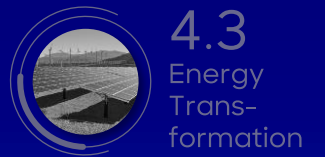
Global economic power shift: Major drivers and indicators



4.1
Global Economics



4.2
Power Shifts



4.3
Energy Transformation



4.4
Debt Challenge

Major drivers

- Globalization, integration of developing countries into global value chains
- Technological catch-up of developing countries
- Opening of economies
- Different patterns of population growth
- Build up/enlargement of economic trade zones/ custom unions/currency units
- Transformation of economies shifting supply and demand, e.g. from traditional to new critical raw materials
- Geopolitics, protectionism

Developed countries

Developing countries

Main indicators

- Global share of GDP
- Global share of trade
- Global share of FDIs

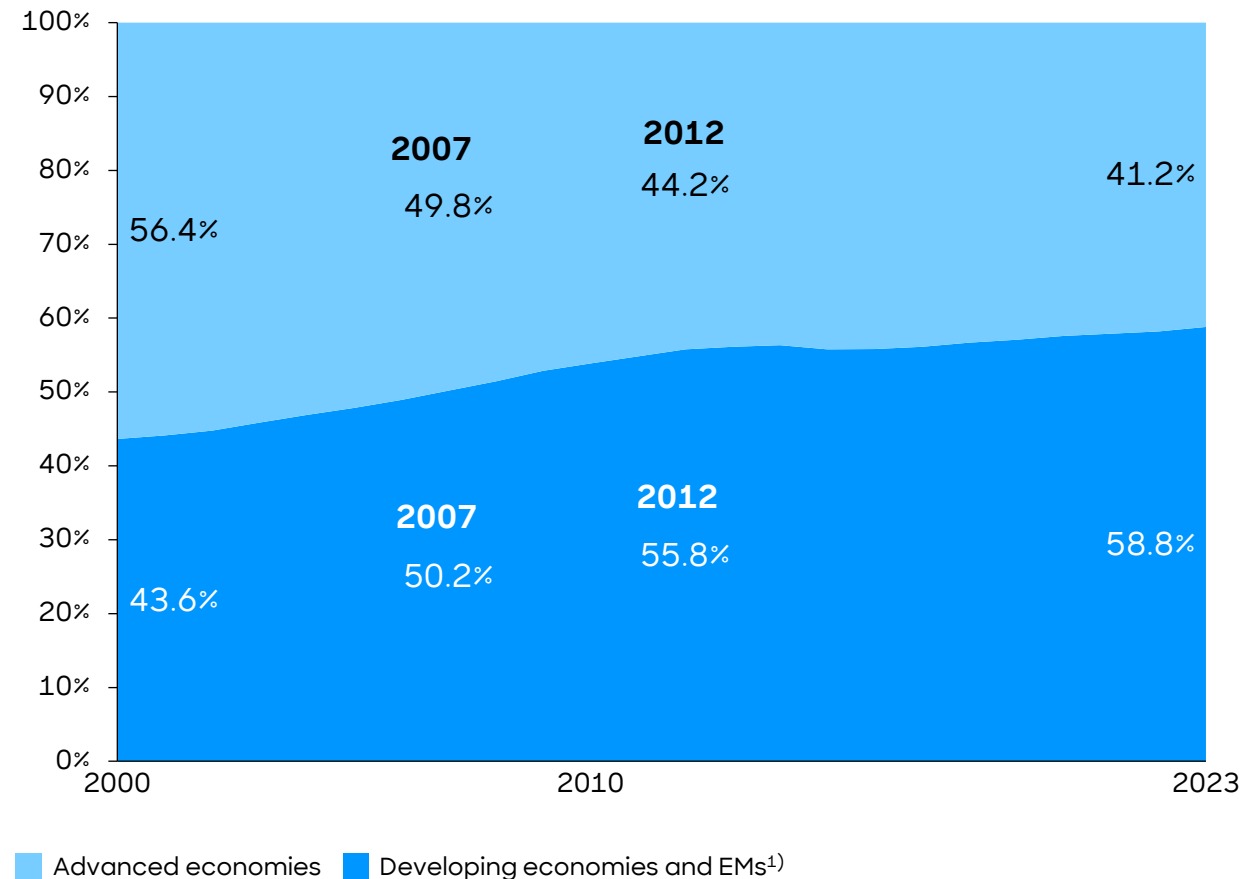
Further indicators

- Manufacturing dominance
- Technological catch-up
- Ownership of critical raw materials

- In recent decades, **globalization** and related factors have driven not only **global growth** but also an **economic power shift towards developing economies**
- **Developing economies** – characterized mainly by a lower GDP per capita compared to developed nations – **increased their share of global GDP, trade, and FDIs**
- Furthermore, several of these countries developed into **manufacturing power houses**, rapidly catching up in terms of **technological know-how** and/or became globally relevant as key **sources of critical raw materials** necessary for the green energy transformation and economic sustainability
- This enhanced **economic influence** is not just reflected in statistics, but also in the fact that developing countries constitute major players in important economic groups, such as the **G20, BRICS or RCEP**. International treaties on global challenges, for example the Paris Agreement, are significantly shaped by developing countries
- **This group of developing countries is not a homogeneous entity**. Some countries, such as China and India, experienced significantly higher rates of economic growth than others and have become economic powerhouses. In contrast, other countries, including some in Africa, have been less successful in catching up
- Since the 2010s, growing geopolitical tensions have led to an increase in **protectionism** and "**slowbalization**". This **decelerated – but never halted – the power shift** towards developing economies, as evidenced in the continued increase of their global share of FDI inflows

Since 2000, developing and emerging markets have seen a notable increase in their global share of GDP - In fact, since 2007, their share is more than 50%

Global share of GDP based on PPP data, 2000-2023 [%]



- Since the turn of the century, developing economies and emerging markets (EMs) increased their **share of global GDP** from around 44% to **nearly 60%** (measured in PPP terms). A significant part stems from China which increased its share of global GDP from 11.1% in 2000 to 19.5% in 2023
- A particular strong increase took place between 2000 and 2012, when globalization was on a high: developing economies and EMs have been **integrated into global value chains** shifting the creation of value added from advanced economies to developing economies and EMs
- A sectoral shift **from agriculture to industry** and then to services took place, while a **know-how transfer** in the later stages of globalization led to an increase in the skill levels of the workforce
- **Population growth** is another factor underpinning this shift from advanced to developing and EMs. While population growth in advanced economies has been subdued in recent decades, it has been strong in developing economies and EMs. The ready availability of working-age people for their labor markets is a key driver of GDP growth in these regions
- Yet, in the period from **2012 to 2023**, the increase of the global GDP share of developing economies and EMs was only small - reflecting the "**slowbalization**" in this period

4.1 Global Economics

4.2 Power Shifts

4.3 Energy Transformation

4.4 Debt Challenge

1.) Aggregate compiled by IMF (see IMF World Economic Outlook database). Some countries categorized as developing economy or EM belong to developed economies in aggregations from other international organizations. E.g., according to the IMF, countries from Eastern Europe like Poland or Hungary belong to developing economies and EMs, while they are classified as developed economies according to UNCTAD

Since 2000, GDP per capita in emerging economies grew faster than in advanced economies – Developing economies struggle to catch up

GDP per capita p.a. based on nominal PPP data, 2000 and 2023 [USD, %]

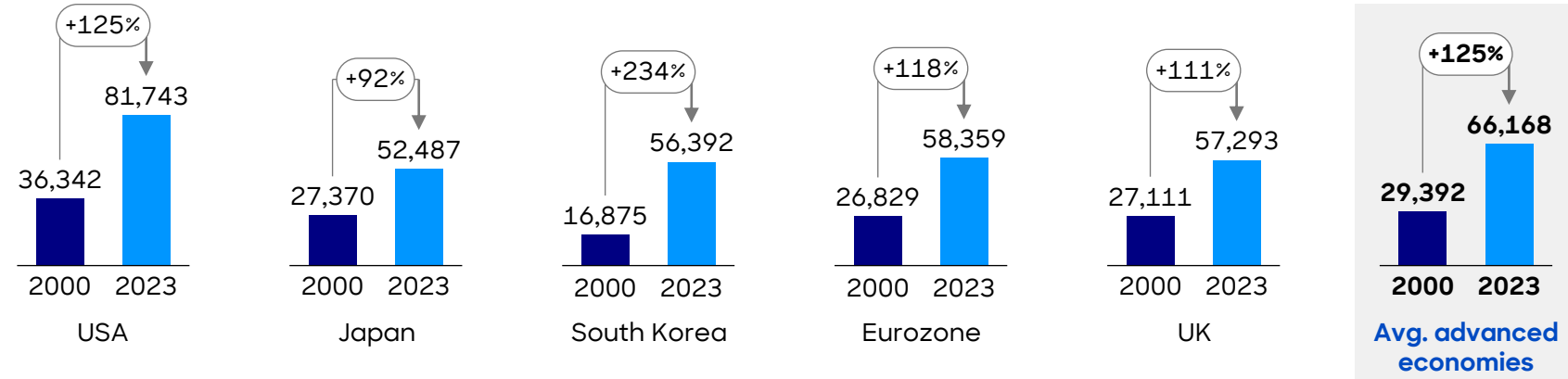
4.1
Global Economics

4.2
Power Shifts

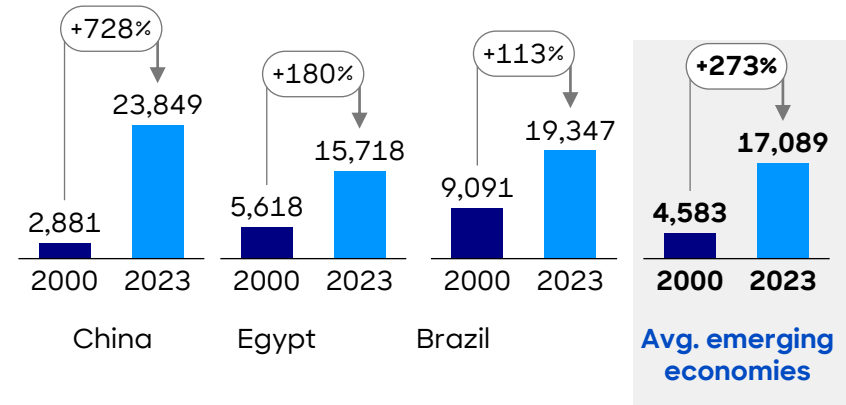
4.3
Energy Transformation

4.4
Debt Challenge

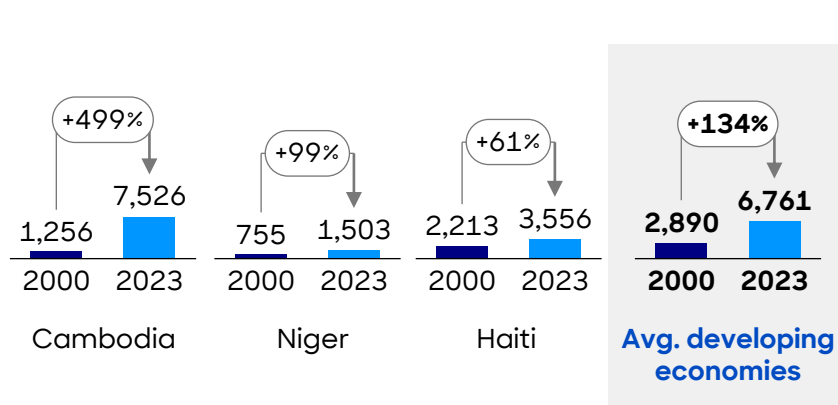
Selected advanced economies



Selected emerging economies



Selected developing economies



- **Emerging markets** have strongly increased their GDP per capita, which has **narrowed the gap in relative prosperity** between EMs and advanced economies. However, the absolute difference has increased
- **Poorer countries**, on average, **did not narrow the gap**. Nevertheless, they also contributed to the overall economic power shift due to their high population growth
- Within the country groups, the **range of GDP per capita growth is large**. Since 2000, a few countries, e.g. Venezuela and Sudan, have even been faced with a decreasing GDP per capita

Power shifts in trade reflect the integration of developing and emerging markets into global value chains – Demand for their end products is growing

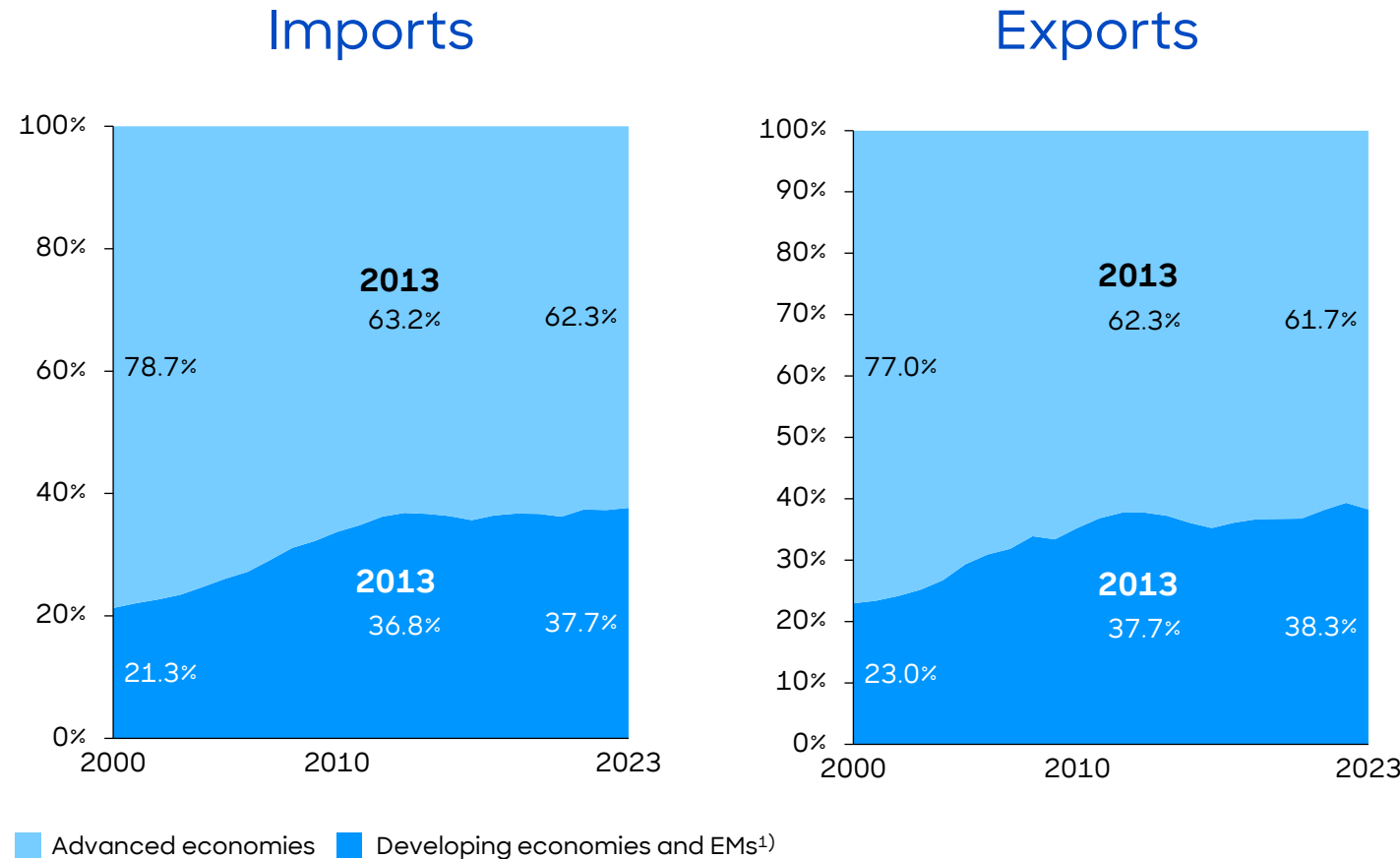
Global share of imports and exports based on nominal data, 2000-2023 [%]

4.1 Global Economics

4.2 Power Shifts

4.3 Energy Transformation

4.4 Debt Challenge



- For more than 20 years, the **global share of imports and exports by developing economies and emerging markets (EMs) has been rising**. The increase was notably high between 2000 and 2010, after which it became more marginal
- Like GDP, the share of **China** in global trade is high: in 2023, it was **10.5%** for imports and **14.2%** for exports
- A major reason for the increase is the growing **integration** of developing economies and EMs into **global value chains**
- In addition, the **product offerings** from developing economies and EMs for **final use** have demonstrated a **sustained global demand**, with notable examples including fashion goods, consumer electronics, and IT/telco equipment
- In many of these markets, **growth in population and purchasing power** raised additional **import demand**
- Finally, the **growing working age population** enabled companies to expand and thus to **increase exports**

1.) Aggregate compiled based on IMF classification of countries (see IMF World Economic Outlook database). Country classifications differ depending on international organizations; according to the IMF, for example, countries from Eastern Europe like Poland or Hungary are categorized as developing economies and EMs, while they are classed as developed economies according to UNCTAD

More than 70% of global FDI is directed toward developing countries - Their growing investment abroad is expanding their global economic footprint

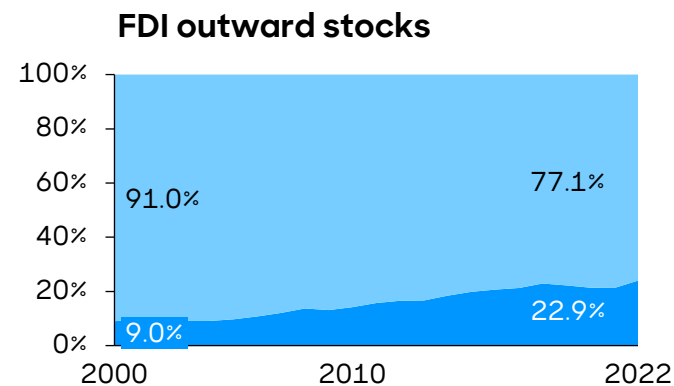
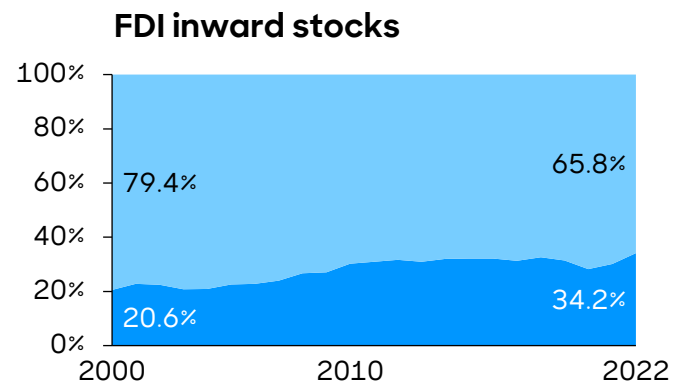
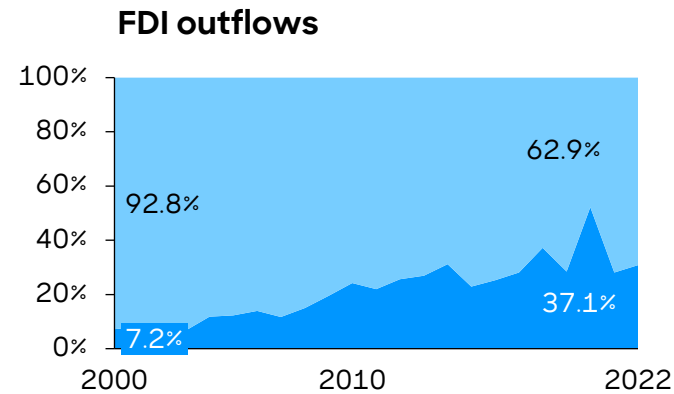
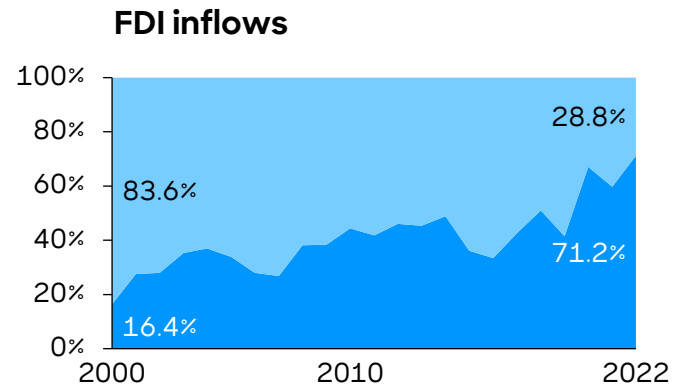
Global share of FDI inflows, outflows, inward stocks and outward stocks based on nominal data, 2000-2022 [%]

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge



■ Developed economies ■ Developing economies

- The development of **FDI flows** shows a strong **power shift** from developed countries to developing countries
- The global share of **FDI inflows** of developing countries increased from **16.4% in 2000 to 71.2% in 2022** (China 2022: 14.4%). **Outsourcing of production** to developing countries is a major reason for this trend
- Global share of **FDI outflows** from developing countries grew from a mere **7.2% in 2000 to 37.1% in 2022** (China 2022: 9.8%) demonstrating the growing **financial power** and **strategic will** of these countries to **expand their economic footprint abroad** - be it for cost reasons or to gain access to markets and know-how
- The evolution of **FDI stocks** reflects the development of flows, but as yearly inflows and outflows are much smaller than current stocks, power shifts in stocks are **less dynamic**
- Nevertheless, global share of **FDI inward stocks** in developing countries increased from **20.6% in 2000 to 34.2% in 2022**, while **FDI outward stocks** held by developing countries rose from **9.0% in 2000 to 22.9% in 2022**

It is important to recognize that advanced economies, developing economies, and EMs are all highly diverse country groups

Selected economic indicators of advanced economies and developing economies and emerging markets:
Range within the groups

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

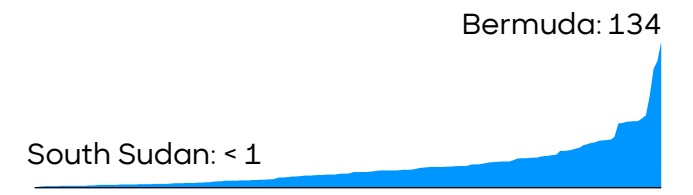
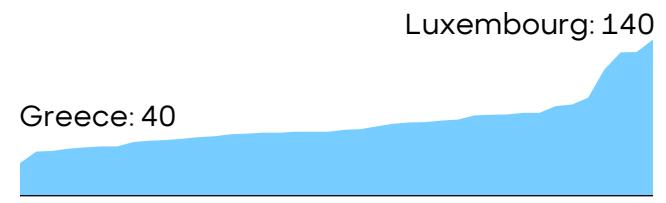
Advanced economies
Number of economies: 40

Developing economies and emerging markets
Number of economies: 162

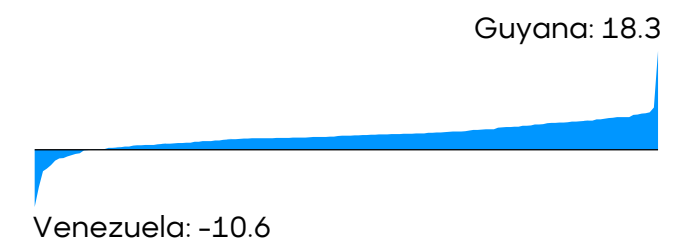
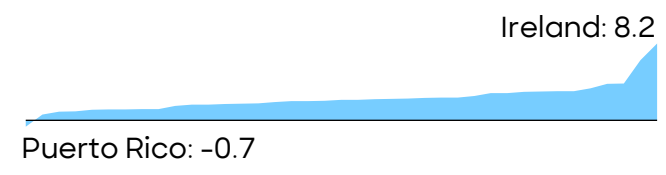
GDP nominal PPP 2023
[USD bn]



GDP nominal PPP per capita 2023
[USD '000]



Average real GDP growth p.a. 2014-2023¹⁾
[%]



1) For average real GDP growth p.a. 2014-2023 the number of advanced economies is 39, and for developing economies and emerging markets it is 153
Source: Oxford Economics; Roland Berger

Toward 2050, power shifts to developing economies and EMs are set to continue - Asia Pacific is leading, LatAm and Africa retain marginal shares

Global share of GDP based on PPP data, 2023 and 2050 [%]

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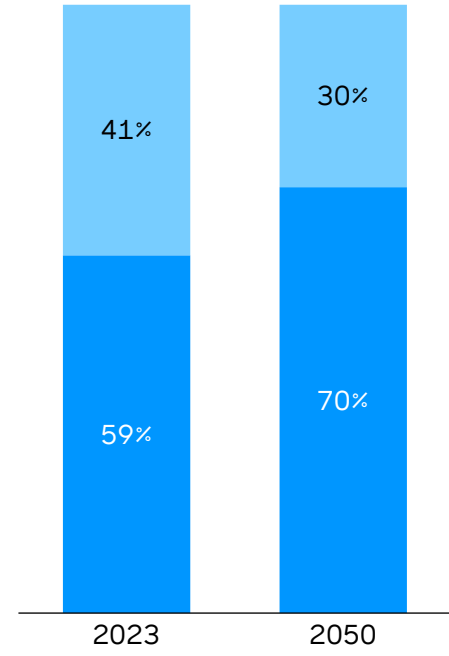
4.1
Global Economics
- 

4.2
Power Shifts
- 

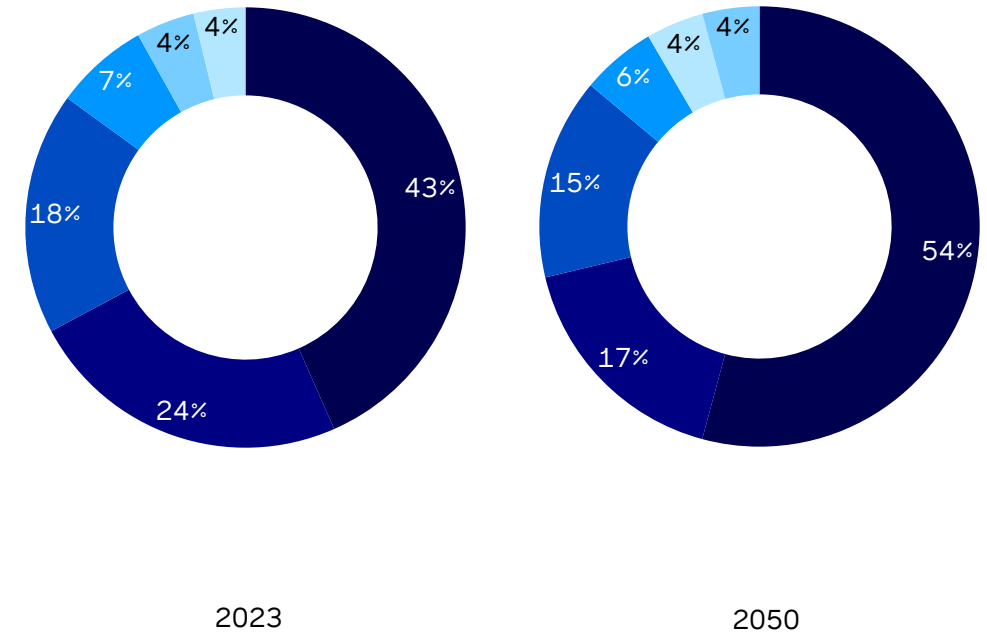
4.3
Energy Transformation
- 

4.4
Debt Challenge

Advanced economies and Developing economies/EMs



Regions¹⁾



- Advanced economies
- Developing economies and EMs
- Asia Pacific
- Europe
- North America
- Latin America
- Middle East
- Africa

- Forecasters expect the **power shift to developing and emerging economies to continue**. By 2050, their share of global GDP is projected to account for 70%, 11 percentage points higher than in 2023
- **Asia Pacific**, already the most economically powerful region in the world, is set to increase its **share of global GDP to over 50% by 2050**
- **Europe and North America**, hosting most of the advanced economies, will **lose ground** but remain as the second and third largest economic regions globally
- Latin America, Middle East, and Africa are expected to roughly hold their respective shares: **Middle East and Africa will stay at 4% each, while LatAm's share is expected to decline from 7% to 6% by 2050**

1) North America = USA + Canada (Mexico is included in Latin America)
Source: Oxford Economics; Roland Berger

Major developing countries and EMs will continue to strengthen their positions in the top 20 global economies – Yet some of them will lose ground

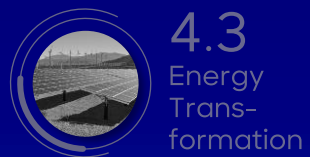
Top 20 countries in terms of GDP, 2023 and 2050 [USD bn]



4.1
Global Economics



4.2
Power Shifts



4.3
Energy Transformation



4.4
Debt Challenge

GDP nominal PPP

Rank		2023		2050
1	China	32,931	China	129,508
2	USA	27,361	India	88,764
3	India	13,342	USA	77,716
4	Japan	6,528	Indonesia	22,244
5	Germany	5,544	Germany	12,628
6	Russia	5,180	Japan	12,051
7	Indonesia	4,391	Türkiye	11,494
8	Brazil	4,085	Bangladesh	11,213
9	UK	3,917	Russia	10,767
10	France	3,865	UK	10,723
11	Türkiye	3,629	Brazil	10,067
12	Mexico	3,276	Pakistan	9,319
13	Italy	3,245	Mexico	8,962
14	South Korea	2,918	France	8,844
15	Spain	2,411	Vietnam	8,215
16	Canada	2,386	Philippines	7,890
17	Saudi Arabia	2,242	Iran	7,602
18	Egypt	1,800	Canada	7,058
19	Iran	1,753	South Korea	7,050
20	Australia	1,724	Italy	6,241

GDP nominal¹⁾

Rank		2023		2050
1	USA	27,361	China	77,834
2	China	17,784	USA	77,716
3	Germany	4,537	India	37,253
4	Japan	4,227	Germany	11,681
5	India	3,490	UK	10,247
6	UK	3,406	Japan	8,079
7	France	3,056	France	7,857
8	Italy	2,258	Canada	7,008
9	Brazil	2,175	Brazil	6,655
10	Canada	2,143	Australia	6,337
11	Russia	2,019	Pakistan	5,388
12	South Korea	1,839	South Korea	5,197
13	Mexico	1,794	Türkiye	4,948
14	Australia	1,738	Mexico	4,910
15	Spain	1,581	Russia	4,850
16	Indonesia	1,371	Italy	4,764
17	Netherlands	1,154	Indonesia	4,619
18	Türkiye	1,096	Philippines	4,320
19	Saudi Arabia	1,068	Spain	4,000
20	Switzerland	885	Bangladesh	3,794

1) Data for Iran not considered due to a period of very high inflation in combination with a fixed exchange rate of the Iranian Rial to the USD

Source: Oxford Economics; Roland Berger

Real GDP growth projections confirm the ongoing power shift to major emerging markets - But within the context of declining growth overall

