BCG

Executive Perspectives

War in Ukraine: Global Update and Perspective on Energy Transition

BCG Global Advantage, Energy and Climate & Sustainability Practice Areas

Prepared: 14 June 2022 – Confidential: Limited Distribution

Introduction to this document

The war continues to be first and foremost a humanitarian crisis, and the top priority for all continues to be the safety and security of people

Moreover, the continuity of the war has resulted in profound economic impact, not only within Ukraine but globally — as supply chains face disruption, commodity prices rise, and unprecedented levels of sanctions take hold

We continue to lean into the most pressing issues and questions on the minds of our clients and teams

This edition shares the latest update on the **global economic impact** of the war, as well as its evolving effect on **Energy Transition**. Using the Energy Trilemma as a lens to understand the implications of the crisis, this edition details global transition trends, selected regional/country views, and implications for business leaders and policymakers

War in Ukraine: Global Update and Energy Transition

AGENDA

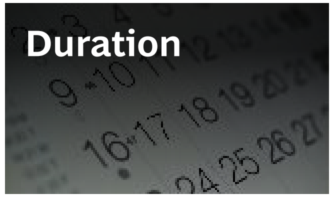
Global economic impact of the war in Ukraine

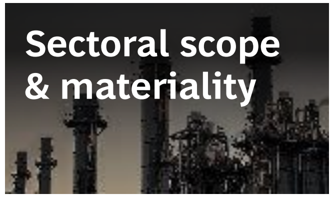
Perspective on Energy Transition

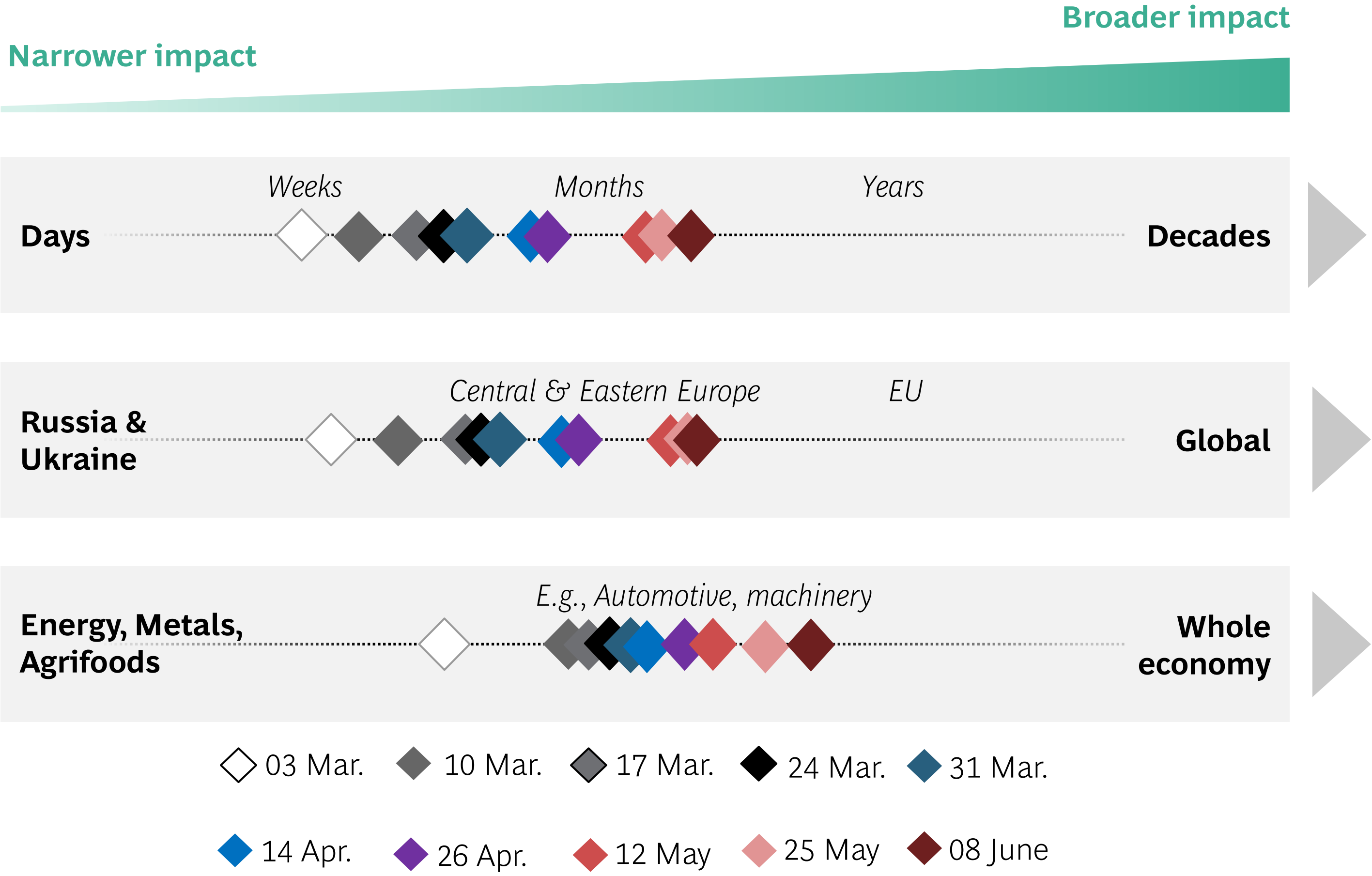
- Global Energy Transition trends
- Selected region/country views
- Implications for leaders