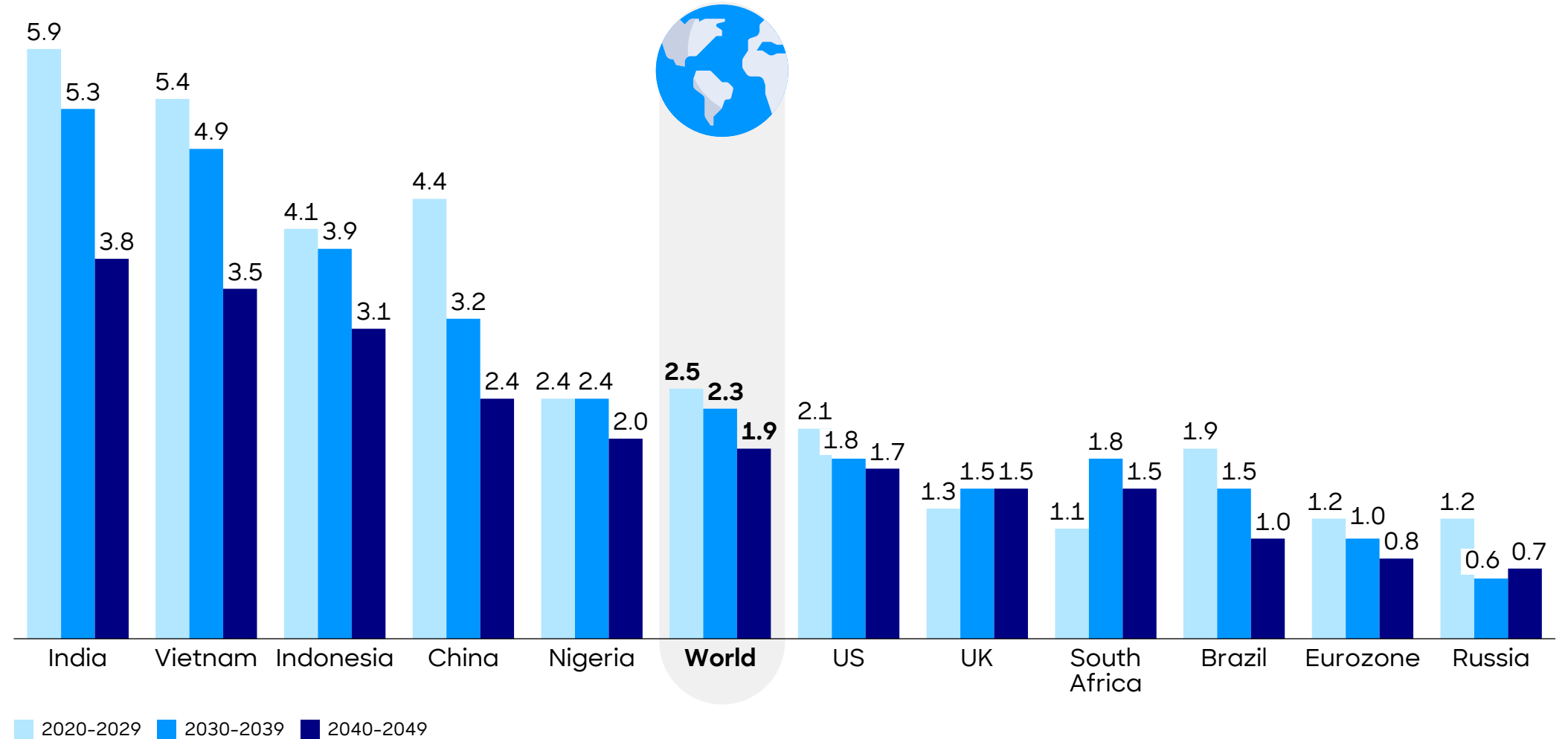
GDP growth projections for selected major economies [average real GDP growth rate p.a., %]

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge



Over the past two decades, manufacturing power shifted to emerging markets – China advanced to become the "factory of the world"

Power shifts in manufacturing value added and trade

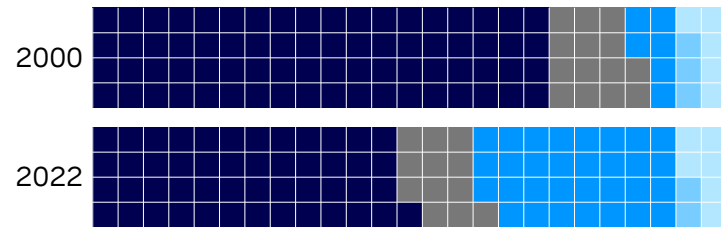
4.1 Global Economics

4.2 Power Shifts

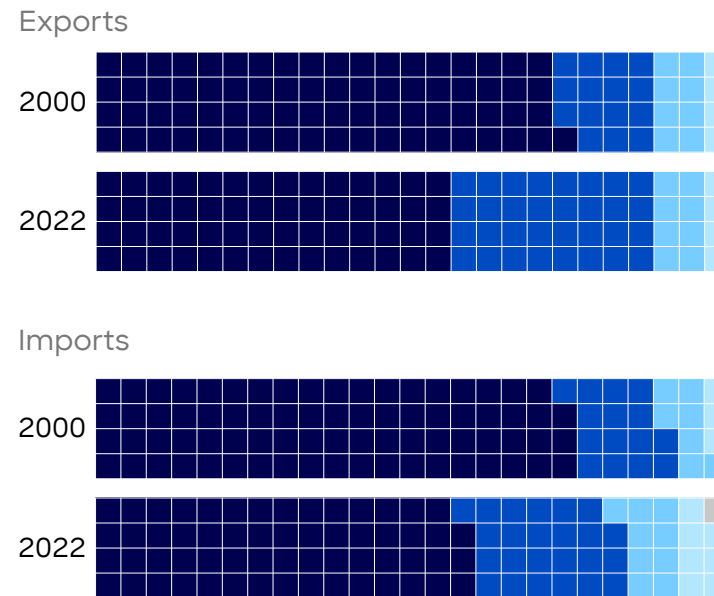
4.3 Energy Transformation

4.4 Debt Challenge

MVA share as proportion of global MVA by country group^{1,2)}

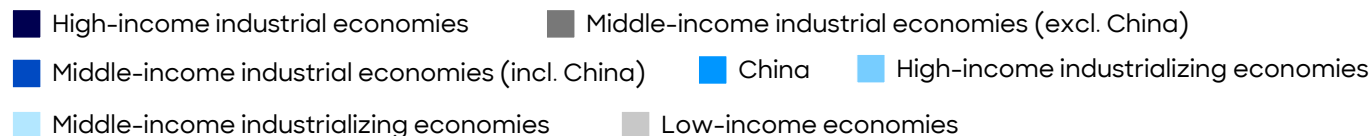


Share of manufacturing trade by country group²⁾



Top 5 countries with the largest manufacturing sector and their share in global MVA in 2022

1. China	30.7
2. United States of America	16.1
3. Japan	6.0
4. Germany	4.8
5. Republic of Korea	3.1



- In 2000, 72% of global manufacturing value added (MVA) stemmed from **high-income industrial economies**. By 2022, this share had decreased to **49%**. During the same time, **China** increased its share from **6% to 31%**
- In 2022, **China's share** was **bigger** than the combined share of its **four biggest competitors**: USA, Japan, Germany, and South Korea (totaling 30%)
- A **similar shift** towards middle-income industrialized economies has been observed in terms of **trade** in manufacturing products
- The main **reasons** for this shift are **outsourcing of production** from advanced economies to EMs due to lower cost as well as market growth, a steep **learning curve** in manufacturing technologies in emerging markets, and an increasing **integration** of emerging markets into **global value chains**

1) MVA = Manufacturing Value Added; 2) One square represents a share of 1%. High-income industrial economies comprise of advanced economies. High-income industrializing economies comprise of advanced economies and emerging markets. Middle-income industrial economies comprise of emerging markets (incl. China, Brazil, Russia, Indonesia, South Africa). Middle-income industrializing economies comprise of a mixture of emerging markets and developing economies (incl. India, Nigeria). Low-income economies comprise of developing economies

The creation of know-how has shifted to Asia/Oceania and middle-income industrial economies - China now dominates AI research output

Power shifts in patent applications and high-impact AI research publications

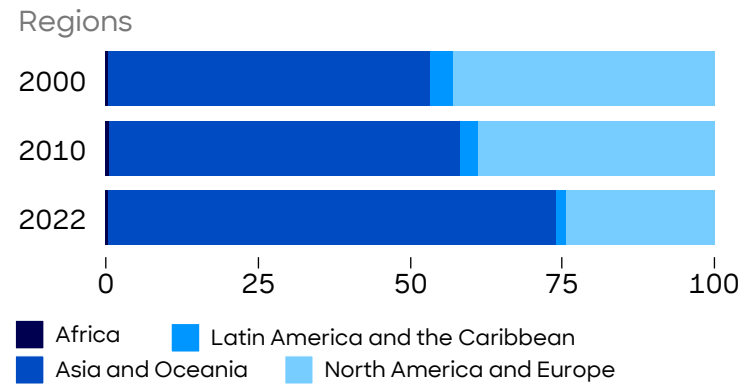
4.1
Global Economics

4.2
Power Shifts

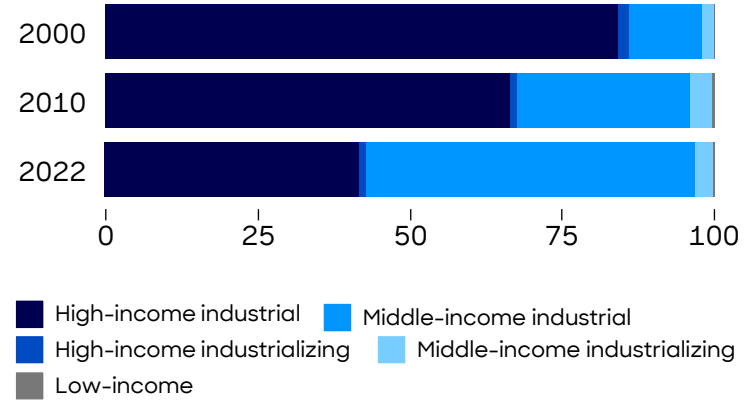
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Energy Transformation

4.4
Debt Challenge

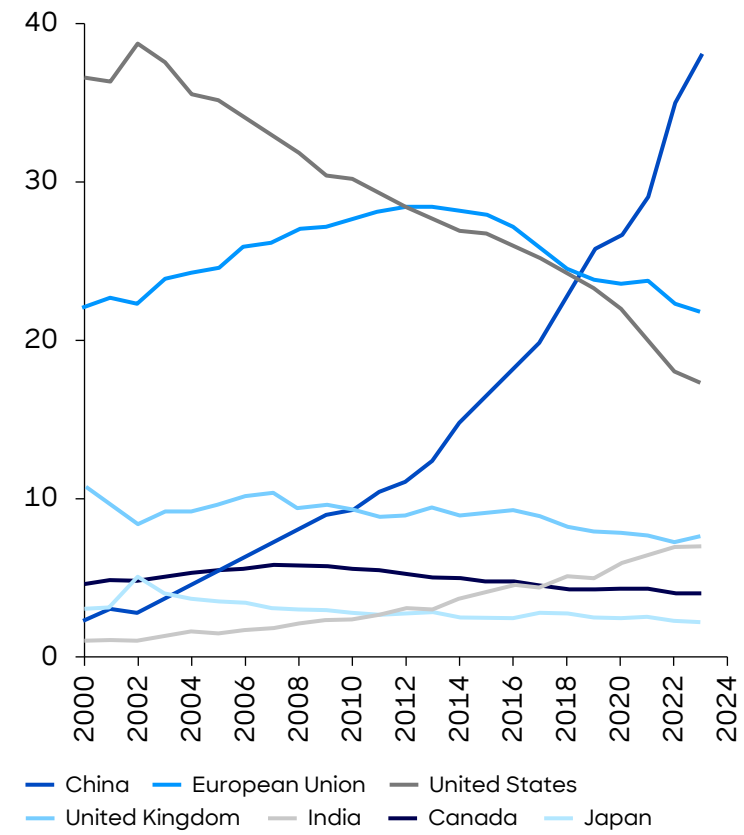
Distribution of total patent applications by regions and country groups [%]



Economies by income group and industrialization status



Share of high-impact AI research publications [%]

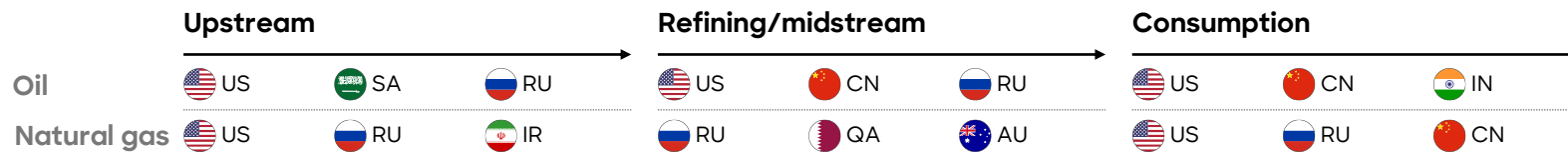


- The number of **patent applications** is a **key indicator** of an economy's or region's **innovation strengths**. Since 2000, the region of **Asia and Oceania** has increased its global share from just over 50% **to nearly 75% in 2022**. By contrast, North America and Europe have seen their global share decline
- A **similar shift** can be observed from high-income industrial economies **to middle-income industrial economies** (incl. China)
- **Artificial intelligence (AI)** is perceived as one of the most important technologies shaping our future. Historically, the US (and later together with the EU) led in terms of **high-impact AI research publications**, **but since 2019 China dominates** this area of know-how creation. In 2023, nearly 40% of all such publications stemmed from China. India also increased its share

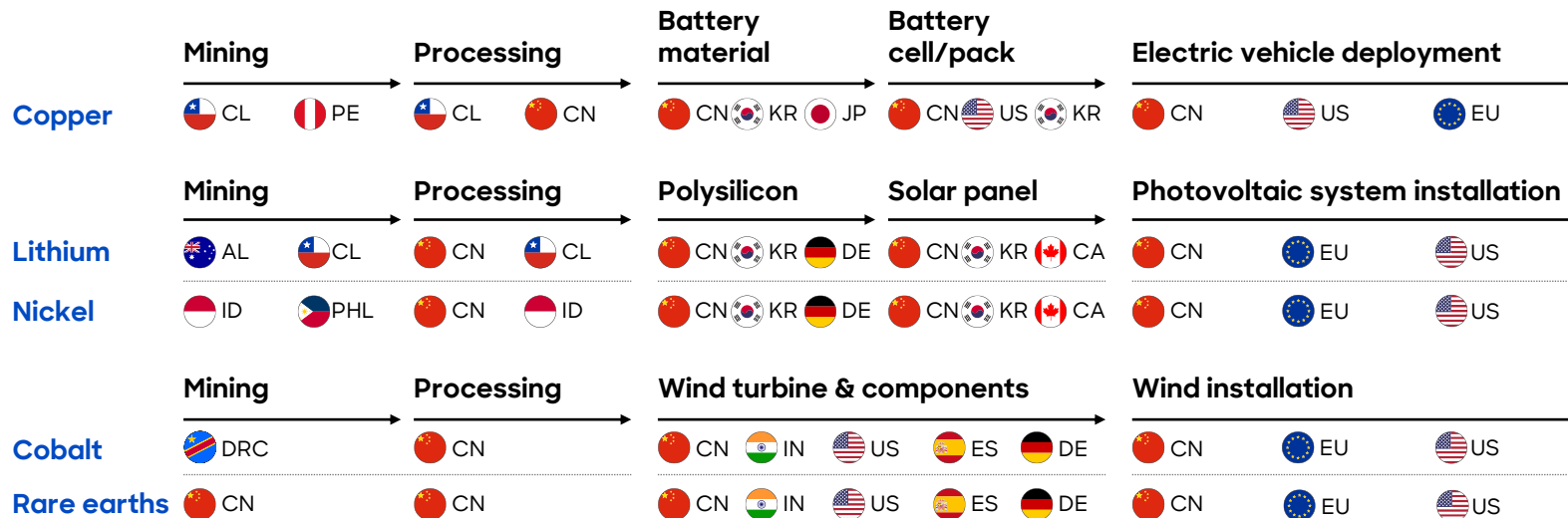
The world is shifting from oil and gas to clean energy technologies - In this domain, China is the dominant player in most stages of the value chains

Indicative supply chains of fossil fuels and selected clean energy technologies¹⁾

Oil and gas



Clean energy technologies



Looking ahead

Regarding the global energy transition and its underlying clean-energy technologies, **certain CRMs²⁾ will be considerably more in demand in the future:**

Mineral	Use in clean-energy tech	Rise in demand, 2050 relative to 2021, factor ³⁾
Lithium	Electric vehicles (EVs), battery storage	24.0
Nickel	Geothermal, EVs, battery storage, hydrogen	12.3
Rare earths	Wind, EVs, battery storage	7.2
Cobalt	EVs, battery storage	6.2
Copper	Solar, wind, bio-energy, EVs, electricity networks, battery storage	2.8

2050

1) Largest producers and consumers are indicative only; 2) CRMs: Critical raw materials; 3) Data calculated under the IEA's Announced Pledges Scenario

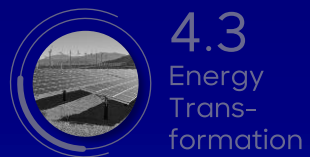
Source: Leruth et al.; Munich Security Conference; Roland Berger



4.1
Global Economics



4.2
Power Shifts



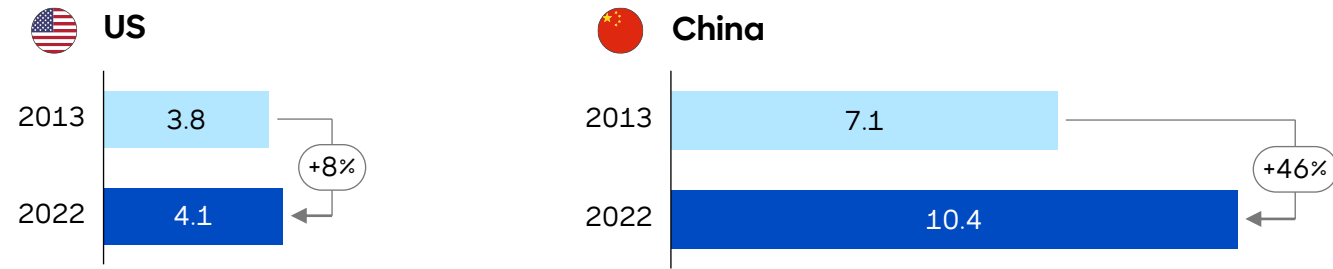
4.3
Energy Transformation



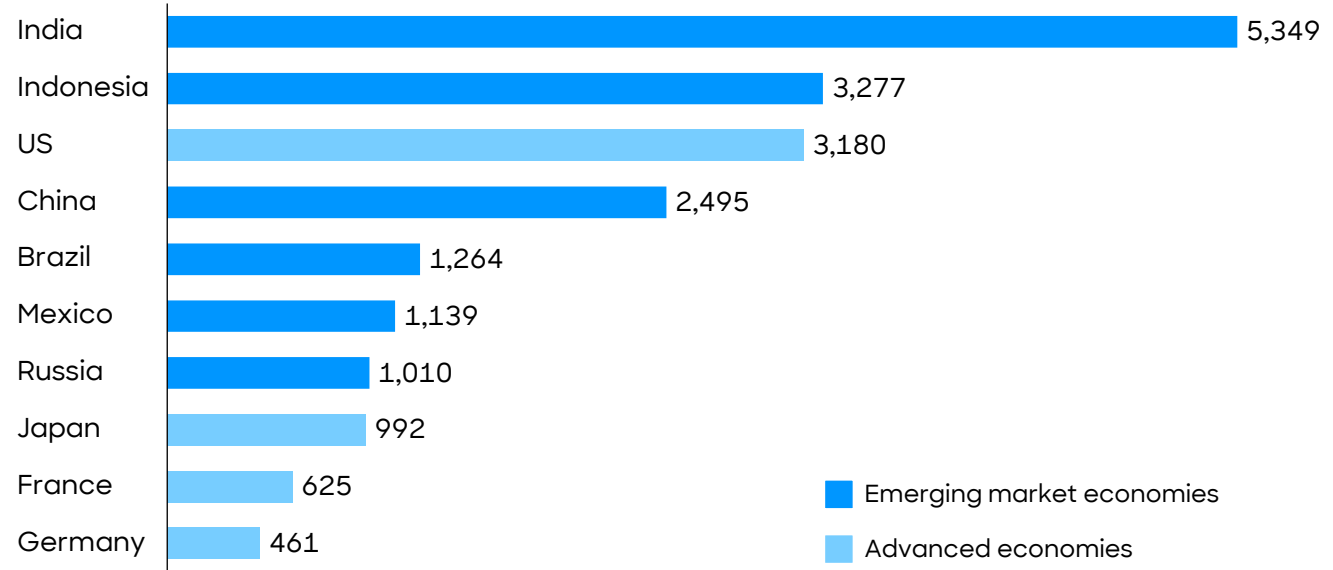
4.4
Debt Challenge

Emerging markets have also become powerhouses in terms of higher education – Investments are paying off now and well into the future

Degrees earned in higher education in the US and China, 2013 and 2022 [m]



Number of universities, 2023



- **Investments in education pay off** (see Trend 1 People & Society of our Roland Berger Trend Compendium 2050): well-educated people drive innovation, economic growth, and prosperity
- **Emerging markets (EMs)** are aware of the importance of education and **invested a lot in all levels of education** from primary to higher education
- **China** saw a **46%** increase in the number of **degrees** awarded in higher education from **2013 to 2022**, while the US achieved a growth of only 8% over the same period. China has achieved an impressive **2.5 times higher degree attainment rate than the US**, with 10.4 million degrees awarded in 2022
- Looking at the **number of universities**, EMs again demonstrate considerable brain power: **six of the top ten countries stem from EMs**, with India and Indonesia in 1st and 2nd place respectively, and China in 4th position
- Although quantity – in terms of degrees awarded and number of universities – does not necessarily equate quality, it clearly highlights **the value EMs place on education**
- Given that working tenure can span decades, **educational investments yield long term benefits**, also underlining the importance of ongoing professional development

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

Emerging markets have created economic strategies to define goals and roadmaps for development, to motivate people, and to allocate resources

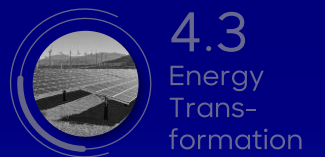
Examples of economic strategies in selected emerging markets



4.1
Global
Economics



4.2
Power
Shifts



4.3
Energy
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4.4
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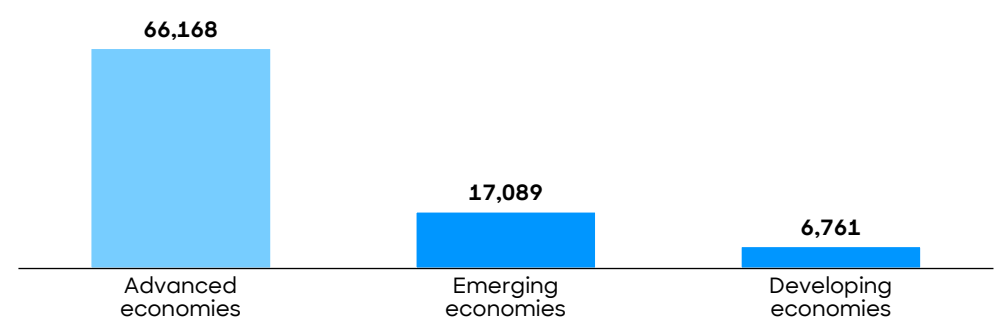


- A key element of emerging market's efforts to narrow the economic gap with advanced economies is the creation of comprehensive **development plans**
- Typically, such development plans comprise **multiple pillars**, including **economic growth**, productivity enhancements, infrastructure building, **technological development**, economic sovereignty, **diversification** of the economy, wider access to education, **welfare improvements**, and the creation of an inclusive, **sustainable and resilient economy**
- Development plans often focus on **key sectors**. These can receive **subsidies or other economic incentives**, which attract domestic or foreign investors
- **Technological advancement** and the development of **relevant skills among the workforce** are crucial for emerging markets, allowing for **a shift towards higher-value production**, enabling the manufacture of medium- and high-end goods instead of low-end items, and expanding their position in **global value chains**
- Development plans give domestic and international companies a clear **framework for their investment plans** and aim to **motivate people to work for and participate in progress**
- Most current plans are **focused on domestic operations**. However, the Chinese Belt and Road Initiative is a strategy that aims to connect foreign countries and China

Although the power shift towards emerging/developing markets is significant, in some key areas advanced economies still dominate

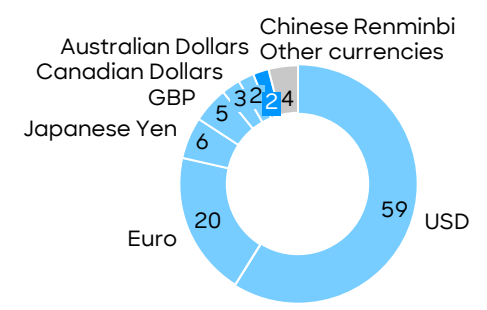
4.1 Global Economics

GDP PPP per capita, averages 2023 [USD]



4.2 Power Shifts

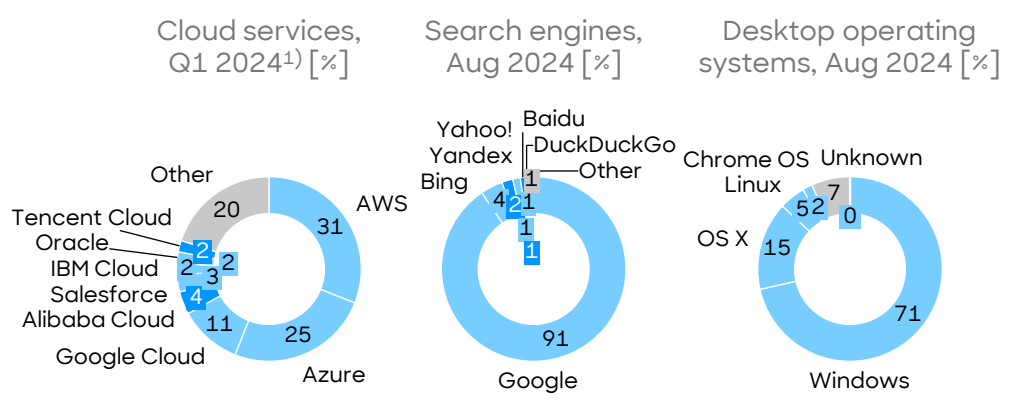
Foreign exchange reserves, global share, Q1 2024 [%]



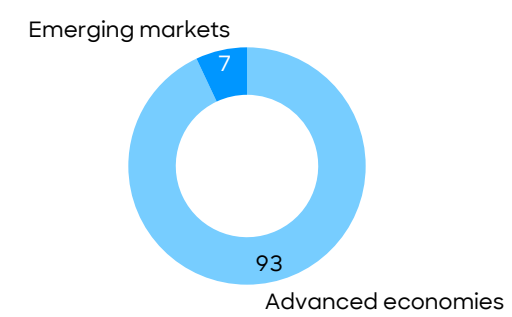
- Despite clear evidence of the economic **power shift towards emerging/developing markets**, in many key areas, **advanced economies retain a significant competitive edge**
- **GDP per capita** of advanced economies is about **four (ten) times higher** than that of **EMs (developing economies)**, even when measured in PPP terms

4.3 Energy Transformation

Global market shares in key IT services, 2024



Top 100 worldwide leading universities, 2024²⁾





- **85% of global foreign exchange reserves** are held in **US Dollar, Euro or Yen**. Most of the rest is held in currencies from other advanced economies
- **US companies dominate** the markets for **key IT services**
- **93 of the top 100 universities in the world** are in **advanced economies**


4.4 Debt Challenge


1) Includes platform-as-a-service (PaaS), infrastructure-as-a-service (IaaS) and hosted private cloud services; 2) According to Times Higher Education World Universities Ranking 2024 considering mainly research and teaching indicators, the number for advanced economies includes five universities from Hong Kong

Today, economic development can no longer be understood without climate change considerations - To achieve net zero, sectoral CO₂ mitigation is key

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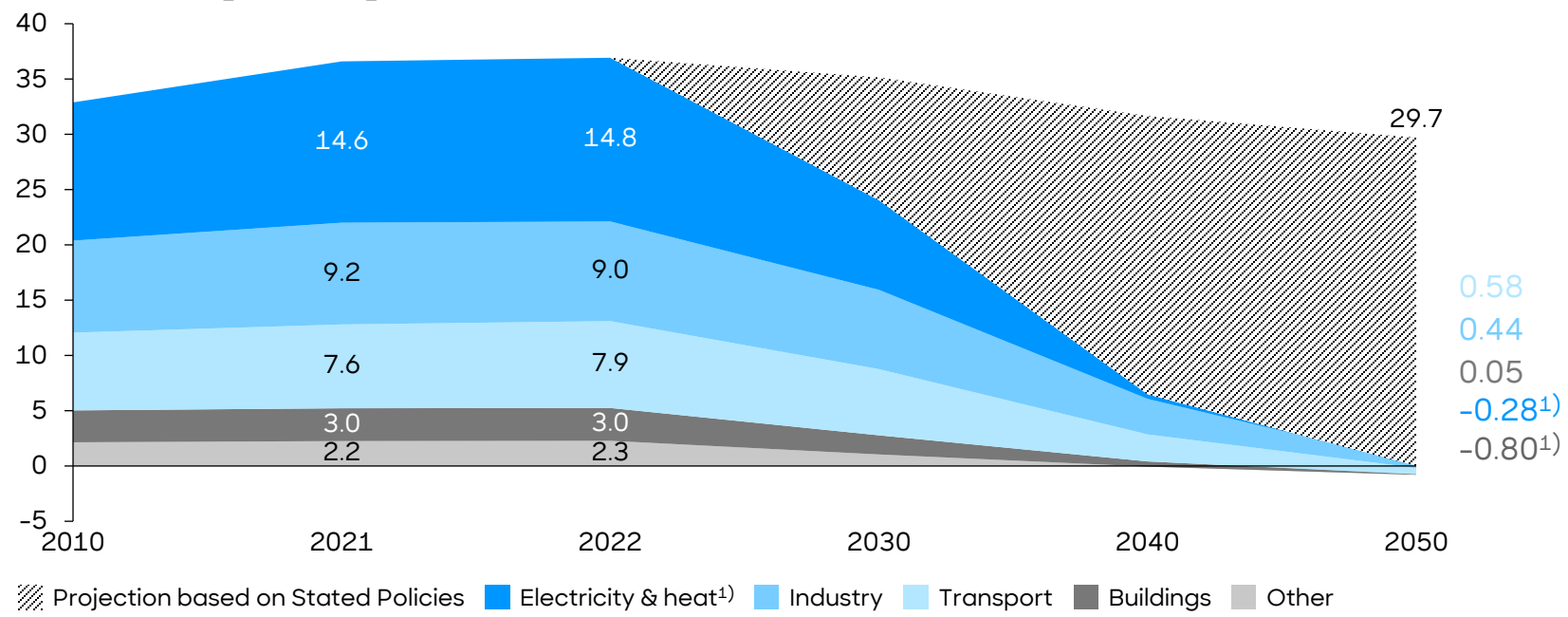
4.1
Global Economics
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4.2
Power Shifts
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4.3
Energy Transformation
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4.4
Debt Challenge

Global CO₂ emissions by sector in the Net Zero Emissions Scenario vs Stated Policies Scenario, 2010-2050 [Gt CO₂]



- With global temperatures continuing to rise and the effects of climate change becoming increasingly evident, **reducing emissions from all economic sectors is essential** to mitigate the worst of these effects and to create a more sustainable future
- To achieve the goal of net zero emissions by 2050, the **transformation of the power and heat generation sector must take place faster than other sectors**, as its electrification is extensive and therefore **relies on vast amounts of green electricity**

Stated Policies Scenario (STEPS)

- Outlines the emissions reduction goals that countries have **already announced**
- Assumes that countries **continue to implement policies** that are **currently in place**, such as emission targets set out in international agreements

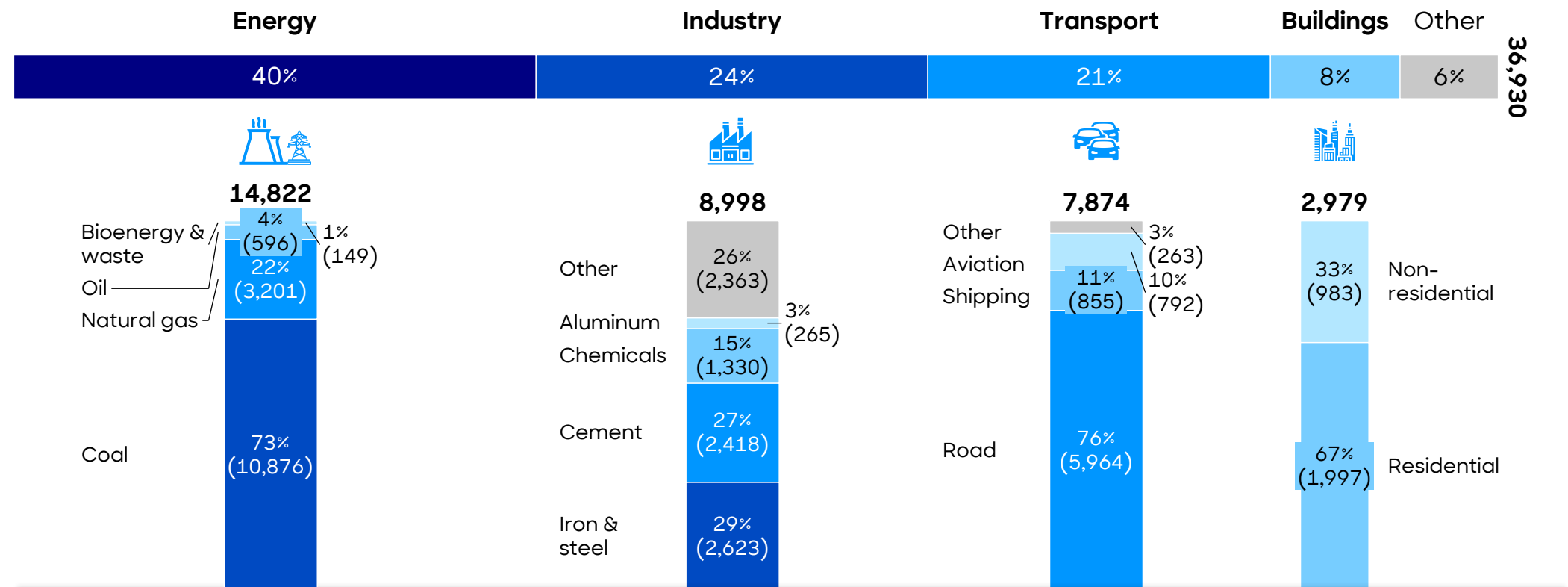
Net Zero Emissions (NZE) Scenario

- Sets out a **path to reach global net zero emissions by 2050**
- Assumes that **all countries** implement **ambitious policies** to reduce emissions from **all sectors**, including energy, industry, buildings, transport, and land use

1.) By 2050, the increased use of carbon capture and storage is expected to offset the CO₂ emissions of other sectors and thus become negative. Carbon removals and capture further contribute to reducing emissions with negative CO₂ emissions

While most CO₂ emissions stem from energy production, other sectors of the economy are also facing urgent requirements to decarbonize

Global CO₂ emissions by sector, sectoral breakdown, 2022 [% , Mt CO₂]

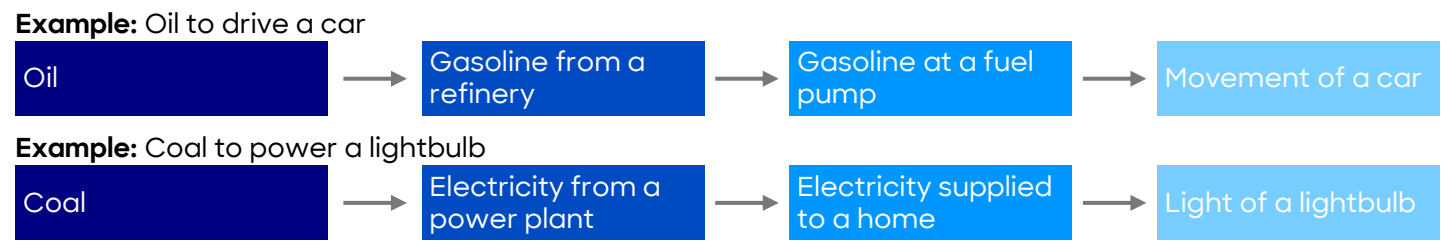
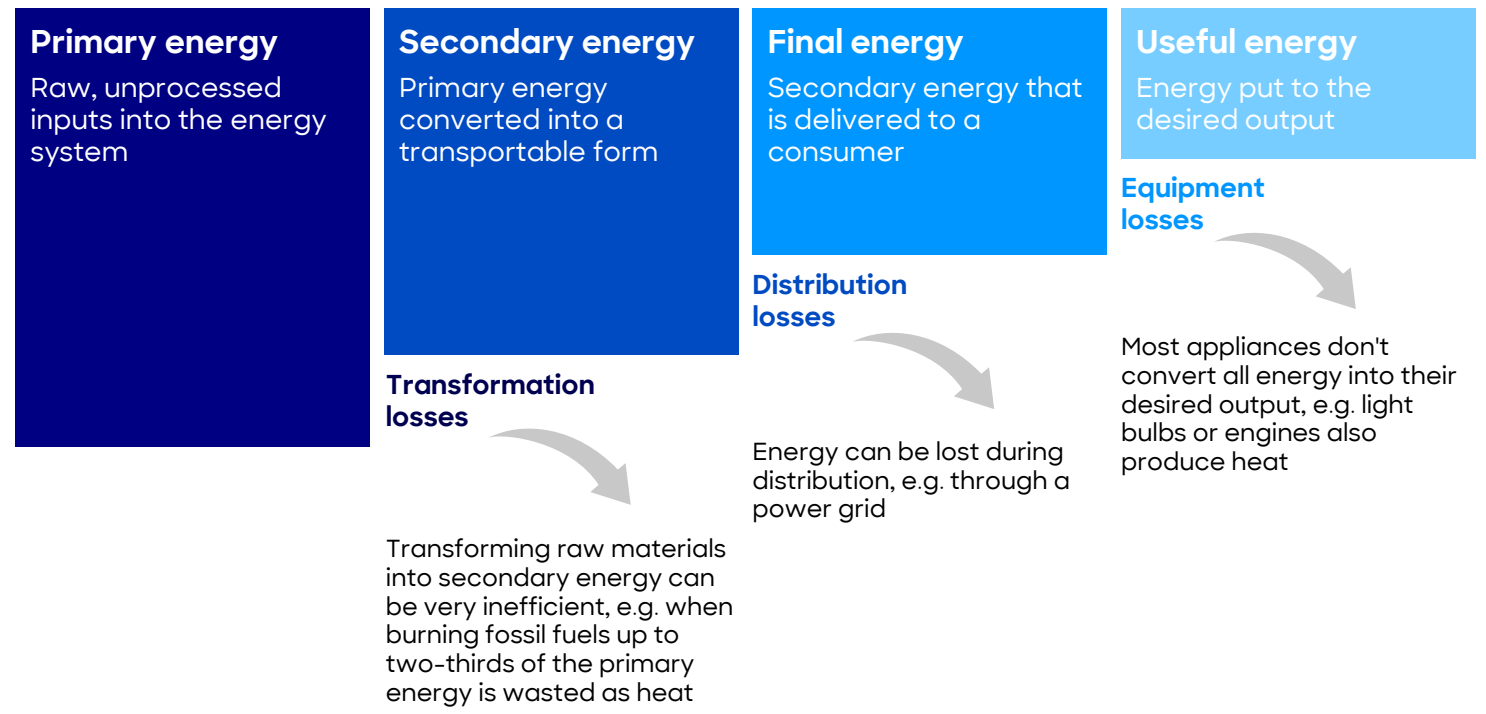


- Energy generation holds the **largest untapped potential for reducing CO₂ emissions**, contributing approximately 40% of the world's total. The sheer scale of emissions from this sector highlights **the critical role it must play in the fight against climate change**. Transitioning to cleaner energy sources and improving efficiency within this domain could lead to significant reductions in greenhouse gas emissions
- However, the energy sector is one of many sectors where emission reduction potentials are sizeable; sectors such as industry, transportation, and buildings also require substantial advancements to achieve **meaningful emission reductions**, thus **contributing more to a sustainable future**

- 4.1 Global Economics
- 4.2 Power Shifts
- 4.3 Energy Transformation
- 4.4 Debt Challenge

The energy chain provides a framework to understand the transformation and flow of energy from natural sources to its end use

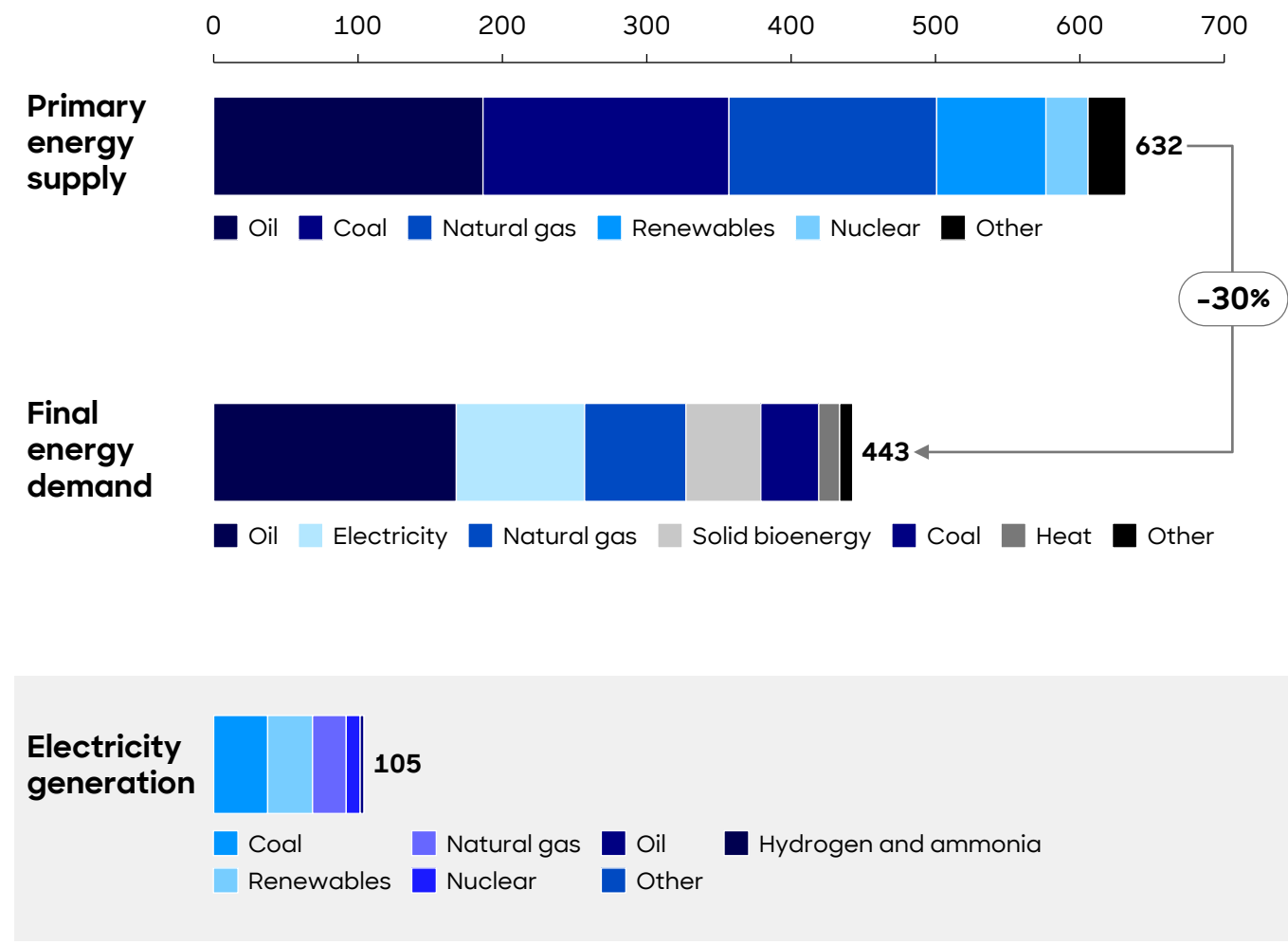
Schematic illustration of the energy chain



- The concept of the **energy chain** provides a comprehensive **framework for understanding the transformation and flow of energy** from its natural sources to its end use, highlighting efficiencies, losses, and environmental impacts at each stage
- It illustrates the **four key stages**: primary energy, secondary energy, final energy, and useful energy. Each stage represents a **transformation regarding the form and application of energy** from its origin to its ultimate use
- **Primary energy** refers to the initial sources of energy found in nature pre-transformation. **Secondary energy** is the energy derived from the conversion of primary energy into more usable forms; this stage involves processes such as refining. **Final energy** represents the energy as delivered to the consumer in its ready-to-use form. **Useful energy** is the actual energy service received by the end-user after accounting for all conversion losses along the energy chain

Along the energy chain, significant amounts of energy are lost through transformation, distribution and equipment losses

Illustration of the global energy chain, by energy source, 2022 [EJ]



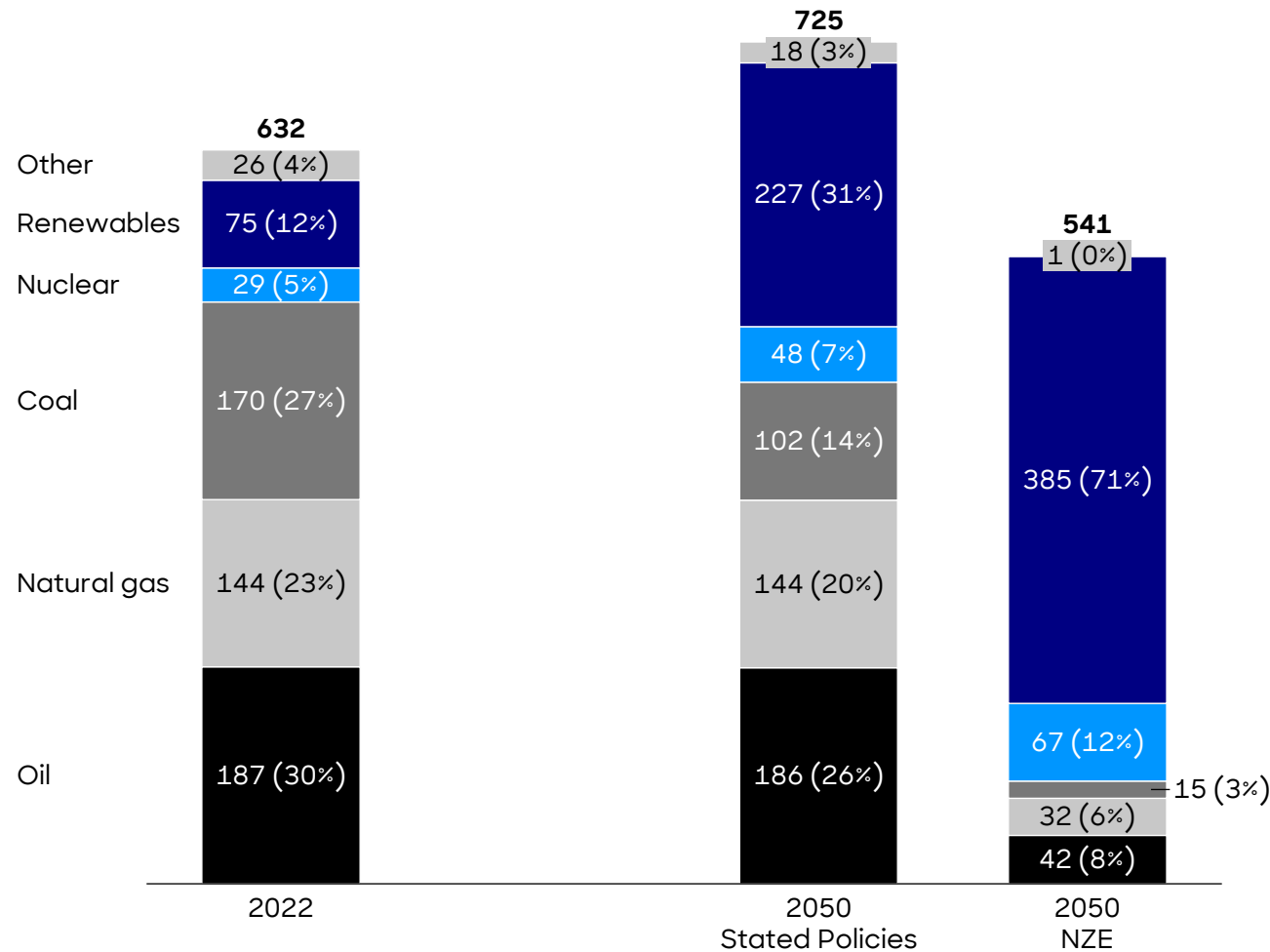
- In 2022, the **discrepancy** between **primary energy supply** and **final energy demand** was approximately 30%. This divergence is **attributable to energy losses** occurring throughout the energy chain
- In the global energy mix, **fossil fuels remained the dominant** source of primary energy supply and final energy demand in 2022. However, **renewable energy** sources contributed significantly to **electricity generation**, comprising approximately 30% of the total – yet still trailing behind coal, which accounted for 37% of global electricity production
- **Decarbonization** of the energy sector will be **driven by comprehensive electrification** and a **transition to renewable energy sources**. In the Net Zero Emissions (NZE) scenario, the share of renewables in electricity generation is projected to **increase to 89% by 2050**, accounting for 71% of primary energy supply
- **Electrification** of the economy **reduces primary energy supply** by **increasing efficiency**. Renewable electricity can be converted to useful energy more efficiently than fossil fuels, thus requiring less primary energy inputs to meet final demand. This shift **lowers energy losses** and improves system efficiency

1) CCUS (Carbon Capture, Utilization, and Storage) refers to technologies designed to capture carbon dioxide (CO₂) emissions from industrial processes or directly from the atmosphere

- 4.1 Global Economics
- 4.2 Power Shifts
- 4.3 Energy Transformation
- 4.4 Debt Challenge

Transition of energy systems is essential to combat climate change - An increasing share of renewables enables reduction of primary energy supply

Global primary energy supply, by fuel type, 2022 and 2050 [EJ, % indicates share of total]



- A far-reaching decarbonization of the energy chain is required to achieve net zero targets: in the NZE scenario, 71% of the primary energy supply must be covered by renewable energies by 2050
- Electrification of the economy can significantly advance this objective by enhancing energy efficiency and delivering clean energy, thereby reducing the overall primary energy demand
- Since electricity generated from renewables can be more efficiently converted to useful energy compared to fossil fuels, less primary energy is required to meet the same level of final energy demand. This shift reduces energy losses and improves overall energy system efficiency, leading to a lower primary energy supply
- Stringent policies and changes in consumer behavior also play a role in reducing energy demand. This includes measures such as improved urban planning, shifts in transportation modes, and more efficient use of energy in homes and businesses
- Despite ongoing efforts, achieving net zero remains a distant goal. Under the Stated Policies Scenario, current projections indicate that fossil fuels will continue to dominate the energy mix by 2050, with primary energy demand also set to increase

4.1 Global Economics


4.2 Power Shifts


4.3 Energy Transformation


4.4 Debt Challenge


Accelerating the electrification of multiple sectors of the economy is vital to mitigate climate change

Global electrification progress

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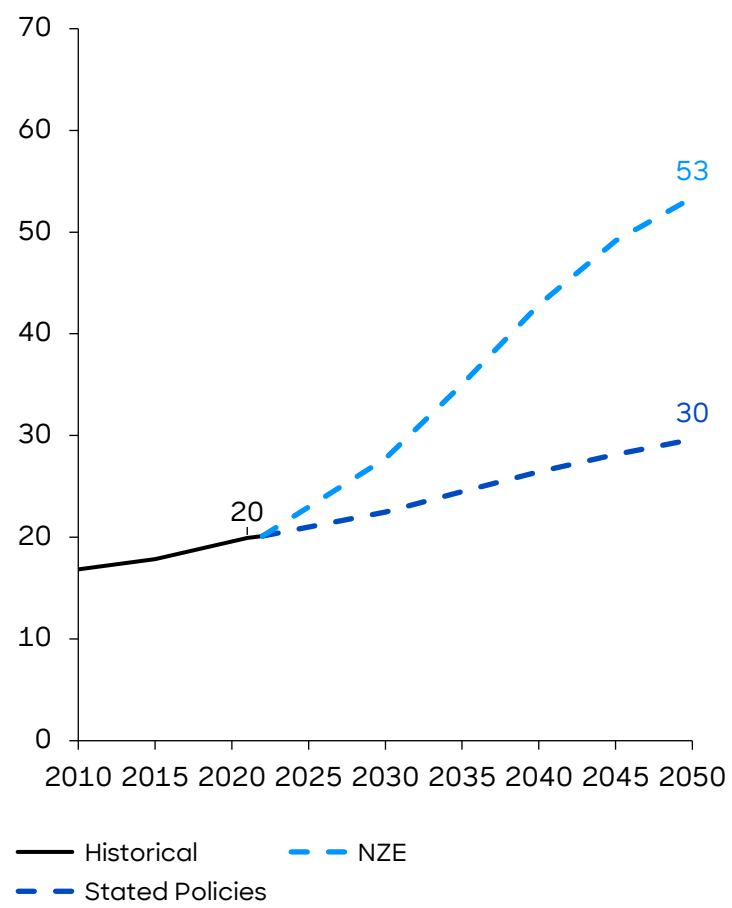
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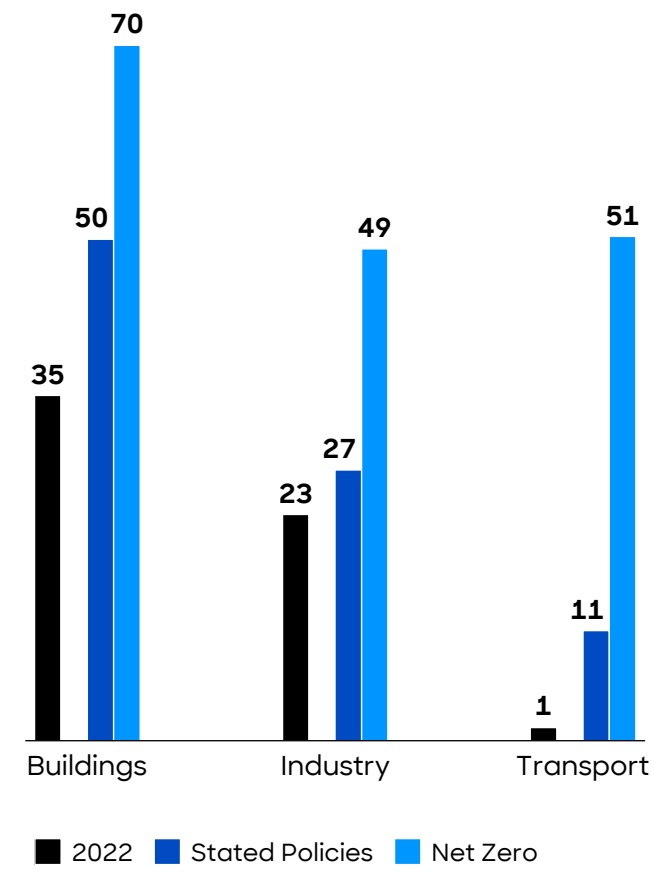
4.3
Energy Transformation
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4.4
Debt Challenge

Electricity as a share of total final energy consumption, 2010-2050 [%]



Electrification across end-use sectors as share of total final energy consumption, 2022 and 2050 [%]





- Globally, the share of electricity in final energy consumption will **increase** significantly by 2050. In the Stated Policies Scenario, the share of electricity increases from 20% in 2022 to 30% in 2050. By contrast, to achieve the net zero target, the share of electricity in final energy consumption must rise to 53%. The remaining energy consumption is largely made up of oil (12%), solid bioenergy (8%), and hydrogen (5%)
- A **major potential for electrification lies in the building sector**. Under the NZE Scenario, the share of electricity in energy consumption in buildings must double from 35% to 70% by 2050
- Similarly, the **transportation sector is undergoing electrification only to a small extent** to date. While progress has already been made in areas of personal mobility, **freight transportation, for example, has yet to experience major electrification**
- To achieve the **net zero target**, the share of electricity in **industrial energy** consumption must also **more than double by 2050**


Source: IEA; Roland Berger


Boosting electricity generation from renewable energy sources is key to improving clean energy production

Global electricity generation by source, 2022, and path to 2050 [TWh]

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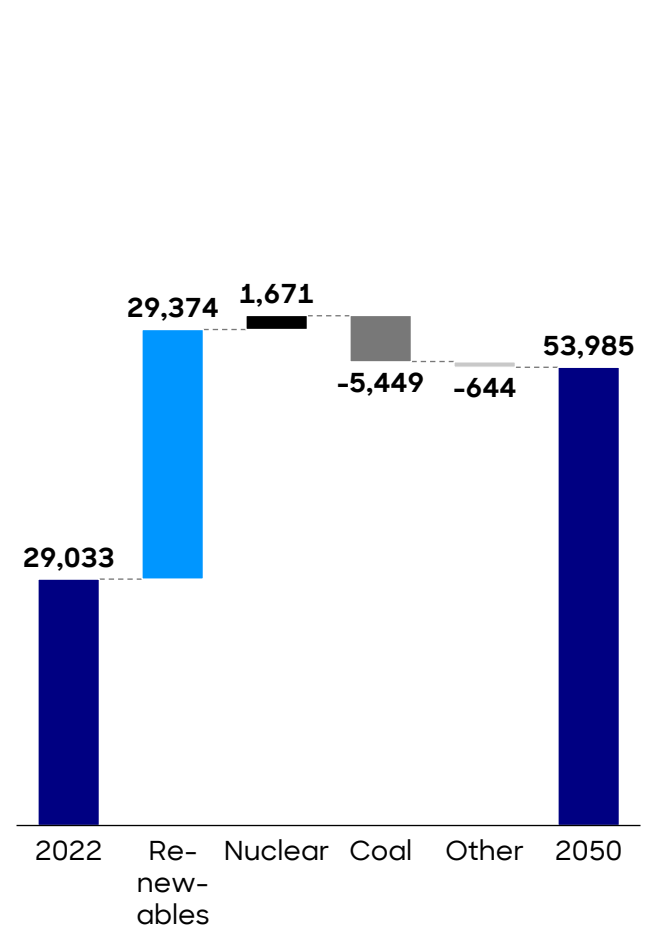
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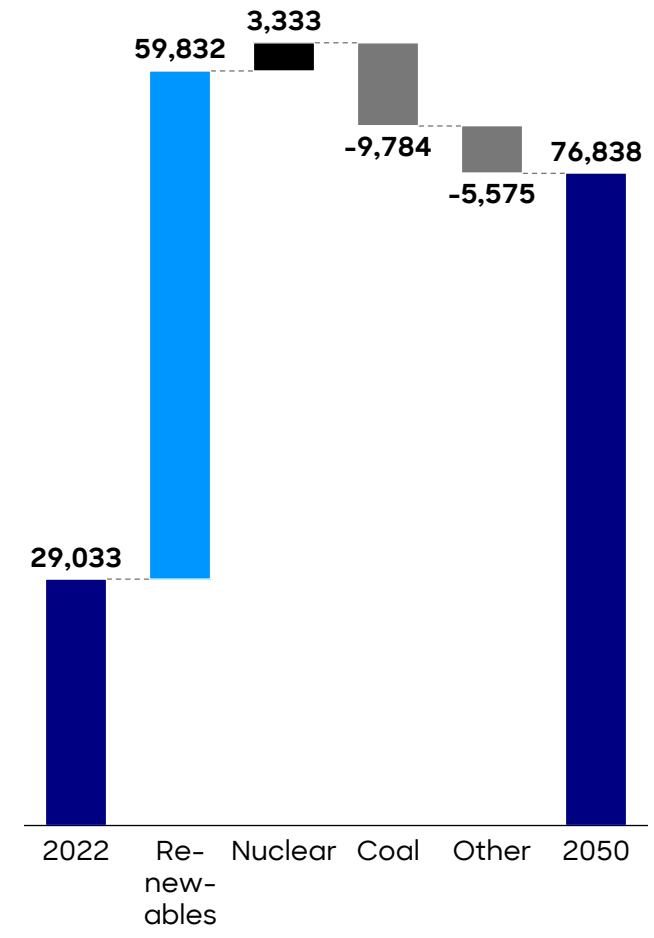
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Energy Transformation
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4.4
Debt Challenge

Current trajectory



Net Zero

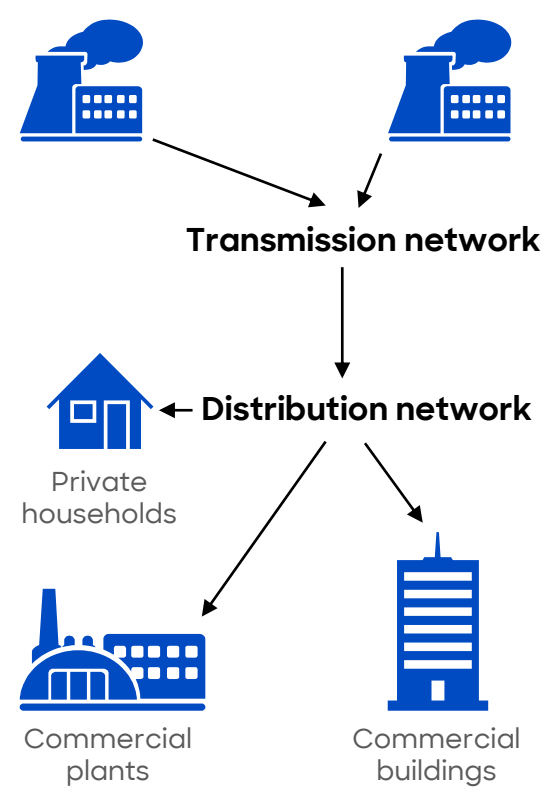


- It is essential not only to increase the share of electricity in final energy demand but also to **decarbonize the electricity generation process** itself. In the Net Zero Emissions by 2050 Scenario, **electricity generation needs to more than double**, necessitating an additional 60,000 TWh from renewable energy sources
- While electricity generation from **nuclear energy sources will also increase**, the demand for energy from fossil fuels, by contrast, is expected to decrease
- **Global coal-fired power generation decreases by around 50% by 2050** in the Stated Policies Scenario (current trajectory), reflecting a broad-based decline across most regions of the world, with the main exceptions being India and emerging Asia. In the NZE Scenario, coal-fired electricity generation even decreases by more than 90%

Near term, energy production facilities will be located closer to where energy is consumed, reducing system inefficiencies and lowering costs

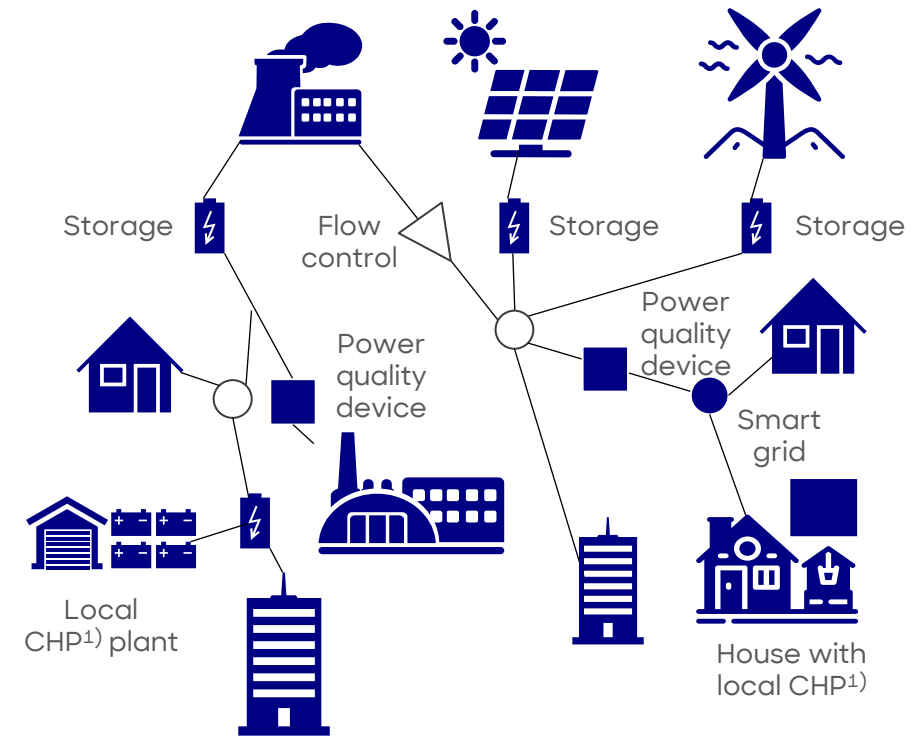
Differences between a centralized and decentralized energy system

Centralized energy system



Unidirectional energy flow
'Generation follows load'

Decentralized energy system



Bidirectional energy flow 'Load follows generation'

- Traditionally, power industry infrastructure has been modelled on a system of **large, centralized power plants** supplying energy via far-reaching **transmission networks** and downstream **distribution networks**, which, in turn, supply households and commercial sites
- **Decentralized energy systems** are characterized by **energy generation facilities located closer to places of consumption**
- Decentralization of energy production **enables optimized use of renewable energy sources** and CHP¹) while reducing fossil fuel consumption under increased eco-efficiency
- As end users are widely distributed, similarly distributed and decentralized power generation can **reduce transmission and distribution inefficiencies** as well as lower associated economic and environmental costs

1) Combined heat and power (CHP) plants recover otherwise wasted thermal energy for heating

Source: Farrell, J.; UN ESCAP; Roland Berger

Increased investment in energy infrastructure is needed to successfully integrate a larger share of renewable energy sources into power systems

Investment needs for power grids

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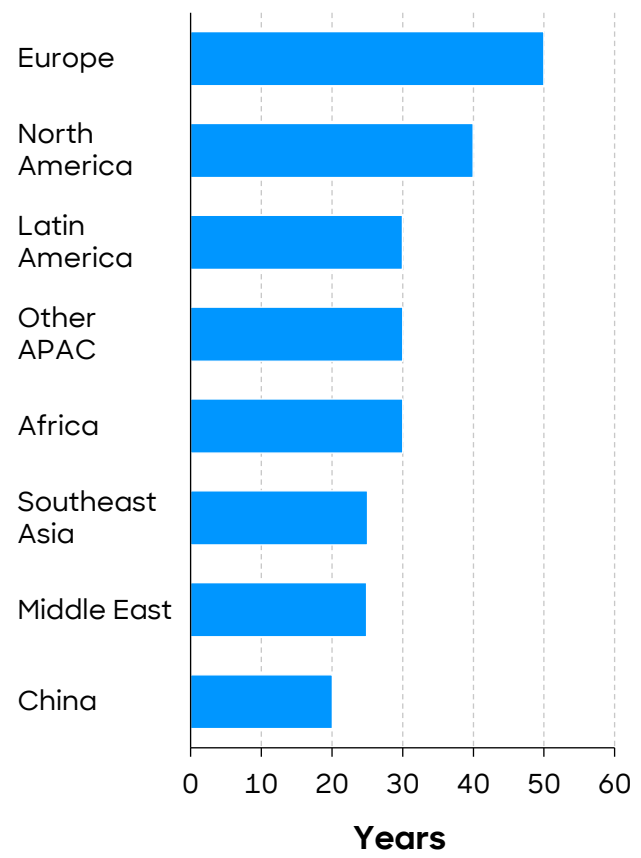
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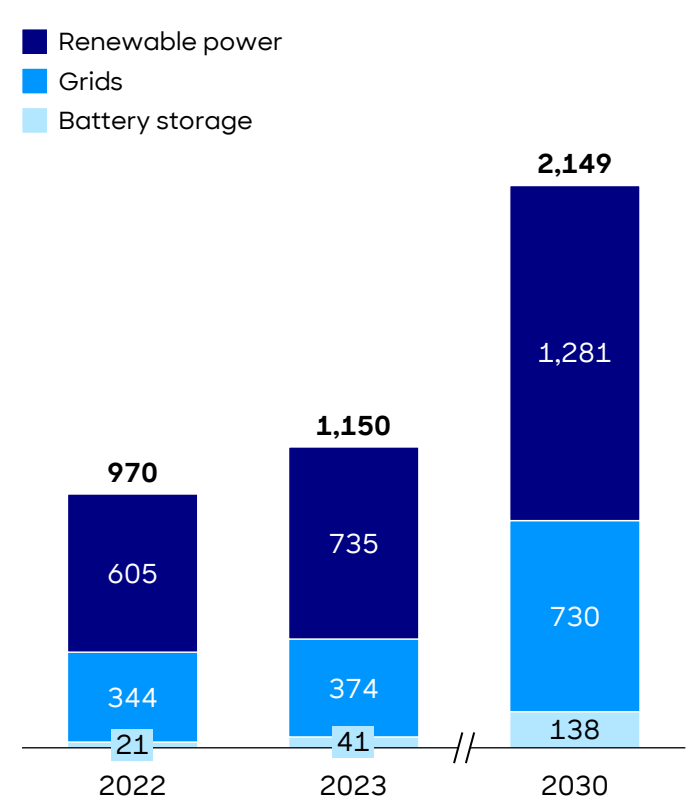
4.3
Energy Transformation
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4.4
Debt Challenge

Average age of regional power grids [years]



Annual global investments in renewables, grids and battery storage in the Net Zero Emissions Scenario, 2022-2030 [USD bn]



- As the demand for clean energy grows, many **existing grids** are deemed **outdated, inadequate, and unable** to manage the **intermittent nature of renewables** like solar and wind
- The rise of distributed energy resources, such as rooftop solar panels and local energy communities, **requires a more flexible grid** capable of handling **bidirectional power flows**
- Furthermore, as economies move towards electrification for heating, in transportation and industry, electricity demand is expected to surge, **necessitating significant grid upgrades**
- Enhancing grid resilience against **extreme weather events and cyber threats** is also a critical consideration, as is the **need for long-distance transmission infrastructure** to connect remote renewable energy sources to population centers
- **Failure** to make these investments could **jeopardize the connection of key decarbonization technologies** such as electric vehicles, heat pumps, and renewables

Road transport accounts for the largest share of transport emissions worldwide - Switching to clean fuels paves the way to carbon neutrality

Decarbonization efforts in transportation

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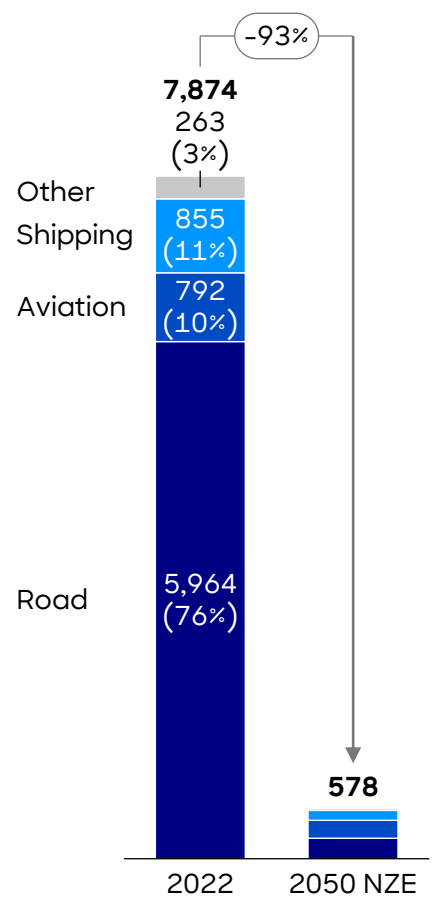
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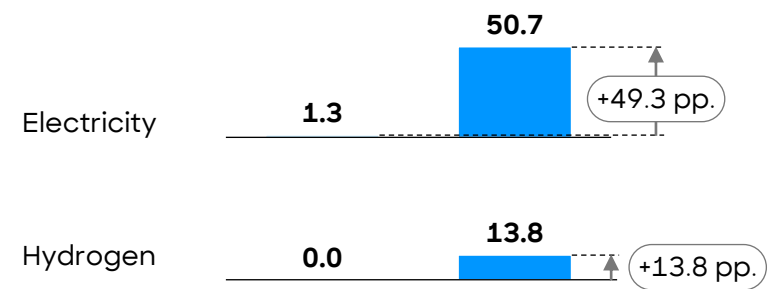
4.4
Debt Challenge

Global transportation CO₂ emissions, 2022 and 2050 [Gt CO₂]

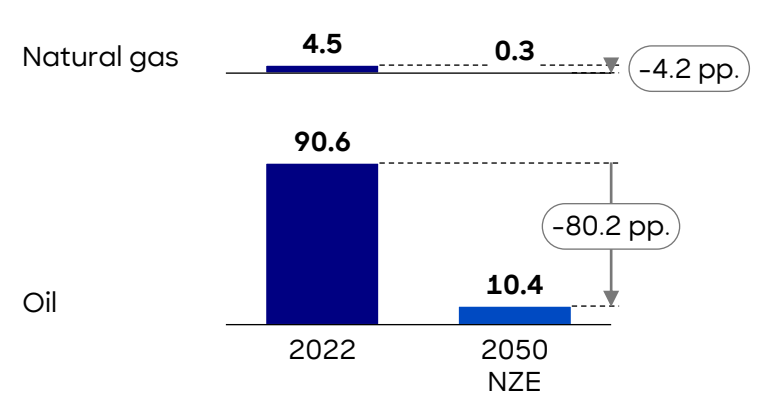


Share of fuel type in transport final energy demand, globally, 2022 and 2050 [%]

Scale up clean fuels



Phase down fossil fuels

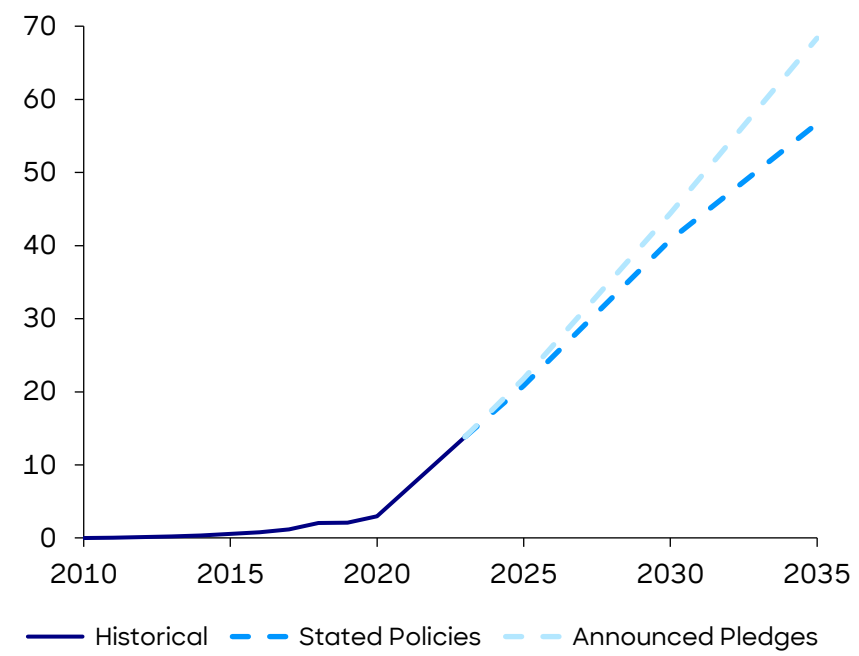


- Transport accounts for more than a **third of CO₂ emissions** from end-use sectors. Motorized transport on land, sea and air remains dependent on internal combustion engines that generally run on fossil fuels
- In 2022, the **rebound in passenger and cargo transport** activity, following the COVID-19 pandemic, led to a **3% increase in transport CO₂ emissions** compared to the previous year
- **Getting on track** with the NZE Scenario would **require transport emissions to fall by about 25% to around 6 Gt by 2030**, even with an anticipated growth in demand
- Achieving this drop will depend on the **rapid electrification of road vehicles, operational and technical energy efficiency measures, the scaling up and commercialization of low-emissions fuels** - especially in the **maritime and aviation sub-sectors** - and **policies** to encourage modal shift to less carbon-intensive travel

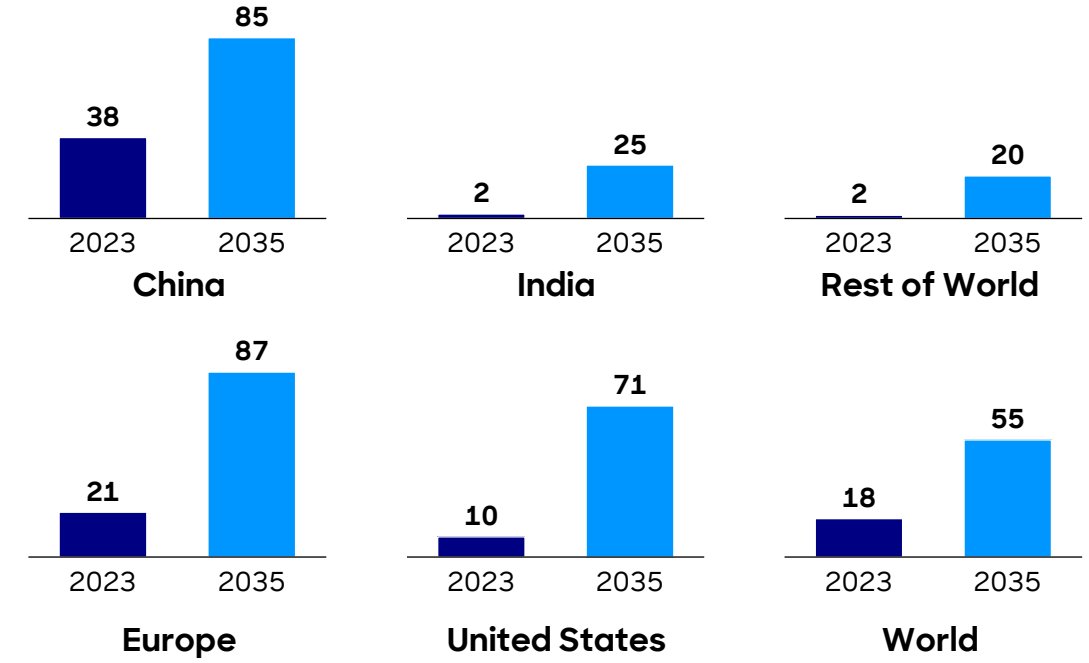
Electrification is key to decarbonizing road transport - EVs must account for a larger share of new car sales to meet climate targets

Global electric car sales and sales share [m, % of all car sales]

Vehicles sold [m]



Share of EVs as % of all car sales in the Stated Policies scenario



- **Electric vehicle sales** continued their **upward trajectory**, reaching nearly 14 million units in 2023, with sales in 2024 projected to rise to around 17 million units, **representing over 20% of global car sales**. Despite concerns about the industry's growth rate – driven by factors such as **narrow profit margins, fluctuating battery metal prices, high inflation**, and the **gradual reduction of purchase incentives** in certain countries – **global sales data indicate a robust demand**
- In 2023, **China, Europe, and the United States** accounted for the majority of electric vehicle (EV) sales, with shares of 60%, 25%, and 10% respectively. Collectively, these regions represent around 65% of global car sales, highlighting that **EV adoption remains more regionally concentrated** compared to traditional vehicles. Although **EV penetration in emerging markets with large car industries is still modest**, several factors suggest potential for significant growth; policy interventions, including purchase subsidies and incentives for EV and battery production, are instrumental in driving this expansion

The growing trend towards SUVs threatens to undermine the achievement of climate targets - SUVs emit 20% more CO₂ than conventional cars

Facts around SUVs

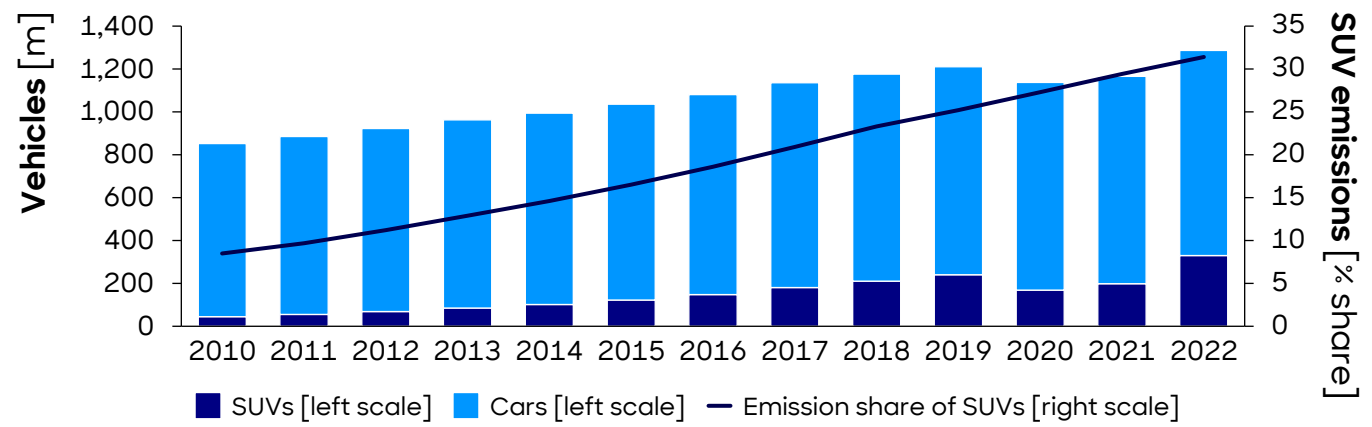
4.1
Global Economics

4.2
Power Shifts

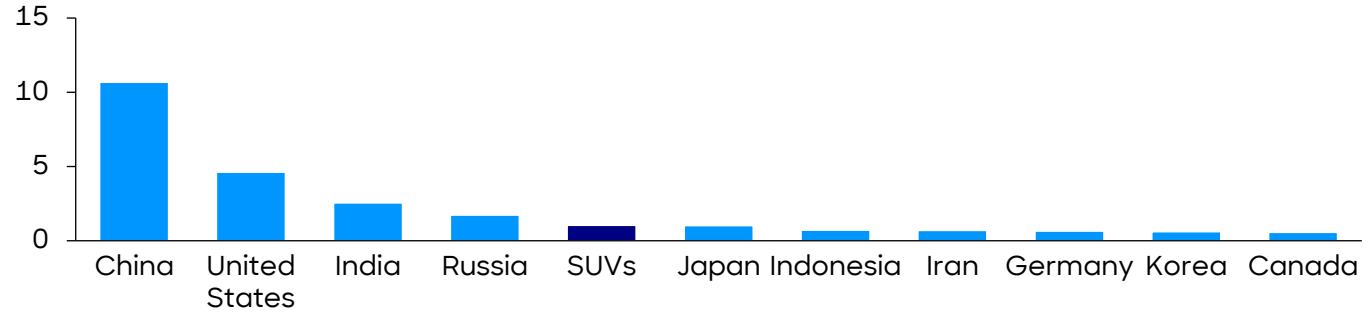
4.3
Energy Transformation

4.4
Debt Challenge

Global passenger car fleet and share of SUVs in total car emissions, 2010-2022 [m vehicles, %]




Global combustion-related CO₂ emissions from SUVs and 10 highest-emitting countries, 2023 [Gt CO₂]





- **Sports Utility Vehicles (SUVs)** continue to enjoy **growing popularity** worldwide. From 2010 to 2022, their numbers have soared, reaching nearly 330 million in 2022
- In 2023, SUVs represented **48% of global car sales**, setting a new record and reinforcing the dominant automotive trend of the early 21st century – the ongoing **transition towards increasingly larger and heavier vehicles**
- There are **various driving forces** behind this trend, including the perception of SUVs as **status symbols**, their perceived advantages in terms of **safety and comfort**, and the **strategic marketing efforts** of major automotive manufacturers
- In large part, though, the rise of SUVs is attributable to a **deliberate strategy by automakers to promote these vehicles**. Despite their modestly higher production costs, SUVs are **sold at a premium**, resulting in a 10-20% higher profit margin compared to smaller vehicles
- The rising sales of SUVs pose a significant **challenge to meet carbon reduction targets**. Owing to their **larger size and increased weight**, SUVs consume notably **more fuel than conventional vehicles**, leading to CO₂ emissions that are approximately 20% higher


As global aviation activity continues to grow, sustainable technologies are expected to pave the way for a net zero aviation future

Global aviation activities

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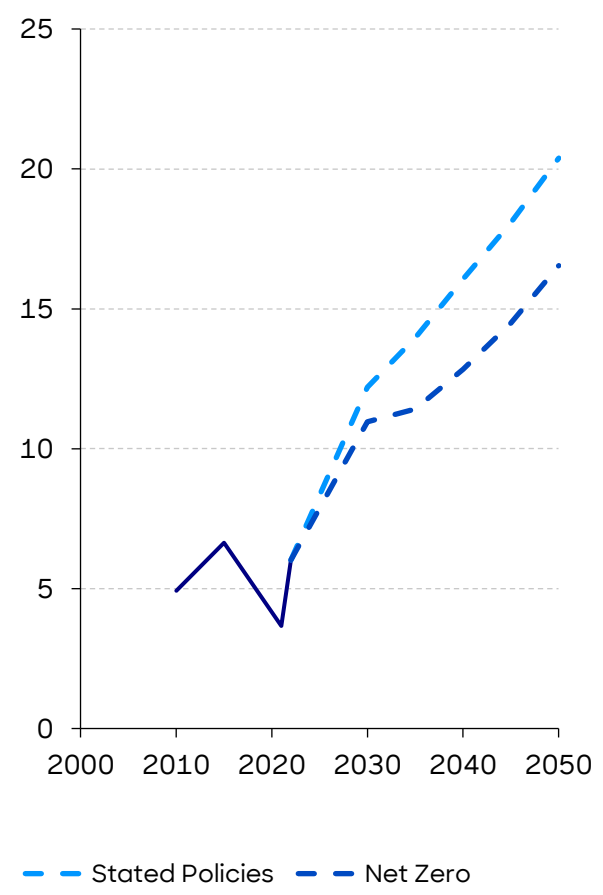
4.1
Global Economics
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4.2
Power Shifts
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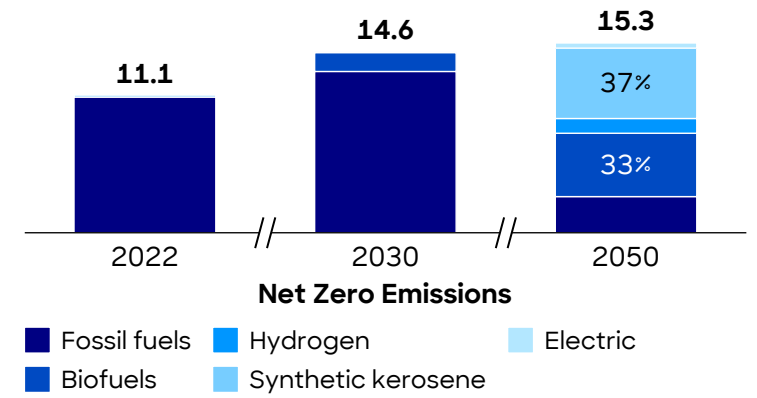
4.3
Energy Transformation
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4.4
Debt Challenge

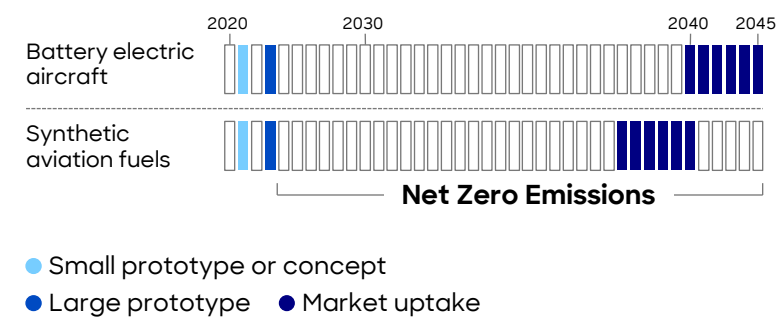
Global aviation activity, 2010-2050
[trillion pkm¹]



Global aviation energy consumption, by fuel, 2022-2050
[EJ, %]



Technologies enabling the use of low-emissions fuels in aviation, 2020-2050
[market status]

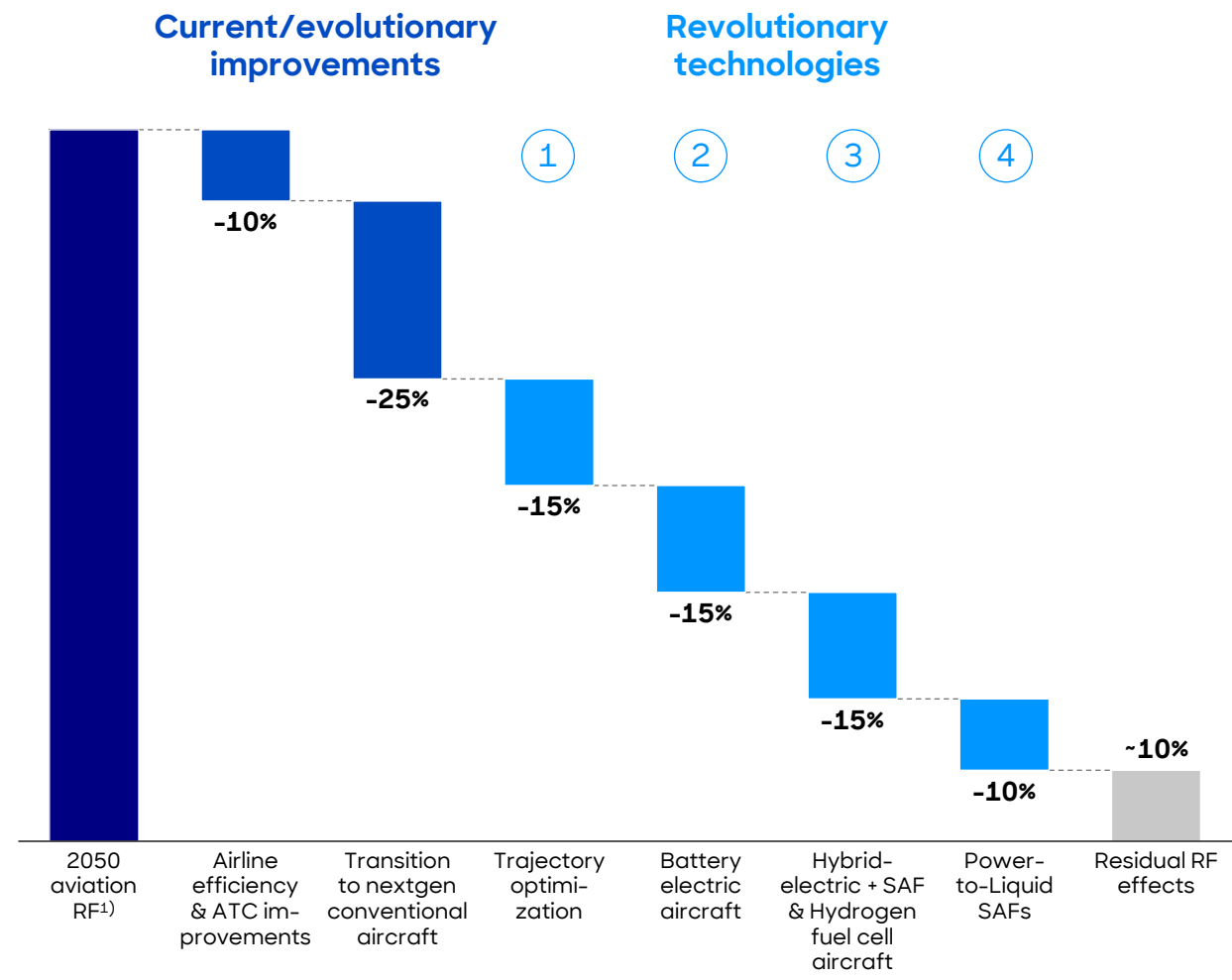


- Although **aviation** is contributing a comparatively **modest share to global emissions**, it remains one of the **most difficult sectors to decarbonize**
- Despite the observed reduction in air travel during the coronavirus pandemic, **demand for aviation is projected to increase significantly through 2030**, even under the Net Zero Emissions Scenario
- As a result, **technological advances throughout the aviation sector are essential**, including the development of **low-emission fuels, aircraft and engines enhancements**, and the **optimization of operational efficiency**
- **By 2050, the proportion of sustainable fuels in the sector's energy consumption is set to increase significantly**: together, synthetic kerosene and biofuels should then account for 70% of energy consumption, while the proportion of fossil fuels should fall significantly
- It may **take some time before these fuels are market-ready**: estimates suggest their uptake from 2035 onward. Battery electric aircrafts are also not expected to be commercially viable until 2040

1) Pkm refers to passenger-kilometer and is a unit of measurement representing the transport of one passenger by a defined mode of transport over one kilometer
Source: IEA; Roland Berger

Aviation can reduce its radiative forcing impact by 90% through evolutionary process improvements and revolutionary new technologies

Radiative forcing¹⁾ mitigation measures



- The **climate impact** of aviation extends significantly **beyond CO₂ emissions** due to factors such as **contrails, aviation-induced cloudiness, water vapor, sulfates, and nitrogen oxides (NO_x)**
- Estimates suggest that the overall **radiative forcing impact** of aviation is approximately **three times greater** when accounting for these additional effects beyond CO₂ alone
- To address these climate impacts, both **incremental improvements** and **revolutionary technologies** are essential
- Enhancements in **airline efficiency** and **air traffic control (ATC)** can reduce radiative forcing effects by approximately one third. **Revolutionary technologies** such as **trajectory optimization, battery electric aircrafts, and sustainable aviation fuels (SAF)** have the potential to mitigate an additional 55% of radiative forcing, leaving a residual impact of about 10%
- **SAF offers the greatest potential** to reduce CO₂ emissions from international aviation. However, while several countries and major oil companies, **are investing in SAF production facilities**, there remain many **challenges**
- Currently, SAF is currently 2-5 times **more expensive than conventional jet fuel**. Additionally, there is still a **huge gap in production capacity**. In addition, the **infrastructure** regarding supply chains and airports must be converted to SAF

1) Radiative forcing (RF) measures the balance of energy moving into vs. out of the Earth's atmosphere (i.e. the instantaneous impact on global warming)

Source: Roland Berger Aviation Radiative Forcing Model

4.1 Global Economics


4.2 Power Shifts


4.3 Energy Transformation


4.4 Debt Challenge


As the shipping industry is expected to grow significantly in the future, the transition to sustainable fuels is vital to achieve net zero targets

Development of shipping activity and energy requirements

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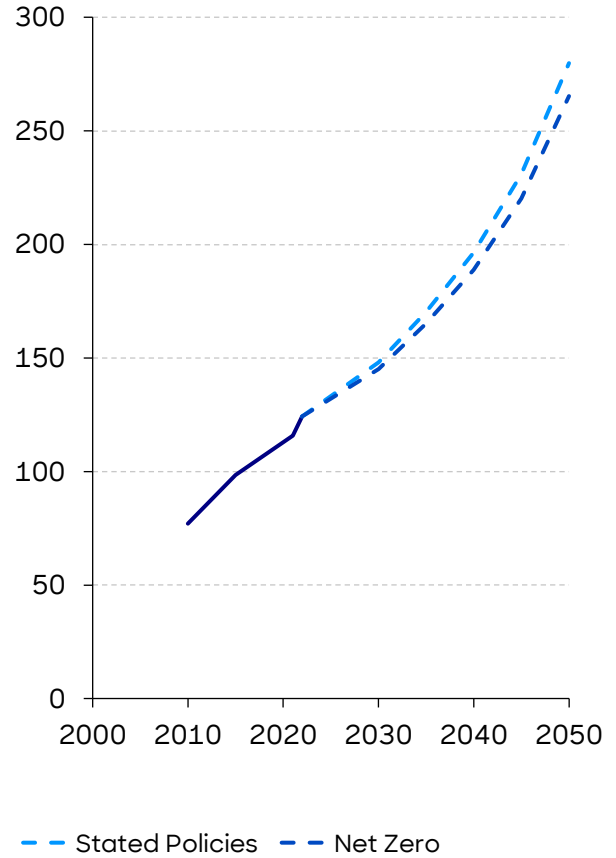
4.1
Global Economics
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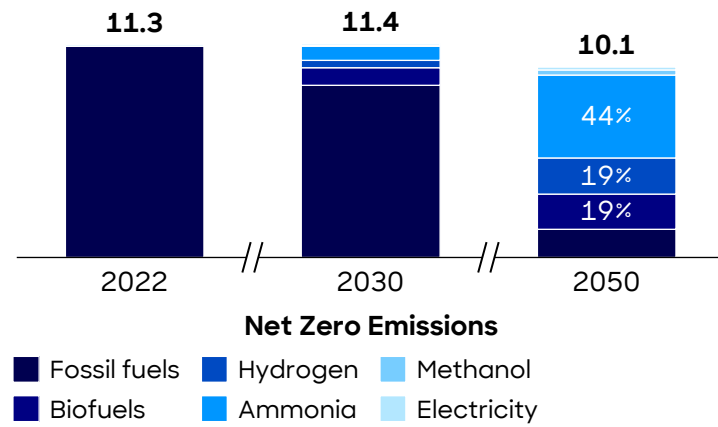
4.3
Energy Transformation
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4.4
Debt Challenge

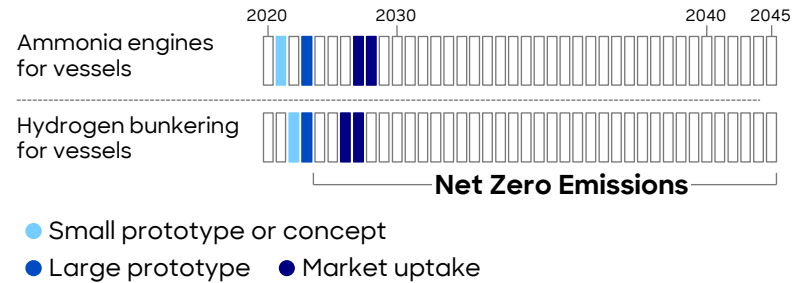
International shipping activity, 2010-2050 [trillion tkm]



Global energy consumption of the shipping sector, by fuel, 2022-2050 [EJ, %]



Technologies to enable the use of low-emissions fuels in shipping, 2020-2050 [market status]

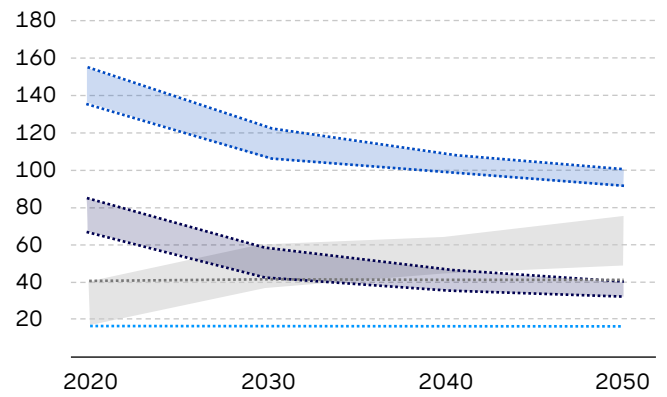


- In 2022, **international shipping** was responsible for approximately 2% of global energy-related CO₂ emissions. To align with the IEA's Net Zero Emissions (NZE) by 2050 Scenario, the sector must achieve a **nearly 15% reduction in emissions by 2030**, despite the **expected growth in shipping activity**
- Historically, **oil-based fuels** have satisfied over **99% of the global energy demand** for international shipping, with biofuels contributing around a near negligible 0.5%
- To achieve NZE goals, the shipping sector must significantly **ramp up its use of alternative fuels**, such as biofuels, hydrogen, ammonia, and electricity. By 2030, these low-emission fuels are projected to account for nearly 15% of total energy demand in the NZE Scenario
- While about **half of low-emission fuel** use in 2030 is expected to be in the **form of biofuels** - which can be used in existing vessels - technological development together with policy support will be needed to **enable the use of other fuels, particularly ammonia and hydrogen**, to reduce dependency on oil-based fuels in international shipping

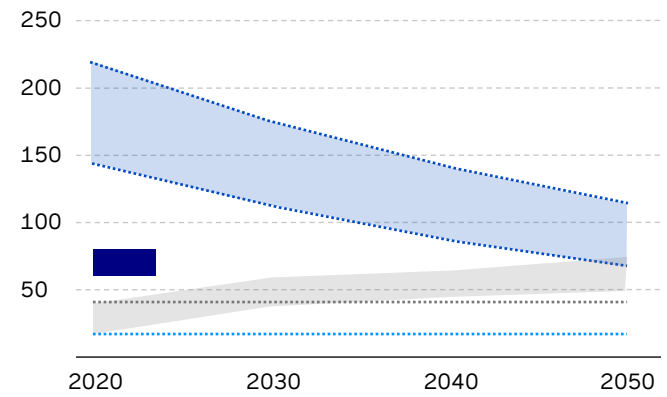
By 2050, under favorable conditions, the price of ammonia and green H₂O used as marine fuel could be competitive with fossil fuels

Cost projection for selected shipping fuels, 2020-2050¹⁾ [USD/MWh]

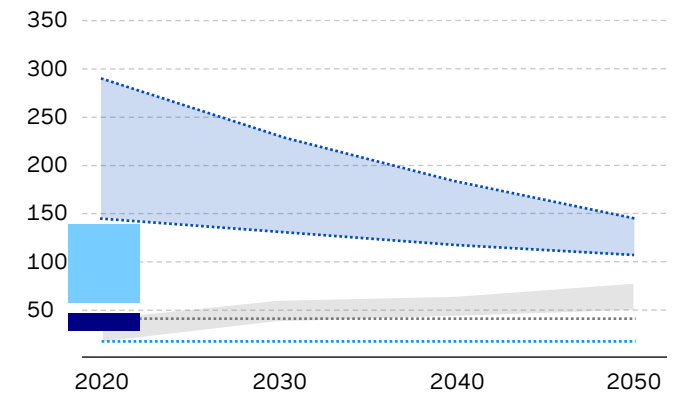
Green H₂ cost projections



Ammonia cost projections



Methanol cost projections



Fossil fuel range projection
 VLSFO²⁾ market price 2019
 LNG market price 2019
 Renewable-H₂ cost range; electricity cost 65 USD/MWh
 Renewable-H₂ cost range; electricity cost 20 USD/MWh

Fossil fuel range projection
 VLSFO²⁾ market price 2019
 LNG market price 2019
 Renewable e-Ammonia
 Natural gas-based Ammonia

Fossil fuel range projection
 VLSFO²⁾ market price 2019
 LNG market price 2019
 Bio-methanol
 Renewable e-Methanol
 Fossil-based Methanol

- To achieve future levels of decarbonization in the shipping industry, the key focus is on a **swift and progressive transition from fossil fuels** to renewable alternatives. The **most viable renewable fuels** for this sector are **advanced biofuels and e-fuels, including methanol and ammonia**
- Each renewable energy fuel presents distinct advantages as well as challenges: the **selection** of an appropriate fuel is **influenced by factors** including **supply chain logistics, engine compatibility, environmental impact, and production costs**. Ultimately, the feasibility of deploying these fuels will be determined by their production costs and availability which are influenced by feedstock prices, production processes, and the technological maturity of production methods
- Ammonia** is poised to become the **backbone in decarbonizing international shipping** over the **medium to long term**. By 2050, e-ammonia production costs are projected to range between USD 67-114/MWh, making it **competitive with fossil fuels**. While the **direct use of green hydrogen** may be **viable for short voyages**, its primary role will be indirect, i.e. in producing other e-fuels for shipping. Although **e-methanol requires little to no engine modifications**, its key **constraint is the availability and high cost** of a non-fossil CO₂ supply required during the production process

1) Figures refer to the cost of fuel production; the total cost of ownership (e.g. machinery, storage, and other) is not captured; 2) VLSFO refers to very low-sulphur fuel oil
 Source: IRENA; Roland Berger



4.1
Global Economics



4.2
Power Shifts



4.3
Energy Transformation

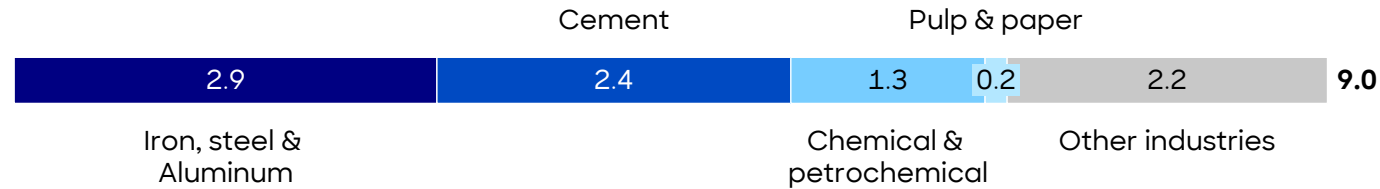


4.4
Debt Challenge

Energy-intensive sectors are major contributors to CO₂ emissions - Industrial heat demand is the main driver

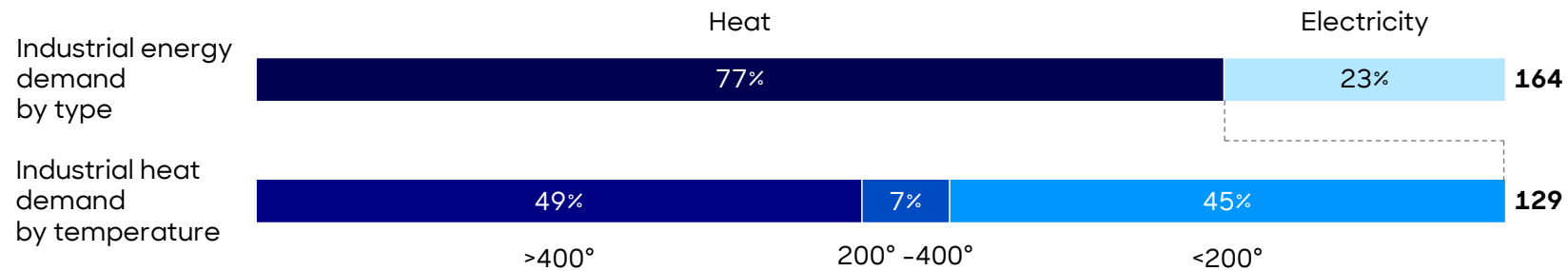
4.1
Global Economics

Total CO₂ emissions from the industrial sector, 2022 [Mt CO₂]



4.2
Power Shifts

Global industrial energy & heat demand, 2022 [EJ]



4.3
Energy Transformation

Overview of heating electrification technologies

Method(s)	Description
Mechanical heating • Heat pumps	Transfers and generates heat using compressed/expanded refrigerant
Resistive heating • Electric boilers • Metallic resistance heater	Generates heat by passing electric current through resistive material
Electro-magnetic heating • Induction • Microwave and infrared • Radio wave	Generates heat using electro-magnetic fields with internal heating
Electric arc-based heating • Electric arc furnaces • Plasma torches	Generates heat by forming electric arc between two electrodes

4.4
Debt Challenge

- Industrial energy consumption - primarily driven by fossil fuels such as coal - accounts for about 25% of energy-related CO₂ emissions. Decarbonization is challenging due to the **high costs and early-stage development of low-carbon technologies**, alongside the long lifespans of industrial assets
- Many industrial processes **rely on high-temperature heat that current technologies cannot fully decarbonize**. Thermal processes dominate industrial energy demand, particularly in sectors like metals, cement, and chemicals

Globally, energy-intensive metals production is expected to grow - Decarbonizing the sector's processes and boosting recycling are key

Decarbonization in metals industries in the Net Zero Emissions (NZE) Scenario

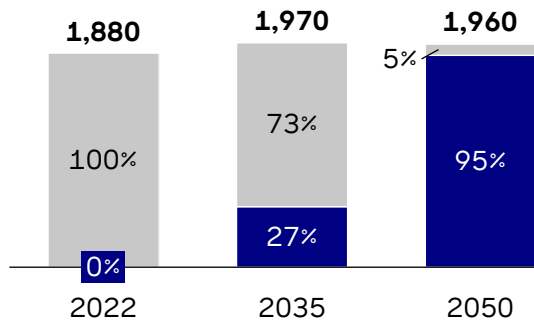
4.1 Global Economics

4.2 Power Shifts

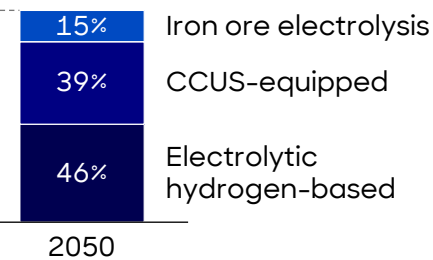
4.3 Energy Transformation

4.4 Debt Challenge

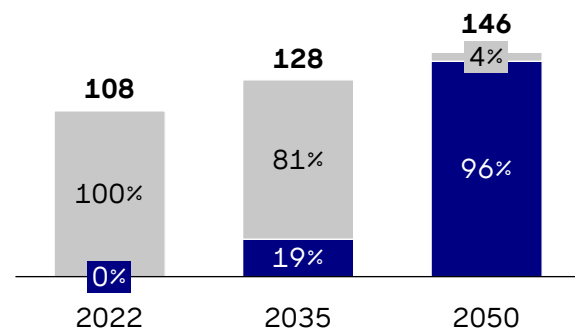
Crude steel production, 2022-2050 [Mt, %]



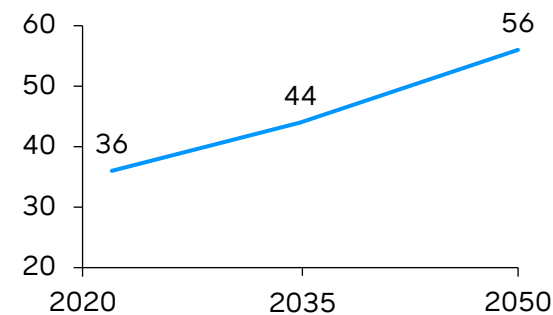
Share of near zero emission iron production, 2050 [%]



Aluminum production, 2022-2050 [Mt, %]



Share of secondary aluminum production, 2022-2050 [%]



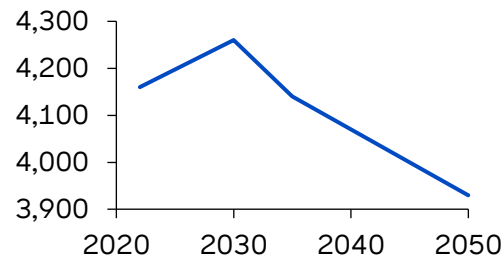
■ Near zero emission production ■ Remaining production

- Global **steel demand** has witnessed significant growth in recent years, propelled by both **population and economic expansion**. This upward trajectory is **anticipated to persist**, particularly due to robust economic development in India, ASEAN countries, and Africa. Alongside, **aluminum demand is also projected to increase**, given it is a **key input** in various technologies **essential for the global energy transition**
- The **potential to lower emissions** stemming from conventional steelmaking processes and scrap utilization remains **constrained**. Thus, **innovation during this decade will be pivotal** in advancing and **commercializing near zero emission steel production technologies**
- According to the IEA, near zero emission production – **the H2-DRI route and CCUS-equipped routes¹⁾** – commences at scale in the 2020s, accounting for more than 25% of primary production by 2035
- Currently, **most of primary aluminum smelting** relies on **carbon anodes**, generating CO₂ emissions as an **inherent part of the electrolysis process**. However, these **carbon anodes can be substituted with inert anodes** composed of alternative materials avoiding CO₂ emissions
- **Recycling** is another pillar in the decarbonization process. By **2050**, the **share of secondary production for aluminum** is expected to reach **56%**. The share of **scrap in steel production** is set to reach **48%**

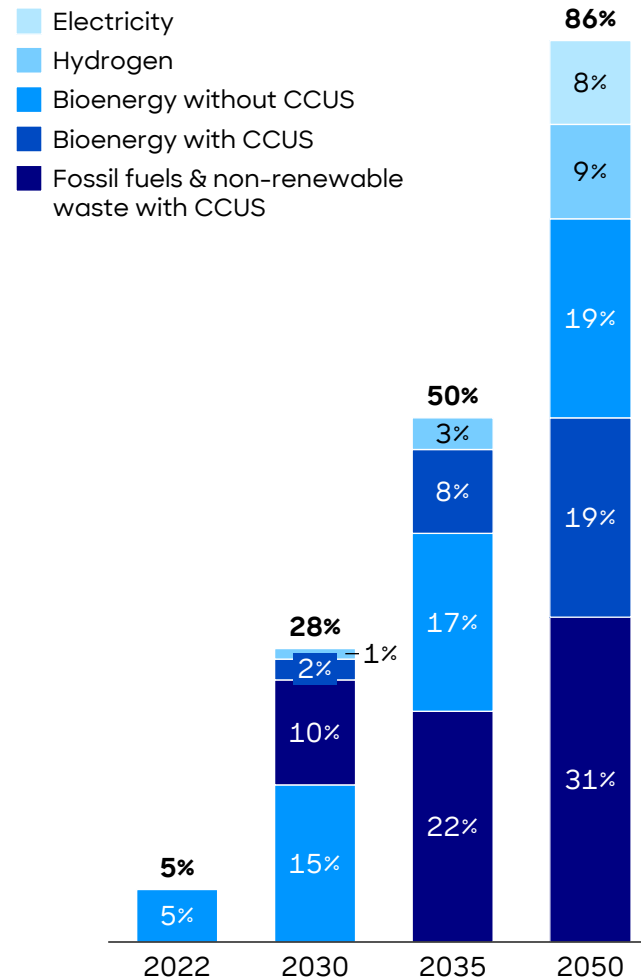
¹⁾ H2-DRI refers to Hydrogen Direct Reduction - a steelmaking process that uses hydrogen instead of carbon-based fuels like coal or natural gas to reduce iron ore into iron. CCUS refers to Carbon Capture, Utilization, and Storage and describes technologies designed to capture carbon dioxide (CO₂) emissions from industrial processes or directly from the atmosphere

To reduce CO₂ emissions from cement production, it is essential to significantly increase the share of low-carbon fuels in the thermal energy mix

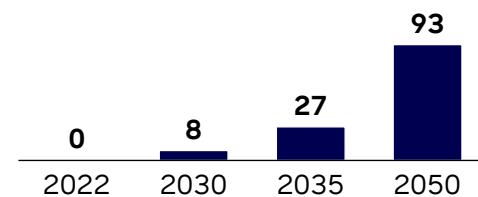
Global cement production [Mt]



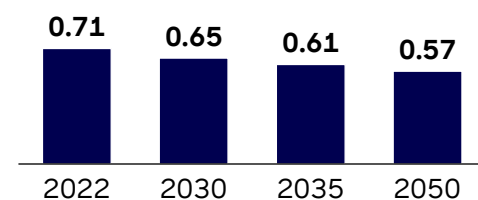
Share of low-emissions fuel in thermal energy use in cement production [%]



Share of near zero emission clinker production [%]



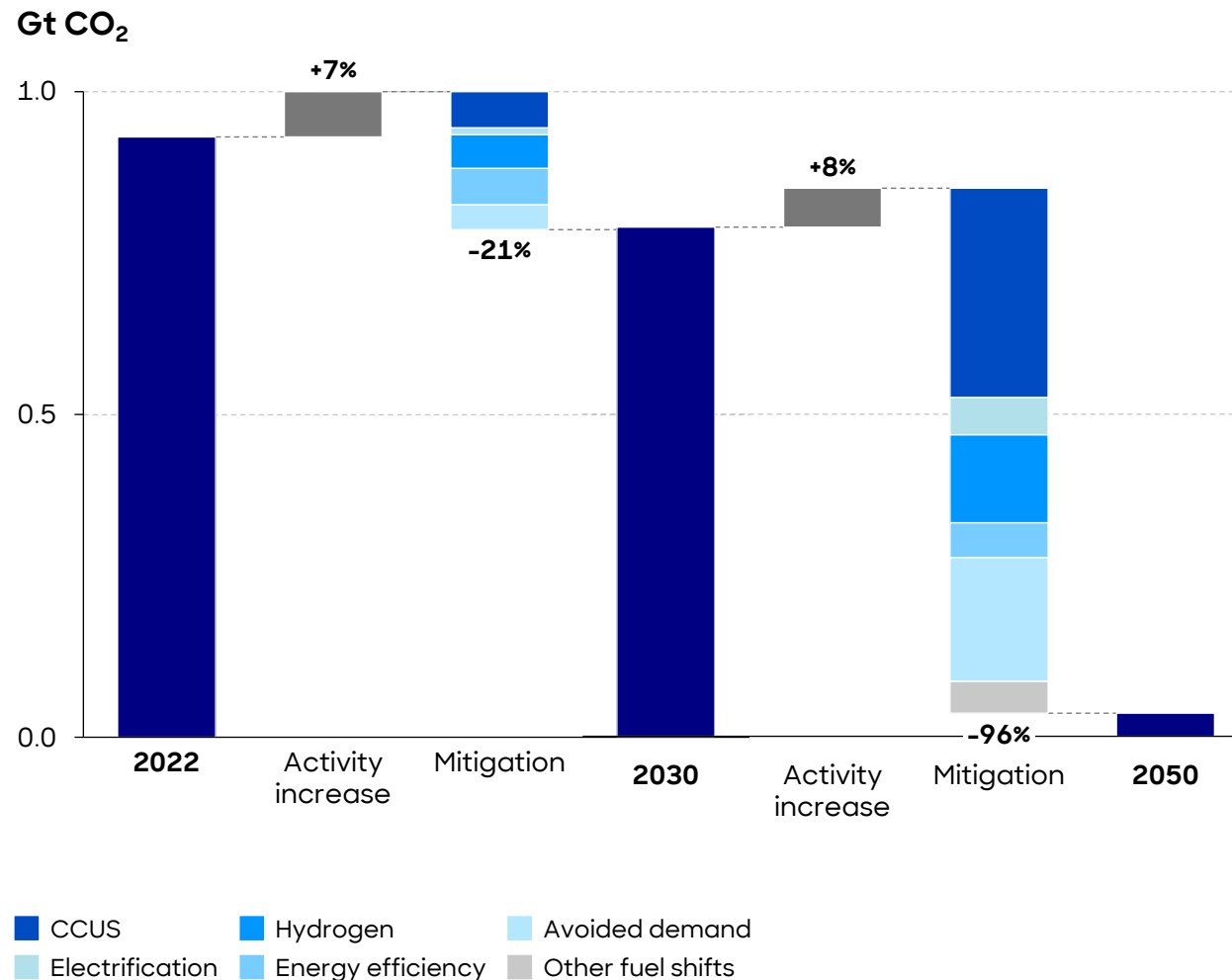
Clinker-to-cement ratio [ton per ton]



- The **cement industry** is faced with the challenge of **balancing CO₂ emission reductions** while meeting strong **global demand**. The **infrastructural needs of developing economies** underscore the urgency for the sector's **global development and deployment of innovative emission reduction technologies**
- Critical strategies for reducing carbon emissions from cement production encompass **enhancing energy efficiency, transitioning to lower-carbon fuels, optimizing material efficiency by reducing the clinker-to-cement ratio** and overall demand, and advancing innovative near zero emission production methods. Of these, **material efficiency and innovative production routes are projected to deliver the most significant direct emission reductions** under the Net Zero Scenario (NZE)
- Emissions from clinker production, the **primary component of cement**, stem from **both chemical reactions and fuel combustion** during manufacturing processes. To mitigate these emissions, strategies include **reducing the clinker-to-cement ratio** by incorporating **supplementary cement materials (SCMs)**, transitioning to low-carbon fuels, and capturing residual CO₂ emissions. While the use of **clinker substitutes is rising**, reducing the clinker-to-cement ratio alone will not suffice to meet NZE targets, underscoring the **urgent need for the development and implementation of new technologies**

The energy-intensive chemical industry is the third-largest CO₂ emitter - Decarbonization will rely on efficiency, electrification, and CCUS

Primary chemicals production emissions by mitigation measure, 2022-2050 [Gt CO₂]



- The chemical sector represents the **largest industrial energy consumer** as well as the third largest industry subsector for direct CO₂ emissions. This is primarily because around **50% of the sector's energy input is utilized as feedstock**, serving as a raw material rather than for energy generation
- There is an **increasing demand** for a wide range of **chemical products**, including plastics and primary chemicals
- **Enhancing material efficiency** through measures such as **improved plastics recycling**, more **efficient use of ammonia fertilizers**, and **reducing reliance on single-use plastics** is critical for lowering chemical demand. While recycling can mitigate the need for primary production, only **about 10% of plastic is currently recycled** globally. Although this percentage is rising, there is a pressing need to accelerate progress in this area
- **Electrolytic hydrogen, carbon capture, utilization, and storage (CCUS)**, and **direct electrification technologies** are essential to achieving the significant reductions in emissions intensity required for primary chemical production

4.1 Global Economics

4.2 Power Shifts

4.3 Energy Transformation

4.4 Debt Challenge

Given the longevity of buildings, today's planning and construction decisions will have a significant impact on energy consumption for decades to come

Statistics on CO₂ emissions and electricity demand in the buildings sector

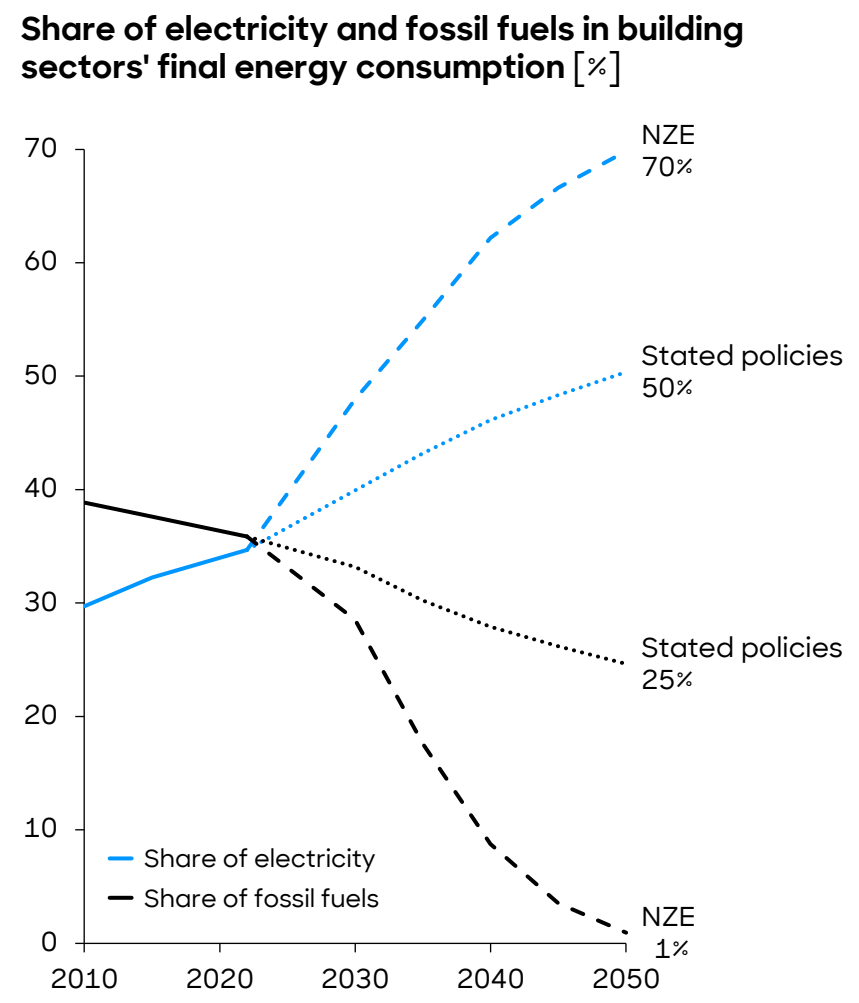
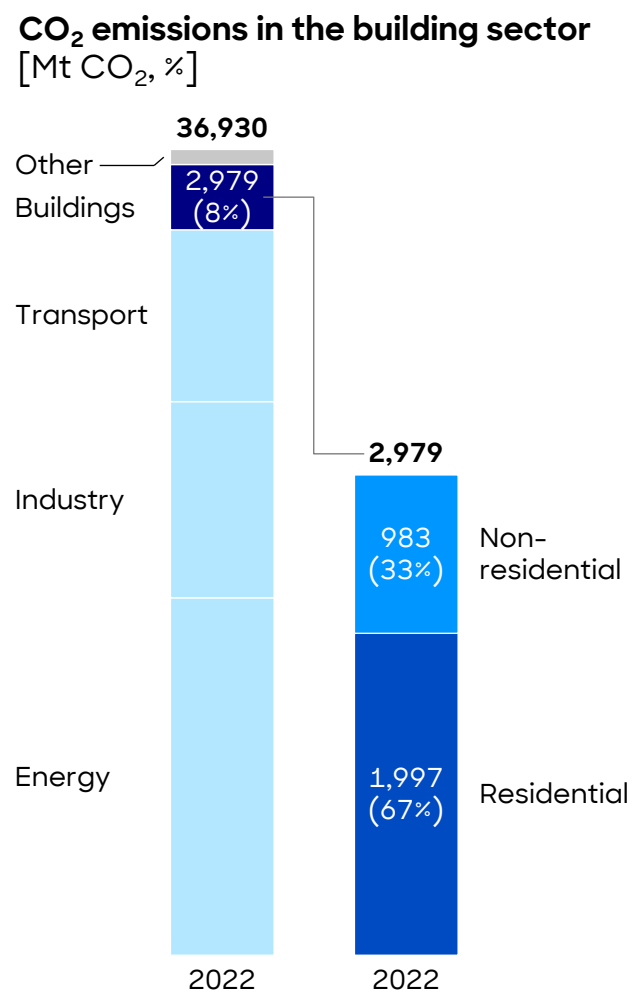
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4.1
Global Economics
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4.2
Power Shifts
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4.3
Energy Transformation
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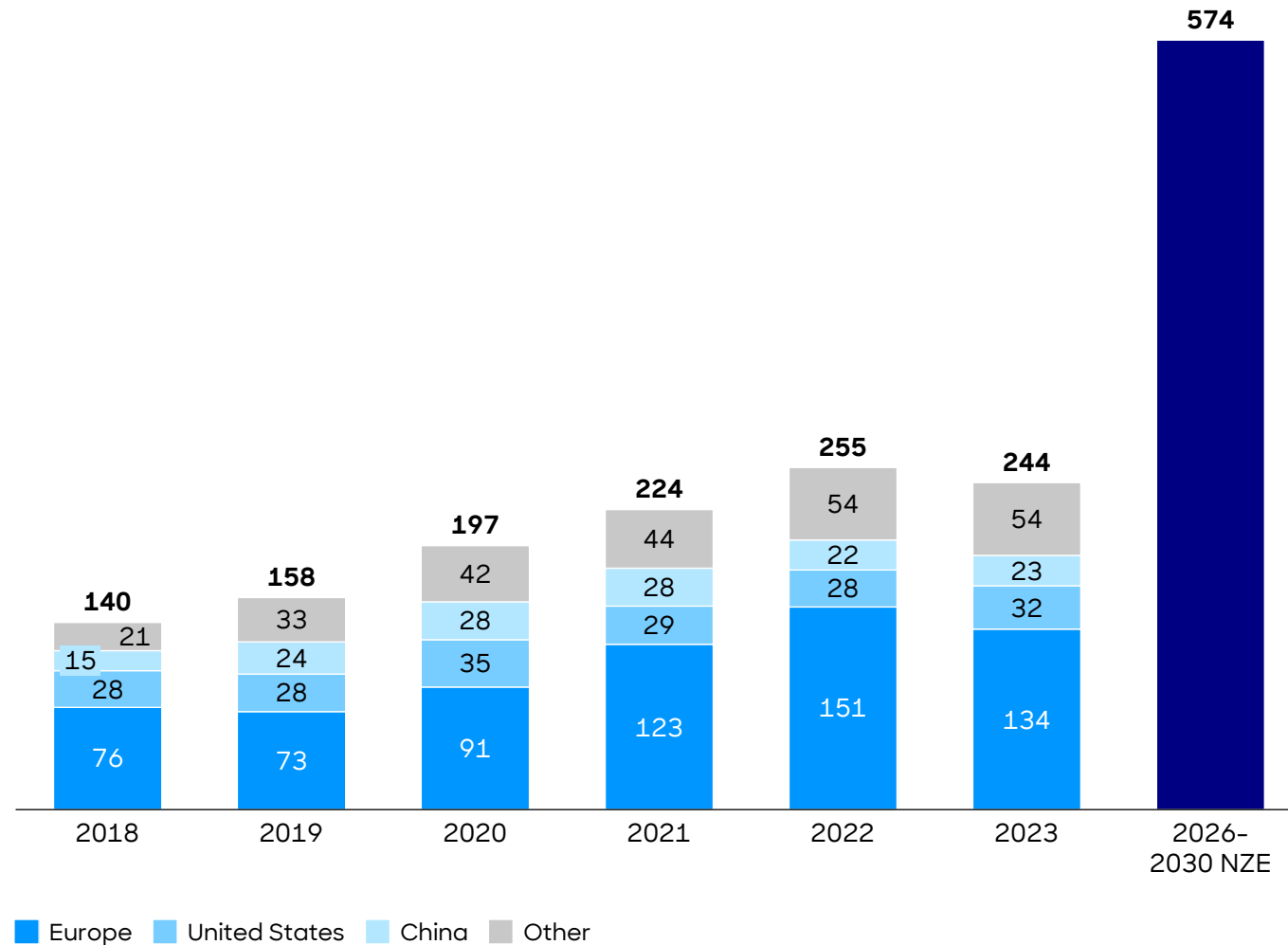
4.4
Debt Challenge



- The buildings sector, encompassing the energy required for construction, heating, cooling, lighting, and the operation of appliances and equipment within residential and commercial properties, accounts for around 30% of global final energy consumption. This sector is directly responsible for around 8% of global CO₂ emissions. When considering the production of electricity and heat used in buildings, a further 18% of indirect global emissions can be attributed to the building sector
- As global floor area expands rapidly, especially in developing countries, and rising prosperity drives increased use of air conditioning and appliances, decarbonizing buildings is pivotal in the clean energy transition. Given the long lifespan of structures and systems, today's planning, design and construction as well as purchasing decisions will significantly influence energy consumption for years to come

To achieve net zero targets in the buildings sector, annual investment would have to more than double

Annual investment in energy efficiency in the buildings sector, 2018-2030 [USD bn]



- Global **annual investments** in **building energy efficiency** have **grown substantially** in recent years. The strong increase in efficiency spending and electrification in 2022 is the result of a **continued effort, led by Europe**, in response to the energy crisis triggered by the Russian invasion of Ukraine, along with policy- and price-driven increases in spending in other countries
- However, to meet the Net Zero Emissions (NZE) targets, these **annual investments will need to double on average** during the period 2026-2030
- The **required upfront investment is substantial**, but these incremental costs are **more than offset by economy-wide fuel savings**, particularly if current high prices persist
- While improving building fabric efficiency remains a significant focus of spending, recent efforts are **increasingly directing investments toward technologies such as heat pumps** that more effectively enable zero-carbon ready buildings

4.1
Global Economics

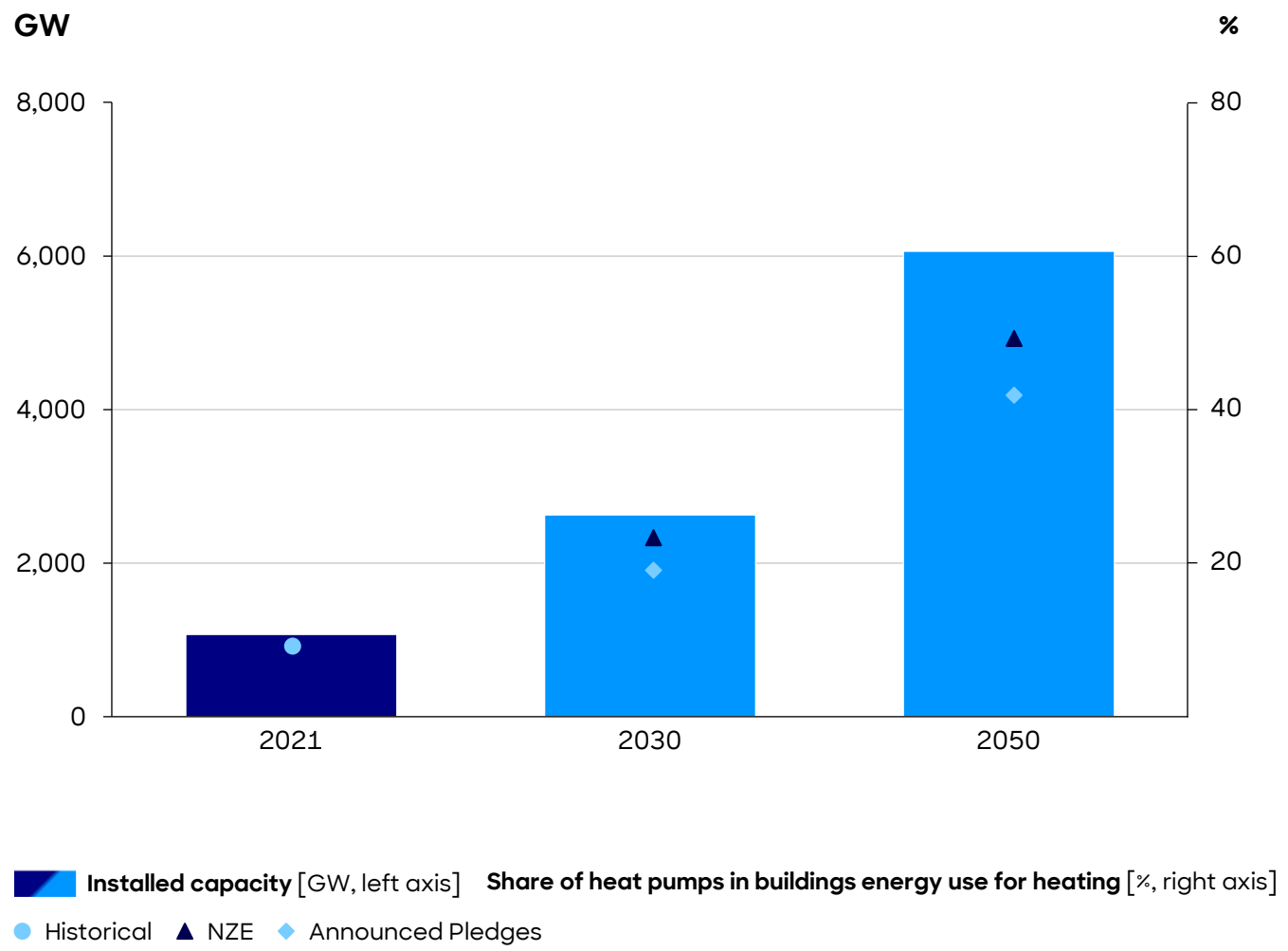
4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

Driven by ambitious policies and innovation, the uptake of heat pumps is accelerating - Global heat pump capacity needs to increase significantly

Global heat pump capacity and coverage of heating needs, 2021-2050 [GW, %]



- To achieve Net Zero targets in the buildings sector, the **capacity of heat pumps installed** globally must **nearly triple** by 2030 - and then **double again** by 2050
- This requires heat pumps to **supply at least 24% of global heating needs by 2030**. By 2050, their contribution is expected to rise to 52%
- In the NZE Scenario, accelerated deployment is driven by **significant cost reductions** for end users through **innovation and subsidies**, increased **carbon penalties**, and a **ban on new fossil fuel boiler** sales by 2025
- The **recent implementation of ambitious policies**, such as the US Inflation Reduction Act, REPowerEU, and Japan's Green Transformation (GX), is already **accelerating heat pump adoption rates** and provides strong market signals to manufacturers and installers
- While these initiatives are broadly sufficient to put the world on track for 2030, **further policy actions are needed** to sustain the accelerated deployment required to meet NZE Scenario targets **beyond 2030, particularly in emerging economies**

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

The rapid growth of AI is set to transform the energy landscape, driven by a significant increase in data center power demand

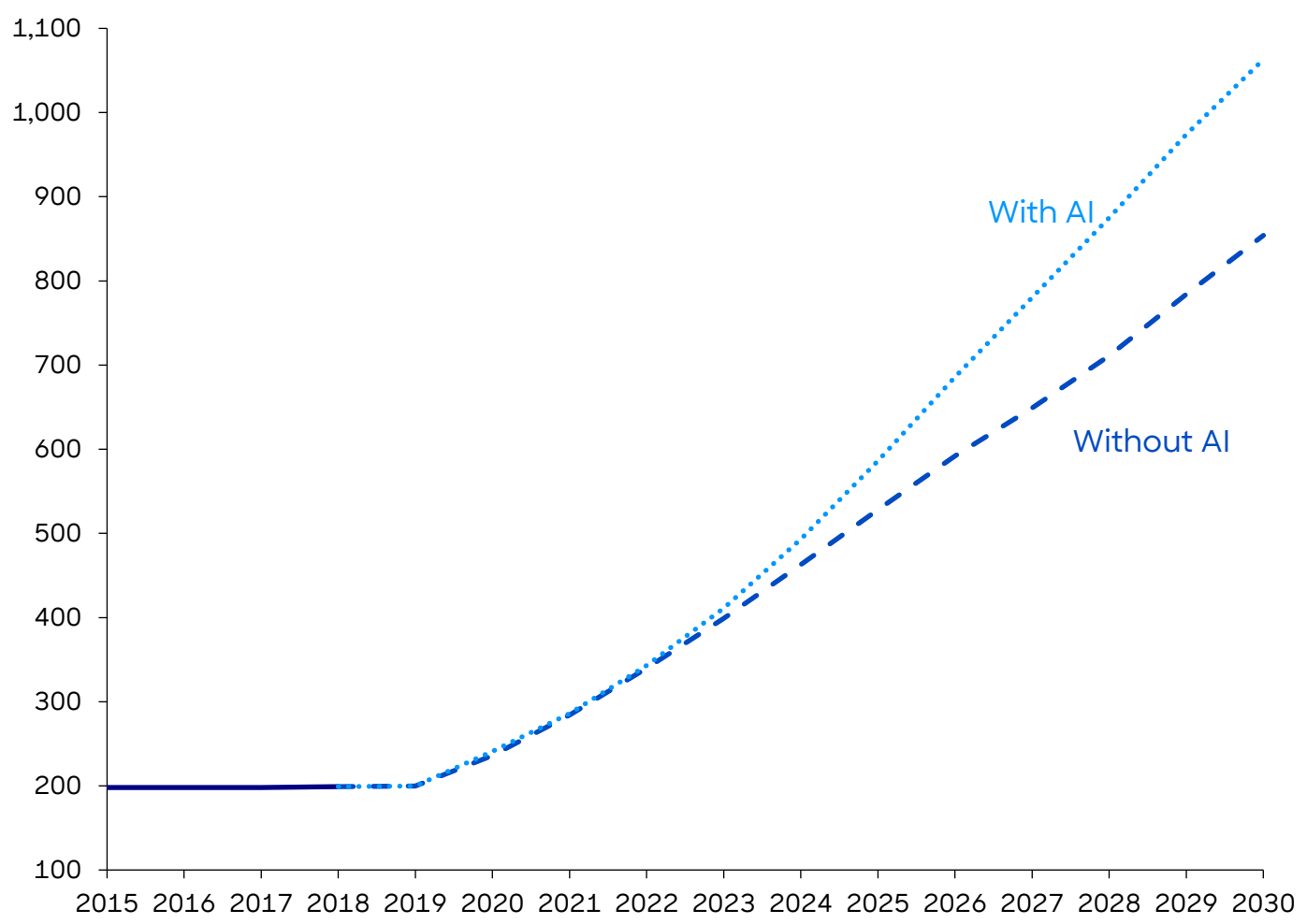
4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

Global data center power demand projection [TWh]



- Even if the reduction of energy consumption in many sectors is necessary to achieve net zero targets, the IEA also recognizes that **electricity generation in particular is likely to increase**
- **One area** in which a **rapid increase** in electricity demand is expected is **data centers**. The **push from AI** will lead to a notable increase in the need for electricity
- A **single ChatGPT query** requires 2.9 watt-hours of electricity, compared with 0.3 watt-hours for a **Google search** - **nearly 10 times more**
- For years, data centers displayed a remarkably **stable appetite for power**, even under increasing workloads. Now, as the **speed of efficiency gains in electricity use slows** and the **AI revolution gathers pace**, estimates suggest that data center power demand will grow 160% by 2030
- At present, data centers worldwide **consume 1-2% of overall power**, but this percentage is **likely to rise to 3-4% by the end of the decade**. In the US and Europe, this increased demand will drive the kind of electricity growth that hasn't been seen in a generation. Along this trajectory, the **carbon dioxide emissions** of data centers may **more than double** between 2022 and 2030

Debt is a fundamental component of economic development, but it is also associated with potential risks

Facets of debt



Why is debt significant for the economy?



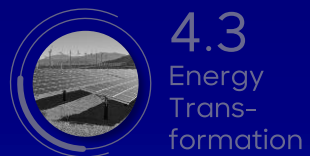
Debt is a fundamental component of economic dynamics, facilitating capital flows that expand investment and consumption beyond current income constraints. It facilitates the optimal allocation of resources, enables intertemporal smoothing and risk sharing, and thus makes a significant contribution to the stabilization and long-term growth of an economy



What are possible negative impacts of debt?



High levels of debt can have detrimental impacts on economic growth and financial stability. They can increase the likelihood of insolvencies and financial crises, which in turn inhibit economic growth and lead to greater financial volatility. In addition, they limit the room for maneuver of fiscal policy in the future, restrict future generations through increased tax burdens or reduced state benefits, and can crowd out private investment, which reinforces negative economic dynamics in the long term



Why is the issue of debt considered "a challenge"?

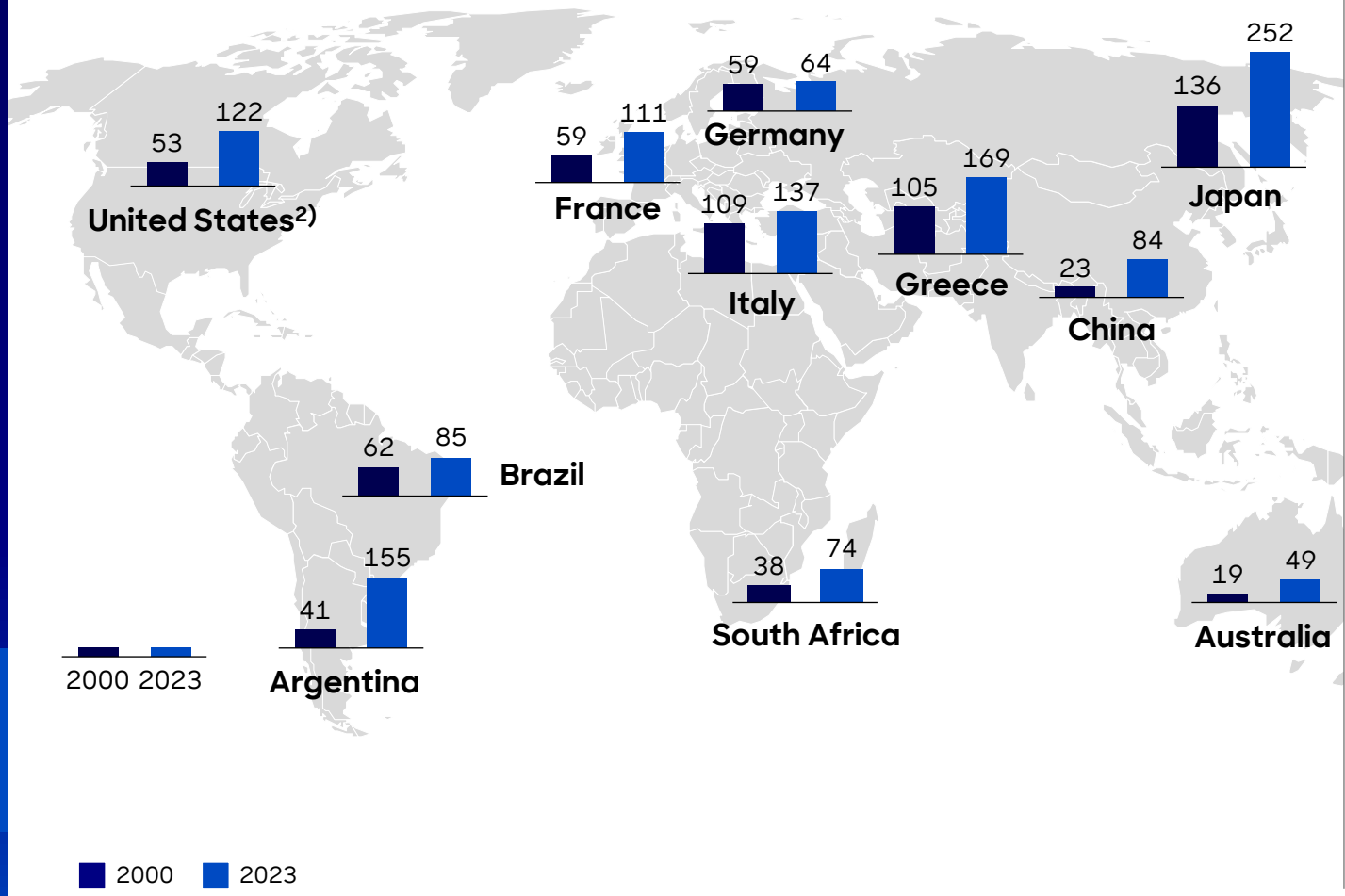


Global debt has reached a historically high level. Total global debt, which includes both public and private debt, currently amounts to 238% of global GDP. Together with high global political and economic uncertainties, growing debt burdens are making crisis management increasingly difficult, while the long-term challenges of demographic and climate change continue to intensify



Public debt in many countries has risen significantly in recent years, in some cases to alarming levels

General government gross debt, 2000 and 2023¹⁾ [% of GDP]



- Over the past two decades, many **governments** around the world have **increased their borrowing**. Significantly driven by major events, such as the Global Financial Crisis and the **COVID-19 pandemic**, and **supported by central banks** – having adapted financing conditions by cutting interest rates and market intervention – **debt ratios** have **risen strongly** almost everywhere
- Public debt must be viewed through a **differentiated, per country lens**: For instance, **Japan's** public debt has been significantly higher than elsewhere for years; Japan has **its own currency** and can therefore **borrow cheaply from its own central bank**. Compared to **Greece**, where debt levels are similarly high, the situation is altogether different: being part of the eurozone's currency union, **Greece cannot refinance itself so easily** as the ECB's debt rules apply
- Rising public debt has consequences: large sustained national deficits result in **lower levels of investment and higher interest rates**. With increased public borrowing, a higher percentage of potential funds – otherwise directed at investment – go toward government securities. When interest rates recover from extended low levels, the government's burden of debt grows rapidly due to compounded interest; servicing public debt takes up more of the budget, thus government spending is reduced. Higher debt levels also **incumber the ability to respond to emerging challenges or crises**, thus increasing the risk of a fiscal crisis

- 4.1 Global Economics
- 4.2 Power Shifts
- 4.3 Energy Transformation
- 4.4 Debt Challenge

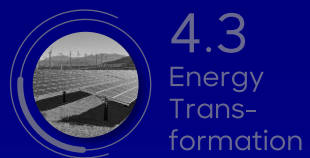
1) General government gross debt relative to the country GDP; general government consists of central, state and local governments and the social security funds controlled by these units;
 2) Left hand value refers to 2001
 Source: IMF; Roland Berger



4.1
Global Economics



4.2
Power Shifts



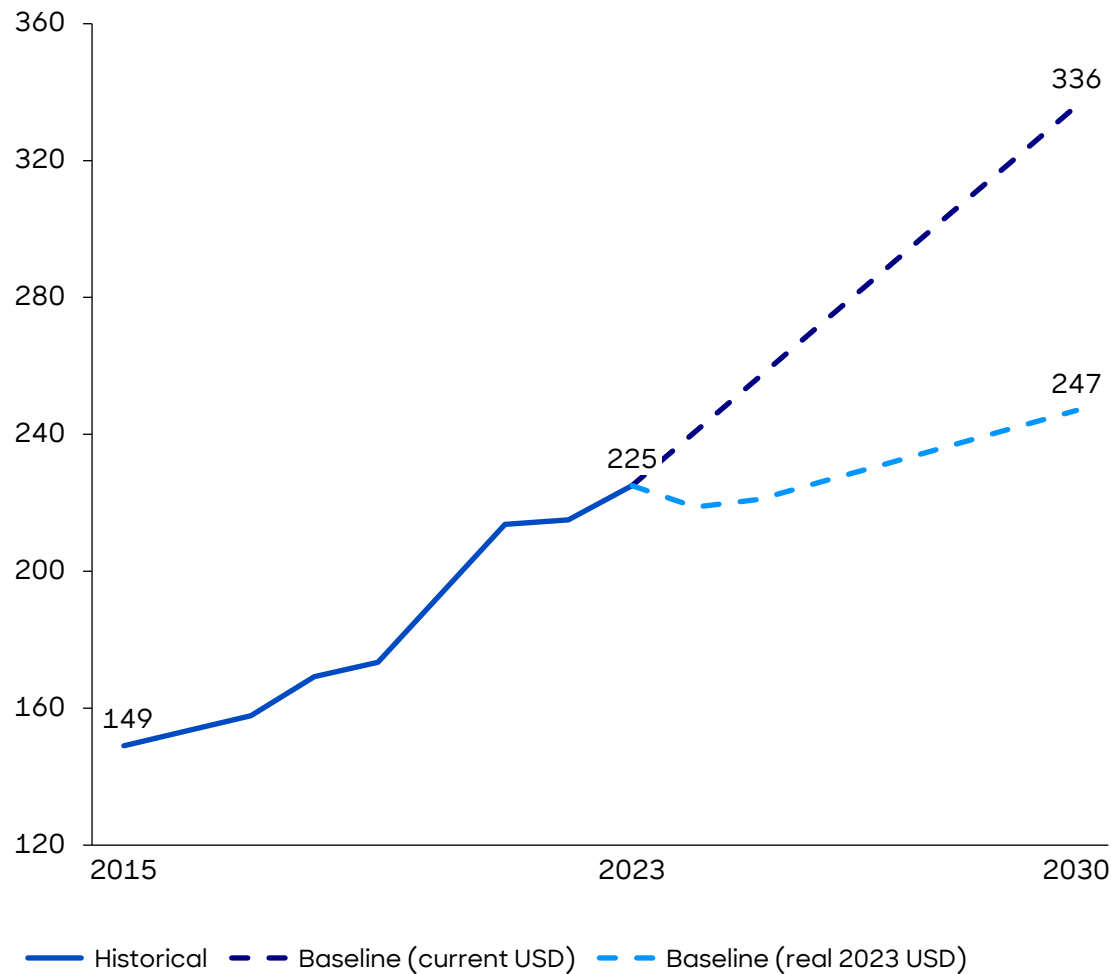
4.3
Energy Transformation



4.4
Debt Challenge

The projected increase in global debt to 2030 is largely driven by inflationary pressures

Global debt 2015-2030¹⁾ [USD trillion]



- Since 2015, **global debt** has **risen** from USD 149 trillion to **USD 225 trillion**. This is largely due to the COVID-19 pandemic, which led to increased government spending to reduce the economic fallout
- **Global debt** is projected to experience significant growth, with nominal values expected to **reach USD 336 trillion by 2030**. Inflation amplifies the nominal value of debt across various sectors. When **adjusted for inflation** in 2023 USD terms, the debt is anticipated to **grow to USD 247 trillion by 2030**, representing a **10% increase in real global debt**
- The trajectory of debt accumulation is expected to vary significantly across different regions and sectors. **Corporate and government debt** levels are projected to rise **more rapidly than household debt**, with **emerging markets** experiencing a **faster increase** in leverage compared to **mature economies**
- By 2030, it is projected that the **US and China** will collectively hold **over half of the world's total debt**, representing 53% of the global total. Additionally, the **US debt-to-GDP ratio** is expected to **increase** from 254% to **269%**, while that of **China** is projected to **rise** from 283% to **295%**
- An additional **USD 37 trillion** is required by 2030 for **climate, digital, and aging-related transitions**, potentially straining global debt further if financed through borrowing
- Rising **global tensions** complicate international collaboration, **hindering** coordinated **efforts to manage debt** and finance critical transitions

1) Global debt includes the liabilities of nonfinancial corporations, governments, and households, excluding those of the financial sector; the values for 2023-2030 are projected
Source: S&P Global; Roland Berger

About 70% of global debt stem from non-government sectors - There is a wide range of debt levels across countries

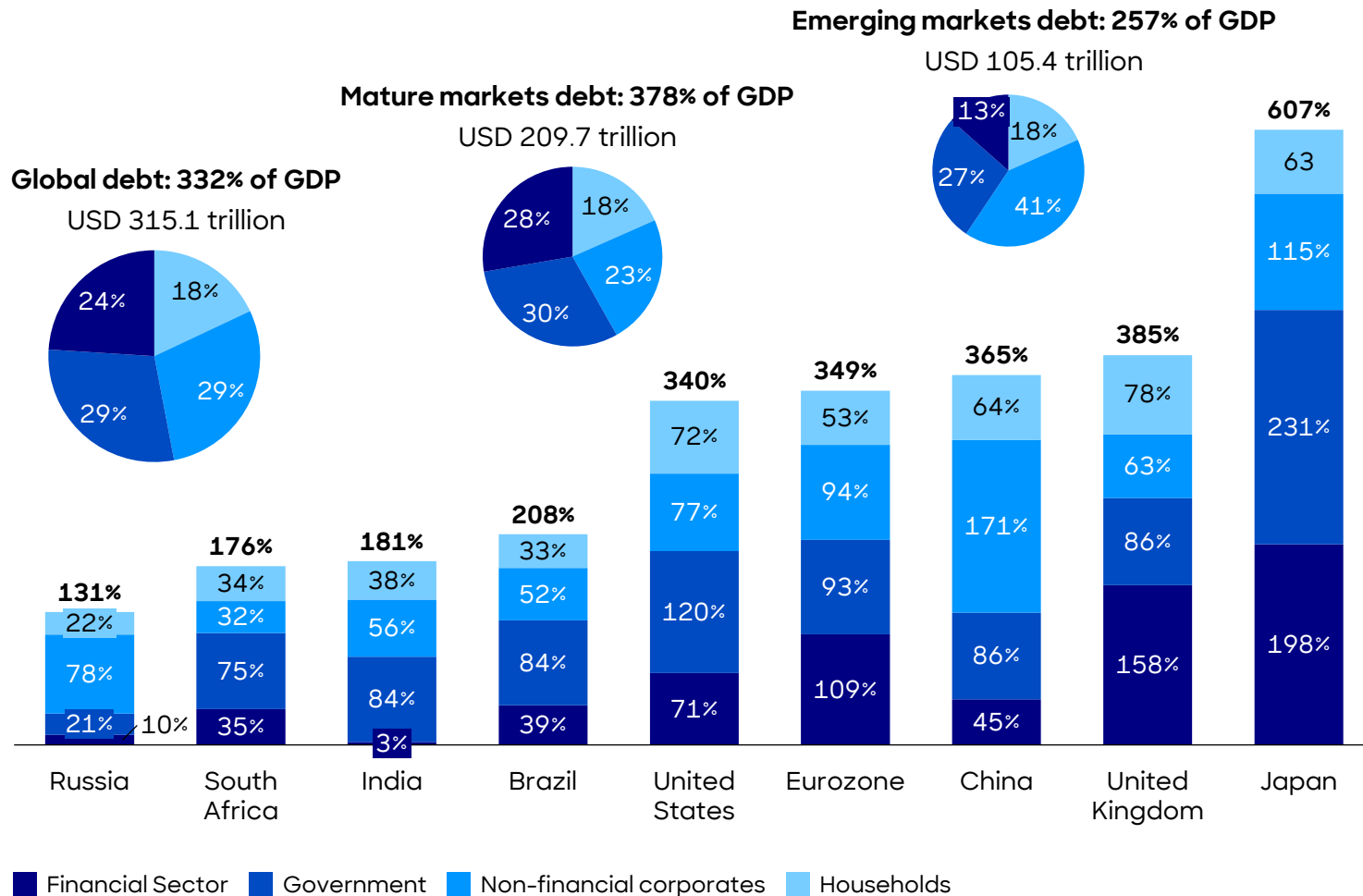
Total debt by sector, Q1 2024 [USD trillion, % of GDP, %]

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation

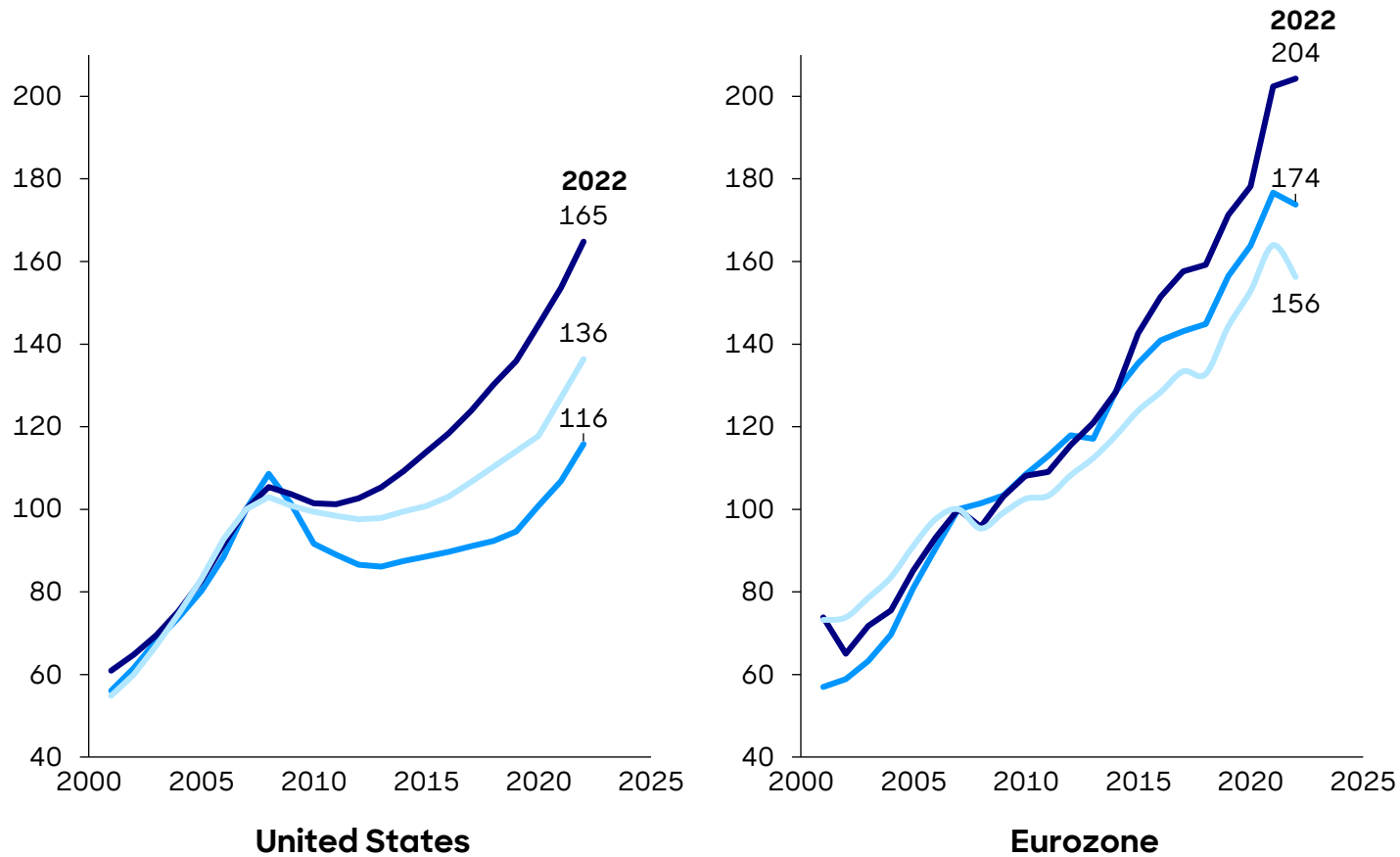
4.4
Debt Challenge



- When it comes to debt, discussions often **focus only on government debt** - although depending on national economic structures, government debt accounts for not even one third of an **economy's total debt**
- In **mature markets**, debt relative to GDP is **121 percentage points higher** than in emerging markets. While the **financial sector** holds a **larger share** of total debt in mature markets, **non-financial corporates** make up a significantly **larger portion** in **emerging markets** due to their **less developed financial systems**
- Looking at both the public and private sectors, **Japan** continues to lead the world with a debt level of **607%**
- Since **debt** also includes **instruments** such as **deposits and refinancing loans**, by definition, **financial service companies** already have higher debt than other sectors. This alone is **not a reason to question the stability of the financial system**

Looking at the private sector in the US and the eurozone, leverage has been increasing for many years

Breakdown of private sector debt [index, 2007 = 100]



— Financial sector — Nonfinancial corporations — Households and nonprofit organizations

- While the **financial sector**, especially in the US, underwent a **major restructuring** following the Global Financial Crisis reducing considerable amounts of debt, **real economy debt** has since become a prominent issue
- The **low-interest-rate environment** has made it attractive, especially for **listed companies**, to **leverage themselves** and **buy back their own shares** – one of the reasons why many US stock market indices have been consistently hitting new highs over past years
- Although loose financial conditions were initially necessary to support the expected recovery from the COVID-19 fallout, both the European Central Bank and the Federal Reserve **shifted to a more restrictive monetary policy** in 2022 in response to high inflation
- Despite these restrictive measures, **private sector debt** in the **US** has **continued to increase**, in contrast to the **eurozone**, where the **debt of households and nonprofit organizations** as well as of the **financial sector** **decreased in 2022**

4.1
Global Economics

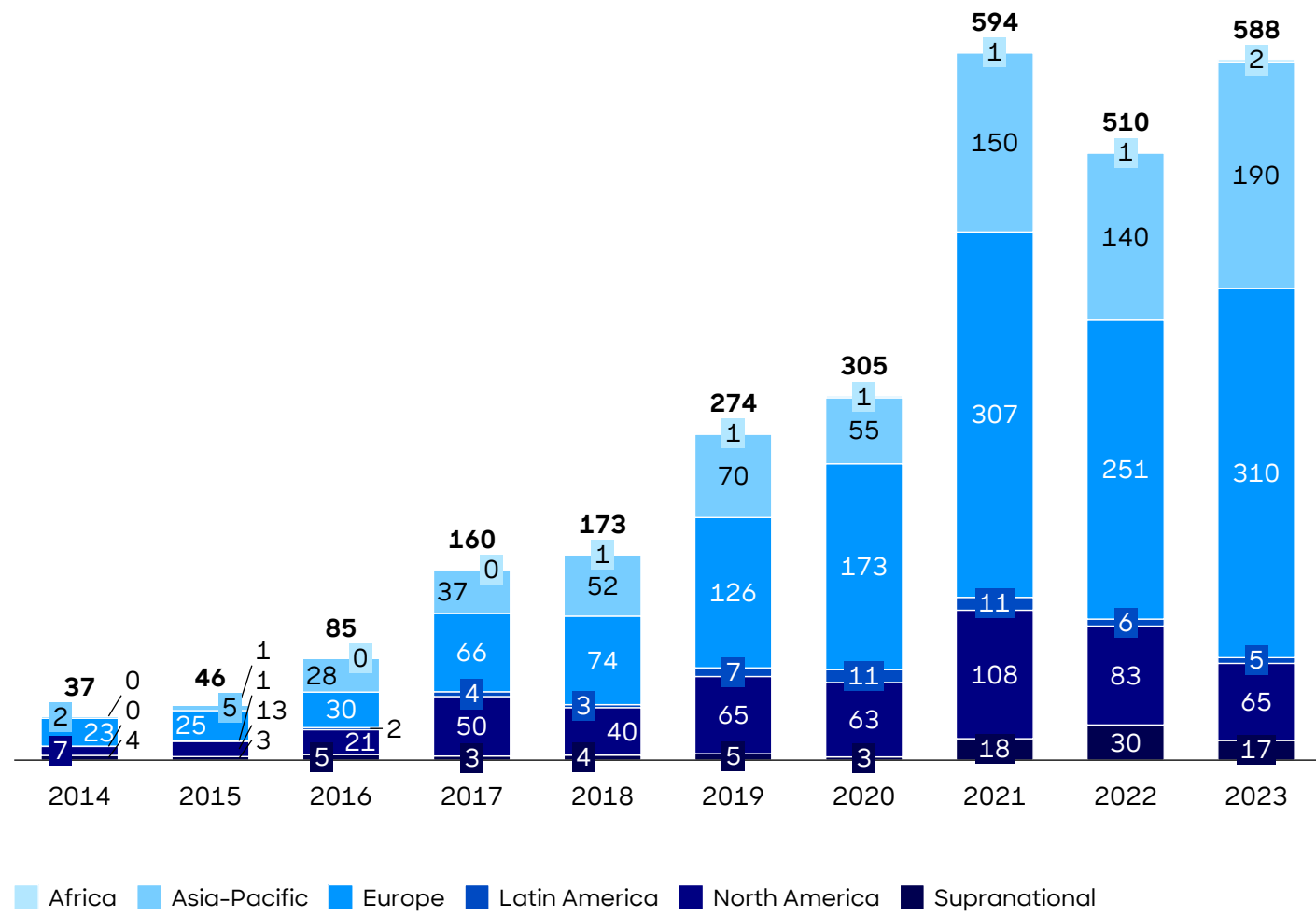
4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

Green bonds have become significantly more important in recent years, with emissions surpassing the half-trillion mark for the third consecutive year

Green bond market by region, 2014-2023¹⁾ [USD bn]



- In 2023, the issuance of **green bonds reached USD 587.6 billion**, marking a **15% year-on-year increase** and **continuing the market's expansion** past the half-trillion mark for the third consecutive year. **Europe continues to lead the market**, contributing 53% of the global total with USD 309.6 billion, representing growth of 23% compared to 2022. Emerging economies, notably **China** with USD 83.5 billion, are also **playing an increasingly important role** in green bond issuance
- In 2022, the green bond market experienced a **decline** due to the impact of **rising interest rates** and **economic uncertainty**. Concurrently, **volatile markets and elevated energy prices** resulted in **decreased demand for green assets** and a shift towards fossil fuel assets
- **Green bonds** offer companies and banks both financial and strategic **advantages**: owing to high demand, issuers can **raise capital on more favorable terms**, with **spreads** typically around **8 basis points** lower than those of conventional bonds. Also, green bonds provide access to **new investor groups**, **enhance the diversification** of the funding structure, and serve as an effective tool for **promoting sustainable projects**

4.1 Global Economics

4.2 Power Shifts

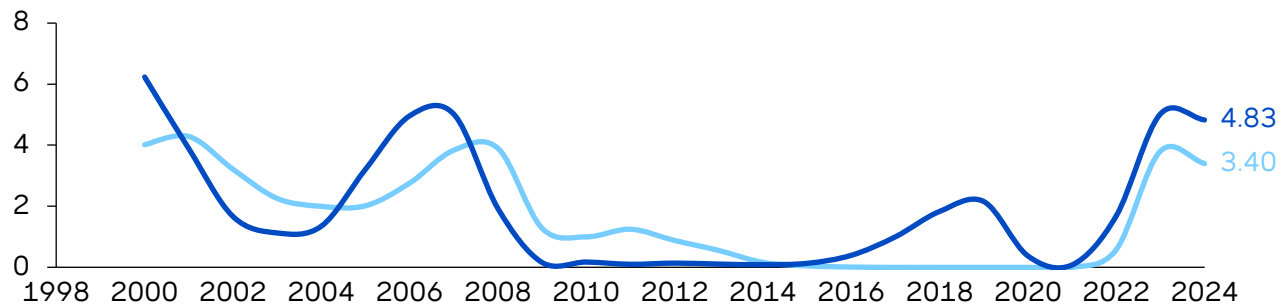
4.3 Energy Transformation

4.4 Debt Challenge

1) Green bonds are debt instruments issued to finance projects that have a positive environmental impact, supporting sustainability and climate change mitigation efforts
 Source: Climate Bonds Initiative; S&P Global; J.P. Morgan; Roland Berger

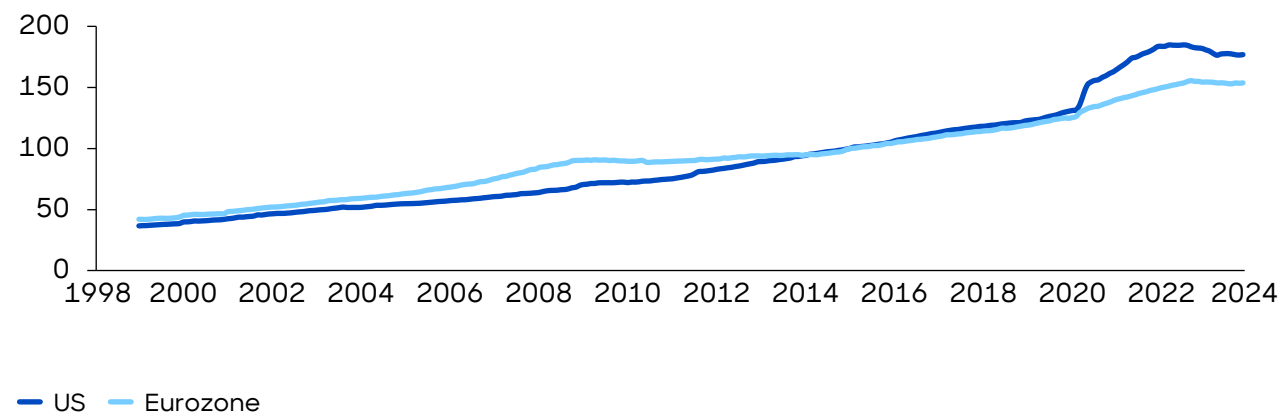
Central banks use interest rate cuts and quantitative easing to maintain support and keep debt levels manageable

Central bank interest rates, 2000-2024¹⁾ [%]



- For decades, central banks have responded to emerging crises with **asymmetric monetary policies**, i.e. **after interest rate cuts, rates were never raised to previous levels**. This has enabled central banks **to prevent wider distortions in financial markets**, but has also contributed to rising debt levels, making the financial system more unstable
- Since **interest rates have remained at or close to zero** for a long time following the financial and sovereign debt crises, other additional instruments such as **quantitative easing** have increasingly been deployed to **dampen down** long-term (sovereign) interest rates and to **support governments' efforts** to stimulate growth after a crisis
- Following the COVID-19 shock in 2020, **central banks** of the larger economies have **responded with unprecedented monetary expansions**
- Notably, the US Federal Bank has significantly increased its M3 money supply to help **fund COVID-19 stimulus checks** – among other pandemic relief measures – and to assist increased lending efforts to shore up troubled businesses
- **Rising interest rates** have altered the economic landscape prompting a **reassessment of asset valuations** and increasing the potential for financial market adjustments

Money supply M3, 1999-2024²⁾ [index, Jan 2015 = 100]



1) The central bank policy rate is the rate that is used by central bank to implement or signal its monetary policy stance, expressed as a yearly average. For the eurozone, it is referred to the main refinancing operation, for the US it is referred to the Federal Funds effective rate; 2) Broad money (M3) includes currency, deposits with an agreed maturity of up to two years, deposits redeemable at notice of up to three months and repurchase agreements, money market fund shares/units and debt securities up to two years. M3 is measured as a seasonally adjusted index based on end of Jan 2015 = 100

4.1
Global Economics

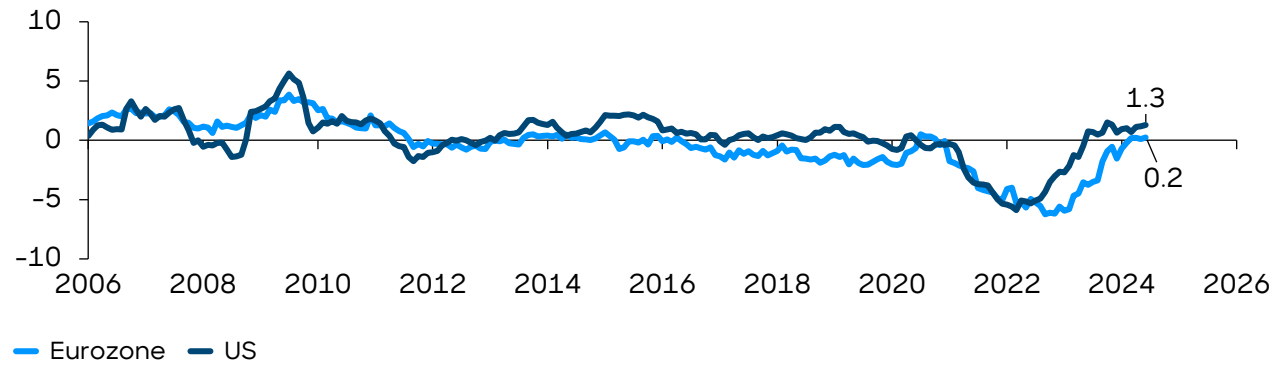
4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

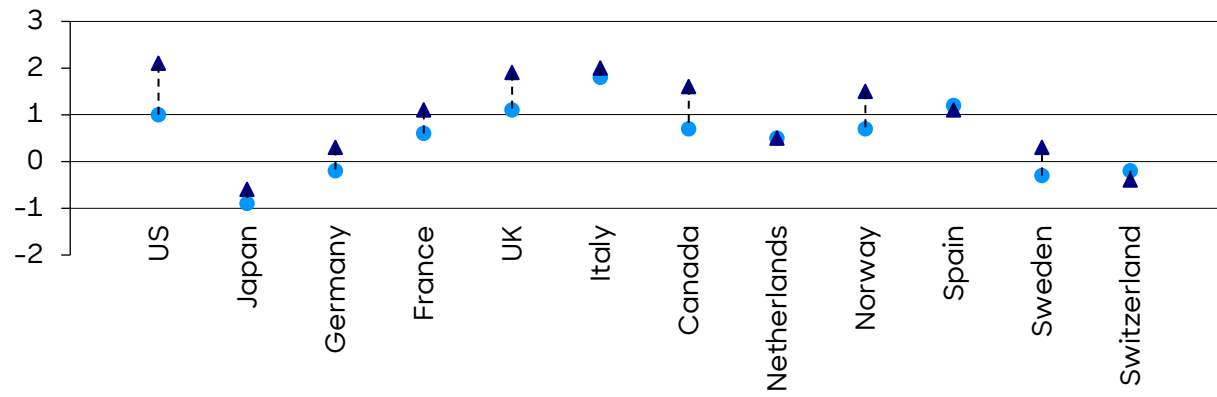
In the longer term, analysts expect real interest rates to return to positive territory, posing a potential debt challenge for governments

Long-term real interest rates in selected economies¹⁾²⁾ [%]



- In recent years, long-term interest rates in industrialized countries, especially in the increasingly integrated G7 capital markets, have been converging toward low or even negative levels
- Adjusted for inflation, real long-term interest rates in the major industrialized countries were broadly **negative** and most analysts expected that negative real interest rates would persist in the future
- However, this has **changed over the course of 2022** due to **soaring inflation rates** and **central banks** across the globe aggressively **hiking rates** compared to prior years - with longer-term **bond market yields responding** in turn
- While real interest rates **are still negative** in some industrialized countries, analysts' **long-term expectations** indicate that real interest rates could again **exceed the 0% threshold** in the long term
- In the event of positive real interest rates, it will become **more difficult to steer the countries' elevated debt levels** in a sustainable manner

Long-term real interest rate expectations¹⁾³⁾ [%]



● Analysts long term expectations as of May 23 ▲ Analysts long term expectations as of May 24

1) The calculation of real interest rates is derived from the Fisher equation, namely $(1+r) = (1+i)/(1+\pi)$, where r is the real rate, i is the nominal rate and π is the expected inflation rate
 2) The nominal rate is represented by yields on 10-year government bonds. For the eurozone, the German government bond was used
 3) Nominal 10-year bond yields deflated using 10-year inflation forecasts, like-for-like inflation adjustment 2024-2033

4.1
Global Economics

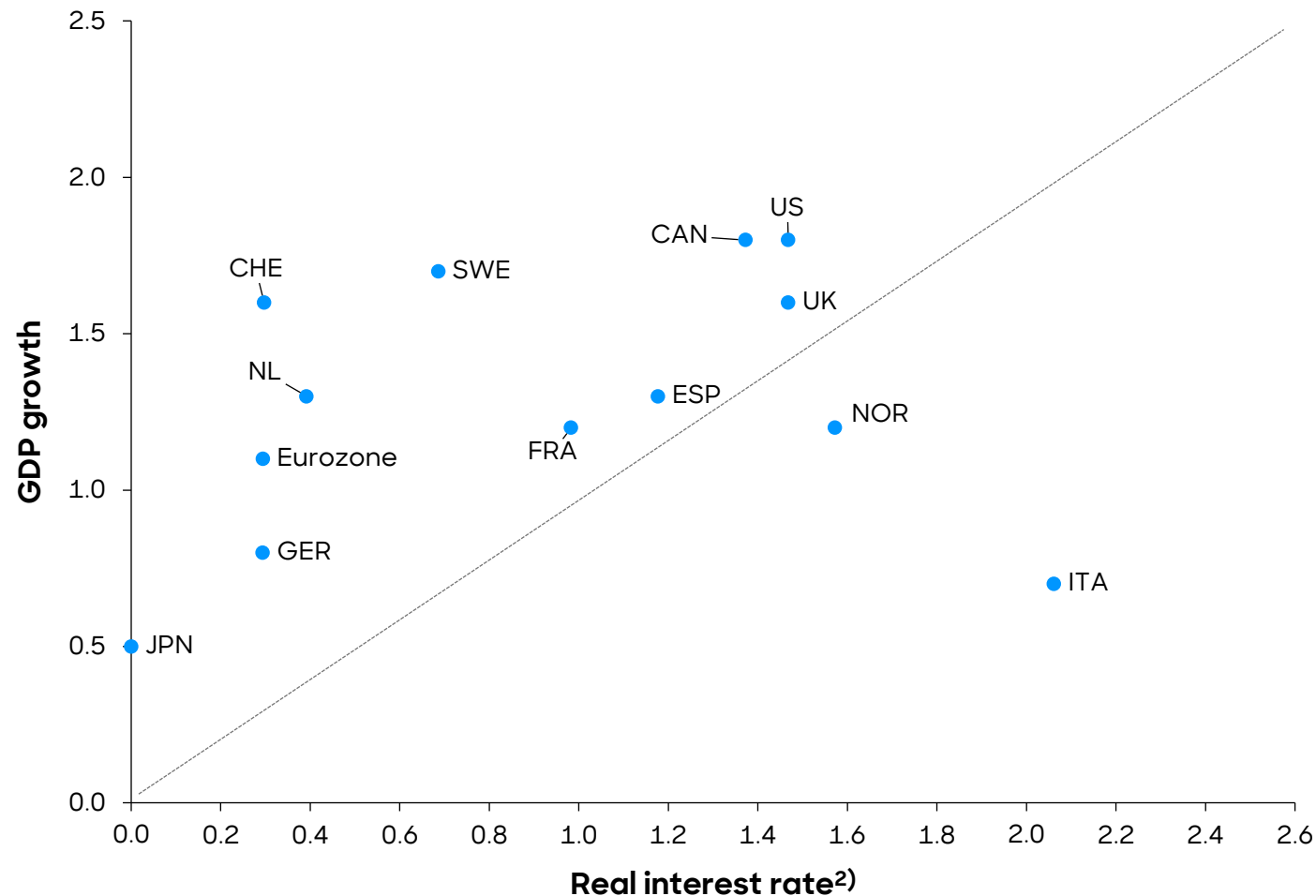
4.2
Power Shifts

4.3
Energy Transformation

4.4
Debt Challenge

Taking on (new) debt is not inherently harmful if funds raised are put to productive use – Growth generated thereof must exceed real interest rates

Growth projections and estimated real interest rates, 2034¹⁾ [%]



- In principle, **debt is a fundamental part of any functioning economy**. This is because debt is an important source for bridging short-term liquidity bottlenecks as well as financing investments – the latter applies to companies and governments alike
- Debt can be characterized in two ways: **"good debt"** refers to debt that **finances investment** and is expected to generate added value in the future, i.e. a return on investment above the cost of borrowing. **"Bad debt"**, however, refers to **funds used for the purpose of consumption**, thus generating no return – it is unproductive, i.e. unrecoverable debt
- If debt is **used efficiently** in a way that its **added value exceeds cost of borrowing**, the amount of debt as such is generally of a **lesser concern** – **at least while interest rates remain stable**. However – and alarmingly – interest rate rises tend to outpace GDP growth rates
- On a **ten-year time horizon**, however, it is expected that this will **not apply** across all economies **equally**: In **Italy** in particular, **GDP growth is no longer sufficient** to beat cost of interest

1) Based on Apr 2024 consensus forecasts for growth, 10-yr treasury bond yields and inflation for 2034;

2) The calculation of real interest rates is derived from the Fisher equation, namely $(1+r) = (1+i)/(1+\pi)$, where r is the real rate, i is the nominal rate and π is the expected inflation rate

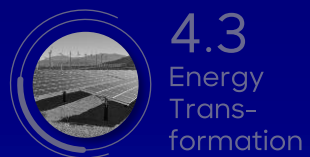
Source: Consensus Economics; Roland Berger



4.1
Global
Economics



4.2
Power
Shifts



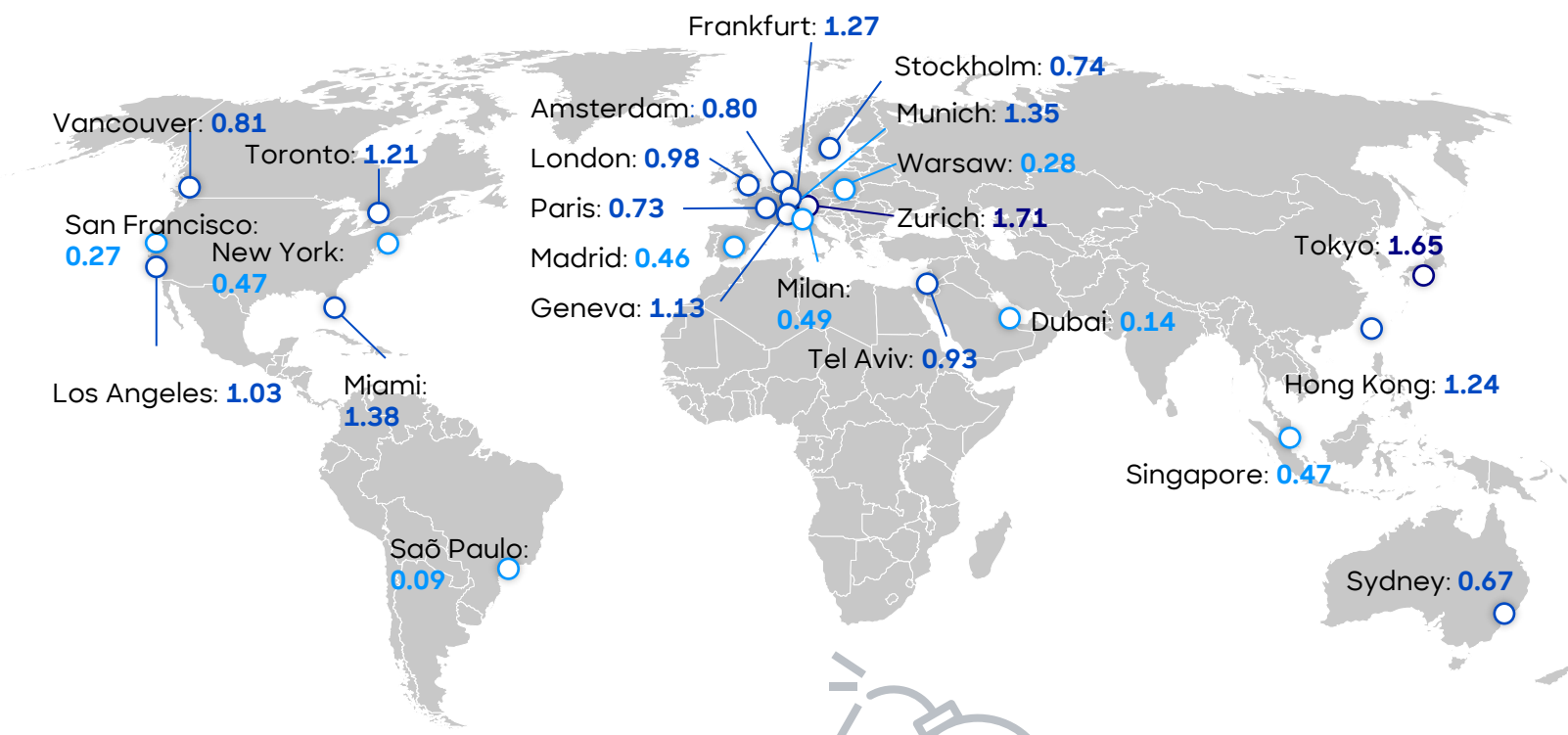
4.3
Energy
Transformation



4.4
Debt
Challenge

The global real estate market is undergoing a period of adjustment, with bubble risks on the decline but overvaluation remains high in key cities

Real estate bubble risks in 2023¹⁾



- High levels of debt financing for real estate purchases can fuel **property bubbles** by driving up demand and prices through **easy credit availability**
- In 2023, the **real estate market** experienced a **notable decline** in property values, particularly in **cities** previously identified as vulnerable to **housing bubbles**. On average, these cities saw a **10% reduction** in property values. Thus, only **Zurich** and **Tokyo** remain in the **bubble risk category**, while cities such as Toronto, Frankfurt, and Munich have shifted to the overvalued category
- The **inflationary environment** has exerted a dual impact on the real estate market. On the one hand, it has exerted **downward pressure** on house prices due to **higher interest rates**. On the other hand, it has provided **support to income and rental growth**, particularly in markets outside the US, where rental growth has accelerated

bubble risks



○ Bubble risk (>1.5)
 ○ Overvalued (0.5 to 1.5)
 ○ Fair valued (-0.5 to 0.5)

1.) The UBS Global Real Estate Bubble Index traces the fundamental valuation of housing markets and the valuation of cities in relation both to their country and to economic distortions. The index score is a weighted average of the following five standardized city sub-indexes: price-to-income and price-to-rent (fundamental valuation), change in mortgage-to-GDP ratio and change in construction-to-GDP ratio (economic distortion), and relative price-city-to-country indicator



4.1
Global Economics



4.2
Power Shifts



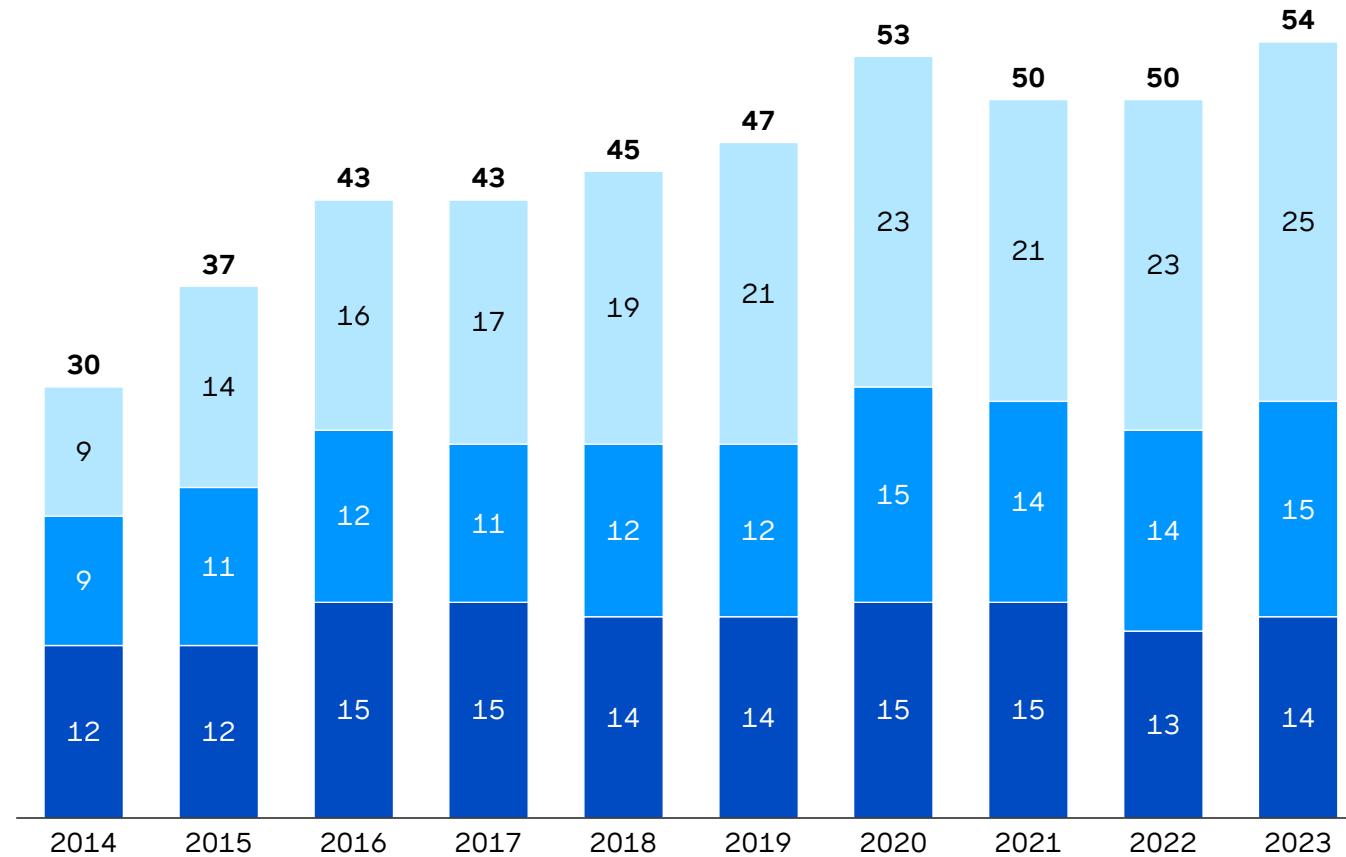
4.3
Energy Transformation



4.4
Debt Challenge

In many developing countries, a considerable proportion of revenue is allocated to interest payments, particularly in Africa

Number of developing countries with net interest payments exceeding 10% of government revenues¹⁾



■ Africa ■ Asia and Oceania ■ Latin America and the Caribbean

- The number of **developing countries** with **interest payments exceeding 10% of their government revenues** has increased from **30 in 2014 to a record 54 in 2023**. Nearly half of these countries are in Africa, where the number has risen from 9 to 25, partly due to high interest rates and less favorable credit conditions
- By contrast, the eurozone has an average interest payment of 3% of revenues, while the United States is at 14%. The **higher US interest payments** are due to a numerous factors, including **lower government revenue** relative to GDP, a **larger deficit** relative to GDP, and the **cost of new debt** being **higher** than in the **eurozone**
- The **pandemic** has resulted in a **reduction in government revenues** in numerous developing countries, coupled with an **expansion of government balance sheets**. This had a significant **impact** on the **capacity to service the debt**, including interest payments
- In periods of **economic pressure**, debtors in developing countries often provide **higher levels of collateral** to gain **access to financing** or to reduce the cost of borrowing. However, this can result in a significant increase in a country's **long-term debt** and **interest burden**

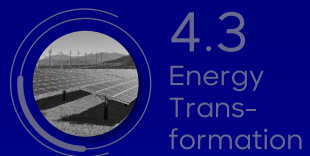
¹⁾ The government's net interest payments relate to the total amount of domestic and foreign interest paid on loans and other forms of borrowing less interest received; government revenue is money the state earns mainly from taxes, social contributions, and sometimes from state-owned enterprises or resources



4.1
Global Economics



4.2
Power Shifts



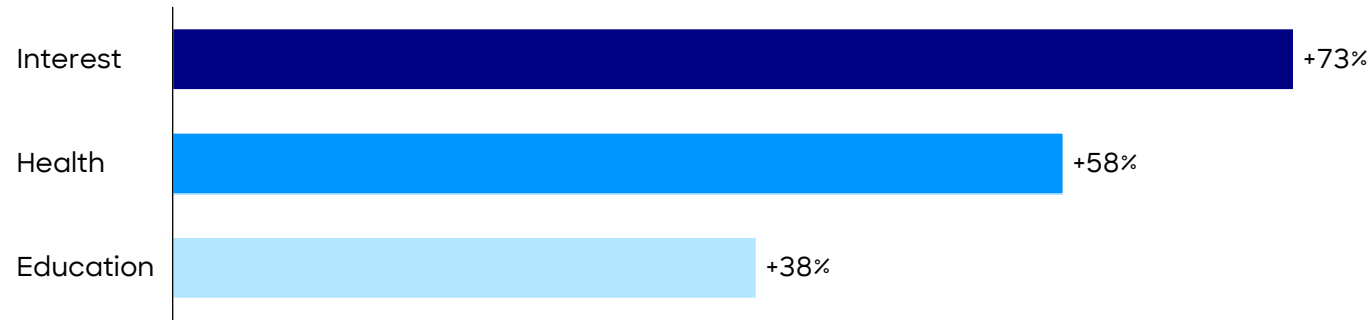
4.3
Energy Transformation



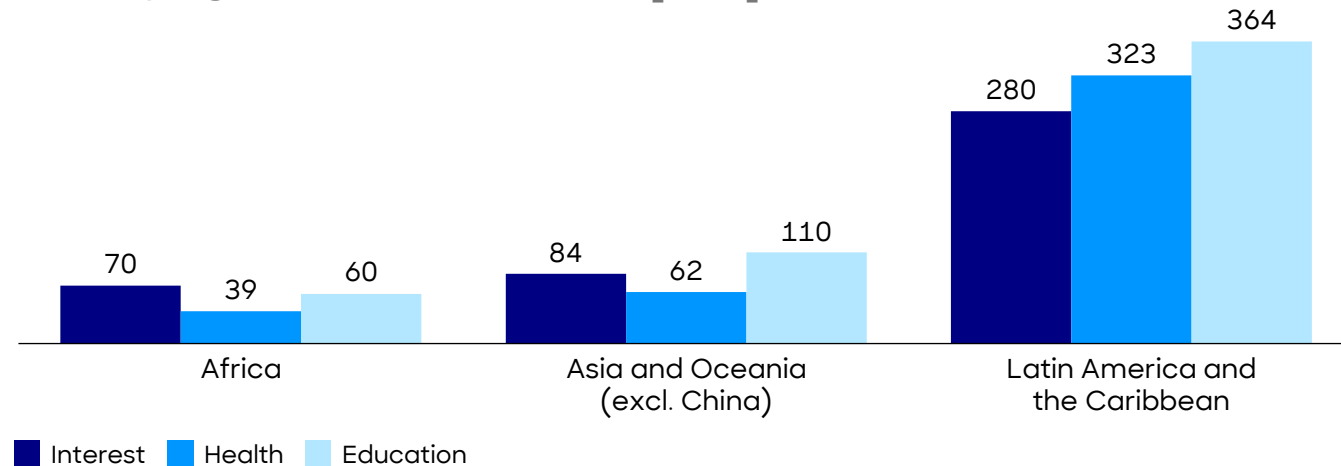
4.4
Debt Challenge

Rising interest payments present a major challenge to debt management in developing countries

Nominal change of public expenditure in developing countries between 2010-2012 and 2020-2022 [%]



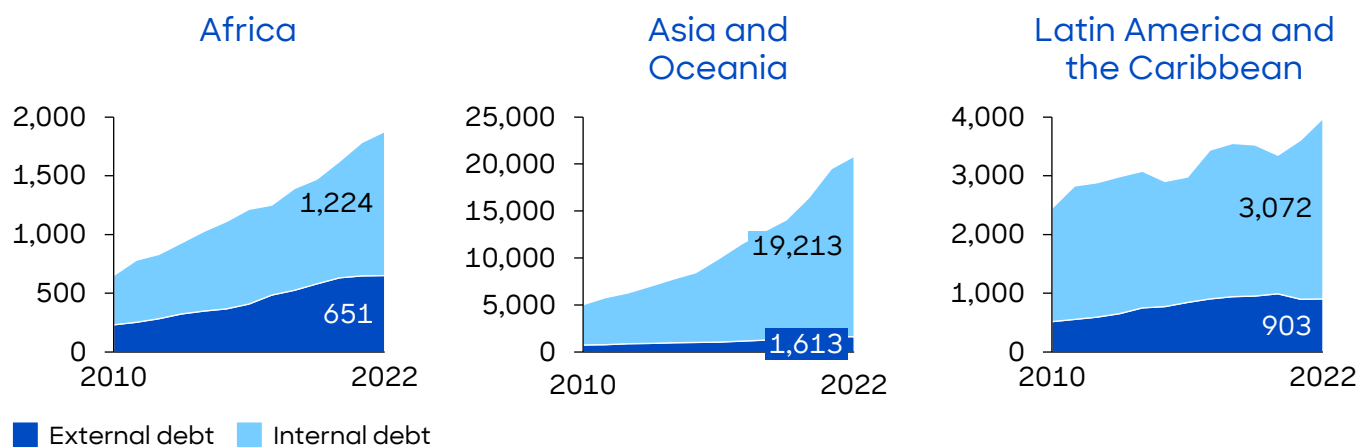
Public expenditure per capita on net interest, education and health in developing countries, 2020-2022 [USD]



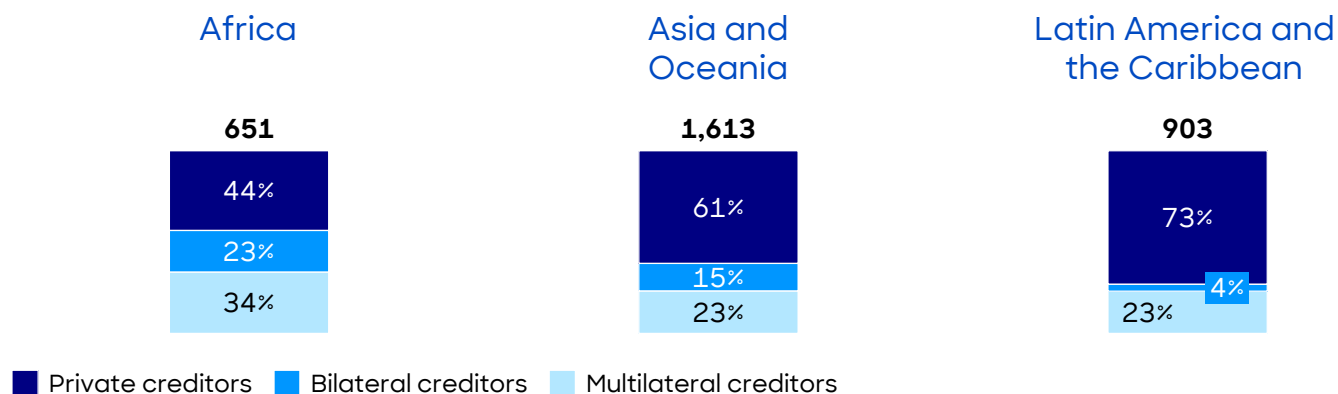
- In developing countries, **interest payments** are not only growing rapidly, they are also **outpacing** growth of key public expenditures such as **health** and **education**. While spending on education has risen by 38% from the period 2010-2012 to the period 2020-2022, interest payments have risen by 73%
- The **high interest payments are partly due to high cost of borrowing**. Developing countries pay 2-4 times higher interest rates than the US and up to **12 times higher than Germany**
- In both Africa and Asia & Oceania (excluding China), per capita payments for **interest exceed** the per capita **expenditure on health**, and in Africa, they are also higher than the expenditure on **education**
- In total, there are 48 developing countries **spending more on servicing the interest payments on their public debt than on education and healthcare** - affecting **3.3 billion people**
- High interest payments also pose a major **barrier** to investing in **climate protection**. These investments are essential for reaching climate goals and reducing the **negative impacts** of climate change, which are hitting **developing countries** especially hard

Unfavorable creditor structures complicate debt management in developing countries even further

External and internal public debt of selected regions¹⁾ [USD bn]



External public debt, shares by type of creditor, 2022 [USD bn, %]

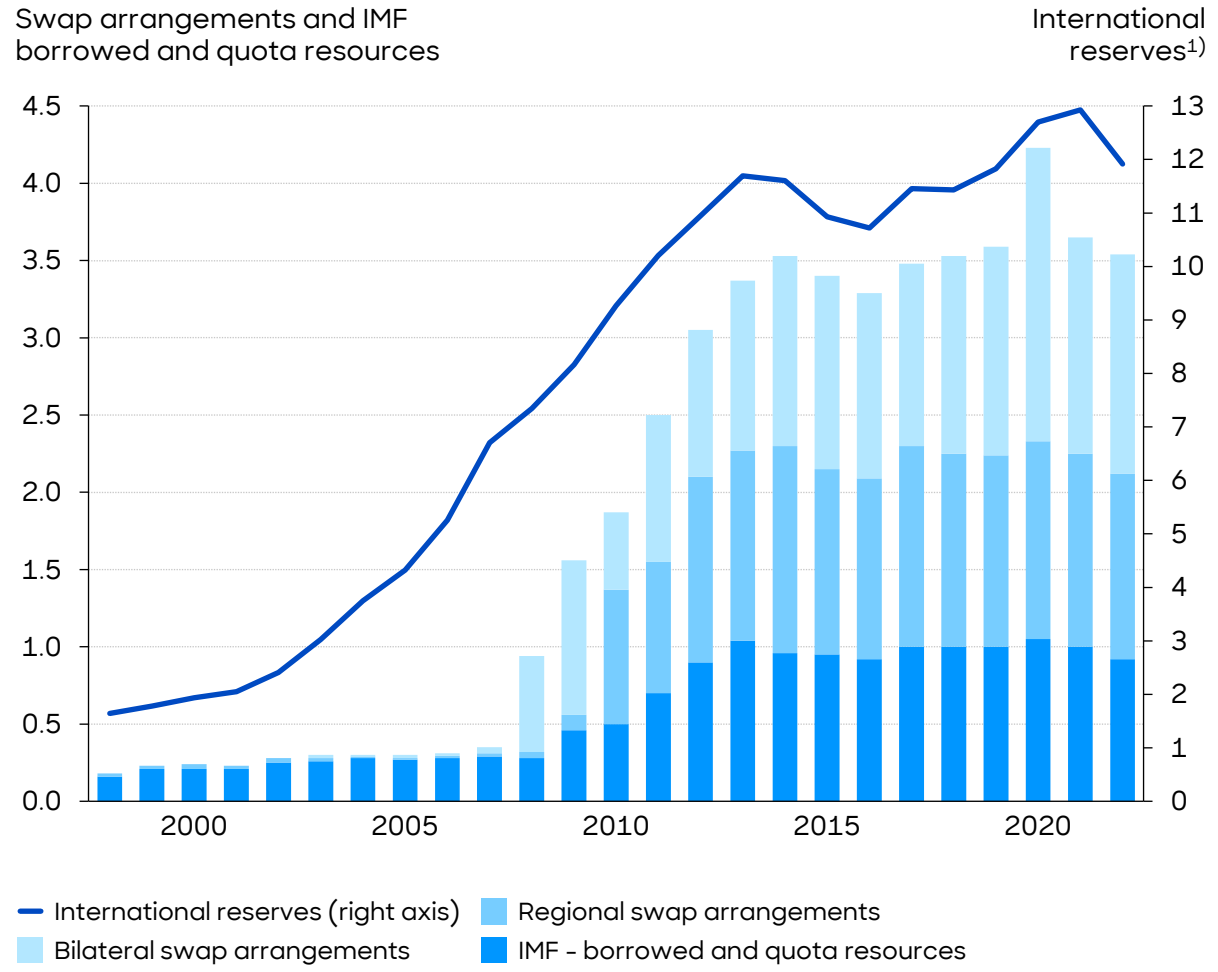


- There is a significant **regional** discrepancy in the **proportion of internal and external public debt**. **Internal debt**, owed to **domestic creditors**, contrasts with **external debt**, which is owed to **foreign creditors**
- In Africa, external debt accounts for nearly 35%, while in Asia and Oceania it was just 8% in 2022. Since 2010, the share of **external debt** in **Asia and Oceania** has almost **halved**, while remaining largely **constant in other regions**
- **External public debt** entails the risk that **currency devaluations** may **increase repayment costs** and thus lead to economic instability
- **Private creditors** hold the **majority share of public debt** across all regions considered. Private credit has the disadvantage of being particularly **volatile** and can **flow out quickly** in times of crisis
- This was particularly evident in 2022, when **private credit withdrawals** caused nearly **USD 50 billion in outflows** in developing countries

1) Internal debt was calculated as the difference between total public debt and external public debt
Source: UNCTAD; Roland Berger

Following the 2007 financial crisis, the vulnerability of financial markets prompted the implementation of a robust financial safety net

Development of the global financial safety net, 1998-2022 [USD trillion]



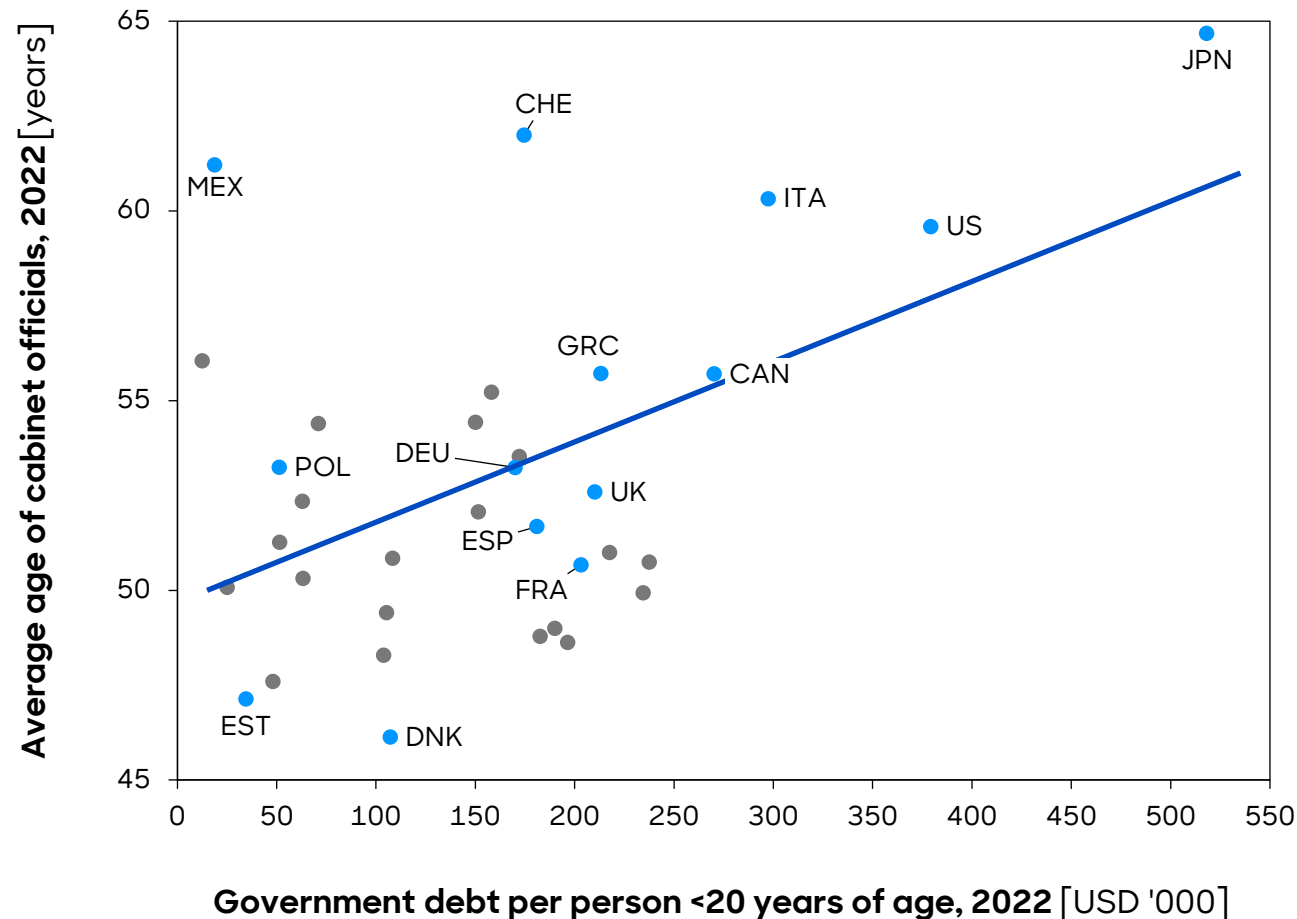
- In the event of an economic crisis, countries have several financial resources at their disposal, both internal and external. The **global financial safety net is a set of institutions and mechanisms that provide assurance against crises and financing to mitigate their impact**
- This safety net has **four main layers**: a countries' **own international reserves**; **bilateral swap arrangements** whereby central banks exchange currencies to provide liquidity to financial markets; **regional financial arrangements** by which countries pool resources to leverage financing in a crisis, and the **IMF**
- **International reserves** serve as a nation's **primary defense** in a crisis, though they are **expensive** to maintain and are predominantly held by advanced and large emerging economies. Unlike these reserves, **other mechanisms** rely on **cooperative efforts across countries**
- Post 2007, the **total stock of international reserve holdings nearly doubled**, reaching around USD 12 trillion by end-2022. **Other layers** of the safety net **increased nearly tenfold**, to around USD 3.5 trillion
- **This enhanced insurance effectively cushioned the shock during the first year of the COVID-19 crisis in 2020.** The increased bilateral swap arrangements – primarily US Federal Reserve swaps – provided prompt liquidity support, helping to stabilize the global financial markets and capital flows to emerging market economies. This surge in support measures, however, subsided somewhat after the initial crisis peak

- 4.1 Global Economics
- 4.2 Power Shifts
- 4.3 Energy Transformation
- 4.4 Debt Challenge

1) The values of the international reserves represent the figures for the fourth quarter of each year
Source: IMF; Roland Berger

Rising debt, especially at the state level, often triggers debate about intergenerational equity

Correlation between Cabinet age and government debt per person aged younger than 20, OECD countries, 2022¹⁾ [USD '000, years]



- The subject of high levels of public debt and its consequences has the potential to give rise to a vigorous **debate on the issue of intergenerational equity**
- The generational aspect can be illustrated by the observation that the **higher the average age of a government's cabinet officials the higher the government debt per person under 20 years of age** - for OECD countries in 2022 at least
- However, there is room for discussion whether higher debts are **causing an inter- or intragenerational issue**
- From an **intergenerational perspective**, it is argued that the **older generation is placing a burden on the younger generation as the latter must repay this debt** in future years, while the former is reaping the benefits from the debt taken on by government in the first place. Yet, this idea **lacks empirical proof**
- However, **empirical evidence** exists on the issue of **intragenerational injustice**: people who are able to invest in government bonds can pass these on to the next generation - while people who cannot are unable to leave such a bequest. Yet, the latter group still **contributes to the servicing of today's public debt through general taxation of their income** - which ultimately benefits government bond holders, i.e. their wealthier contemporaries

1) The proportion of the population under 20 years of age was multiplied by the nominal government debt to calculate the debt per person under 20 years of age
Source: OECD; Roland Berger

4.1
Global Economics

4.2
Power Shifts

4.3
Energy Transformation


4.4
Debt Challenge

History offers several lessons regarding the handling of high levels of public debt – In most cases, debt reduction is accompanied by cutbacks

Historic efforts to reduce public debt: Orthodox policy options

 **4.1**
Global Economics

 **4.2**
Power Shifts

 **4.3**
Energy Transformation

 **4.4**
Debt Challenge

Enhancing growth

Higher growth – in excess of interest rate levels – has facilitated the **reduction of debt levels** in some countries (relative to GDP). However, when relying solely on growth to reduce burden of debt, **several factors warrant caution:** for example, favorable past differentials regarding interest rates and growth rates may dissipate over the next decade because of **declining productivity**. Also, **interest rates may begin to rise** if **inflationary pressures** build up

Privatization

Proceeds from the privatization of public assets have also been employed to **raise debt service levels**. While privatization can facilitate **debt reduction**, certain **prerequisites** (e.g. agreements on **market entry conditions**, etc.) are not yet in place in all **indebted countries**



Fiscal consolidation

Fiscal consolidation can lead to **primary fiscal surpluses** to pay down debt by **cutting expenditures** or **raising revenues**. The real or potential **loss of access to financial markets** has, on occasion, forced countries into **strict fiscal consolidation**. However, such consolidation is usually accompanied by **lower growth**

Wealth taxation

Since the global financial crisis, **wealth taxes** are again in the spotlight, largely due to heightened perceptions of **wealth inequality**. However, governments are confronted with numerous challenges, including **procedural risks and complexities** associated with existing taxation systems, as well as **lobbying efforts by the ultra-rich** and the potential of **capital flight**. Moreover, **wealth tax revenues** may not be as sizable as they first appear. For example, in Germany, wealth tax plans failed when it became clear that the **cost to determine the tax base** would have consumed nearly **one-third of the projected wealth tax revenue**

In the past, more controversial methods of debt reduction have been used - in some cases with negative social consequences

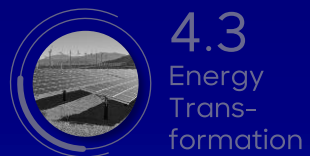
Historic efforts to reduce public debt: Heterodox policy options



4.1
Global
Economics



4.2
Power
Shifts



4.3
Energy
Trans-
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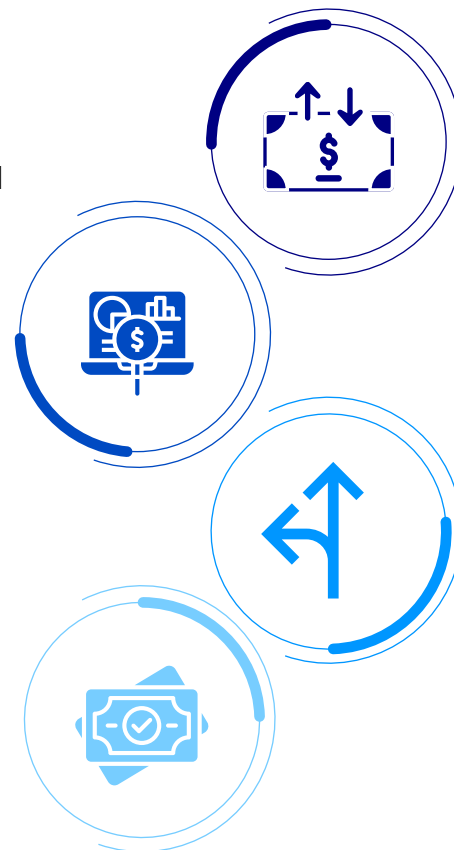
4.4
Debt
Challenge

Financial repression

Financial repression, including **capital controls** and specific measures to **regulate the financial sector**, are options to **reduce the differentials between growth rates and real interest rates** by locking up savings in special instruments. However, this strategy is a **high-cost approach** to reduce debt because it **discourages a more productive use of savings**. Moreover, decades of **financial and capital account liberalization** have reduced a government's room for financial control

Domestic debt default

Domestic debt default differs from external debt default and includes **forced conversions, lower coupon rates, unilateral principal reductions** (at times with currency conversion), and payment suspensions. However, governments that default on their domestic debt are still **vulnerable to inflation risk** and the risk of **interest rate spikes** if inflation expectations become unmoored



Inflation

Inflation reduces the real debt burden when the rise in **nominal government income** (e.g. tax payments) outpaces **nominal interest payments**. However, inflation as a debt reduction strategy also has drawbacks: for example, inflation is usually accompanied by an **exchange rate depreciation**, which increases debt if the share of short-term debt or **debt denominated in foreign currency** is large. If high debt is the result of **persistent spending pressures** or revenue weakness, unexpected inflation may also fail to reduce debt sustainably. Moreover, **inflation can spiral out of control** and **undermine the economic stability** of a country

Debt restructuring

Default and restructuring may sometimes be the only way for a country to deal with **foreign-owned sovereign debt denominated in a foreign currency** and adjudicated by foreign courts. While default and debt restructuring can provide immediate **debt reduction**, they also come with **long-term costs**. Protracted debt rescheduling negotiations prolong the **loss of market access**, can **weaken financial institutions' balance sheets**, and **undermine financial stability**

Corporate actions - Let's talk about challenges and opportunities arising from megatrends regarding economics & business (1/3)

Conclusion and corporate impacts



4.1
Global Economics

↘ ↙ **Impact:** Rising protectionism is changing the environment in which
↗ ↖ companies operate, affecting both value chains and sales markets

- Companies need to reassess their value chains and sales markets. This not only affects companies with foreign subsidiaries but all companies that have (directly or through other suppliers) foreign suppliers in their value chain, export to markets abroad, or have other relationships with overseas markets (e.g. in R&D or sourcing labor)
- Adaptations of the value chain or sales markets require a reassessment and possibly an adjustment to the entire business model. If certain supplies cannot be sourced from another country and there is no viable substitute, it may be that a certain product will no longer be produced. In this case, the product-market approach must be adapted



4.2
Power Shifts

↘ ↙ **Impact:** Rapid and unpredictable changes in the international business
↗ ↖ environment are the new normal - Companies need to be robust to cope

- Companies should seek to diversify their business model to reduce their vulnerability to change. They should adopt a multi-sourcing approach, diversify their global production footprint, develop a varied product portfolio, and sell to different markets
- The degree of diversification needs to be balanced. Sourcing large supplies from a limited number of suppliers drives down prices, and a focused product portfolio allows companies to achieve economies of scale and become more attractive to customers



4.3
Energy Transformation



4.4
Debt Challenge

Actions

Actions

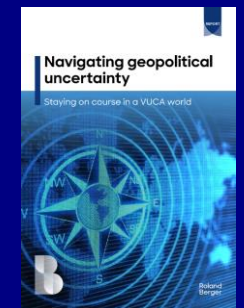
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RBI Quarterly:
A New Phase of Globalization



Navigating Geopolitical Uncertainty



Corporate actions - Let's talk about challenges and opportunities arising from megatrends regarding economics & business (2/3)

Conclusion and corporate impacts

Impact: Power shifts create new business opportunities in emerging and developing markets

- Companies need to evaluate the current and future potential of emerging and developing markets compared to advanced economies. Economic criteria should include not only current and projected GDP growth but also the overall size of the market, the state of manufacturing and technology, the availability of skilled labor, labor costs, the purchasing power of the population, the quality of the infrastructure, access to resources, and the ease of doing business in the country
- In addition to economic considerations, it is essential to evaluate political and legal factors, such as political stability, the level of corruption, legal frameworks, and environmental standards

Impact: The transition to renewable energy is inevitable – Companies should adapt and view this change as a strategic opportunity to gain a competitive edge

- Companies should increase investment in energy efficiency by upgrading equipment and optimizing processes to maximize efficiency and to reduce both operational costs and emissions. Additionally, investing in renewable energy assets, such as solar, can increase energy independence as well as reduce exposure to market price fluctuations
- Setting clear targets for carbon neutrality goals, adopting frameworks such as Science-Based Targets (SBT), and actively participating in carbon trading or offsetting programs is vital



4.1
Global Economics



4.2
Power Shifts



4.3
Energy Transformation



4.4
Debt Challenge

Actions

Actions

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Global Carbon Restructuring Plan



Corporate actions - Let's talk about challenges and opportunities arising from megatrends regarding economics & business (3/3)

Conclusion and corporate impacts

➤ ➤ **Impact:** The expansion of the green bond market lowers the cost of financing, provides long-term access to capital, and enables the participation of new investor groups

- It is in a company's best interest to enhance its ESG performance and obtain ESG certification to secure more favorable financing conditions. Green bonds typically offer a lower spread than conventional bonds
- In addition, green bonds promote sustainable financing, helping mitigate the risk of future exposure to stricter ESG regulations, while also enhancing the company's reputation as a responsible corporate citizen

➤ ➤ **Impact:** Rising interest costs and unfavorable debt structures in developing countries are becoming an increasing challenge for global supply chains

- It is advisable for companies to review and diversify their supply chains to mitigate risks such as delivery failures, non-payment, and rising procurement costs
- In developing countries, particularly in parts of Africa, high interest rates and unfavorable credit structures often lead to financial instability. However, it would be unwise for companies to ignore developing countries entirely, as not all regions are affected equally. Instead, companies should consider alternative sources of supply and maintain a presence in more economically stable areas

Actions

Actions



4.1
Global Economics



4.2
Power Shifts



4.3
Energy Transformation



4.4
Debt Challenge

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From Gray to Green



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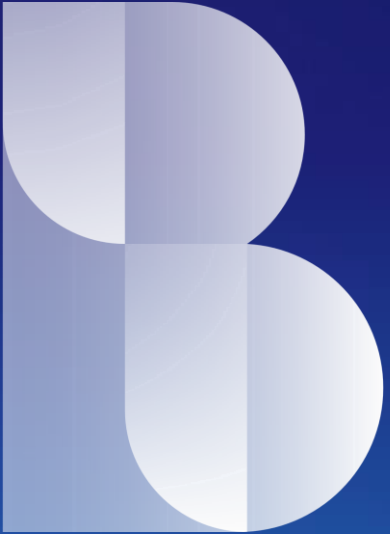
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