War in Ukraine continues to evolve along several dimensions

Interrelated dimensions







Battle intensifies for control of Donbas region. Pres. Zelensky says Russia 'feels too strong' to end war

7.2M refugees from Ukraine; with growing number of countries outside the EU hosting them, e.g., Japan

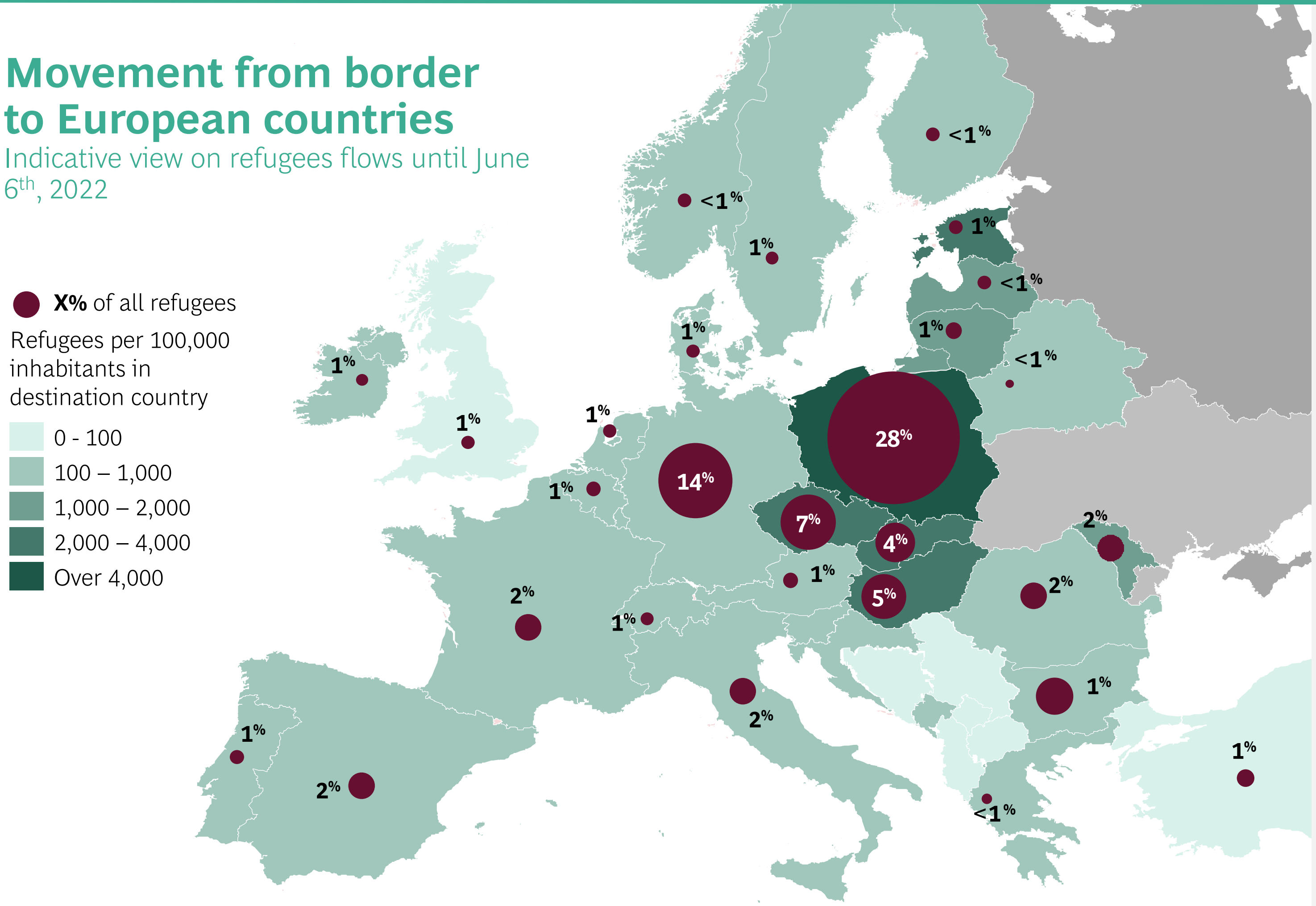
The World Bank slashed its global growth forecast by nearly a third to 2.9% for 2022

1: Independent 2. Japan Times, Washington Post, Reuters 3. European Commission; Source: BCG analysis Note: BCG does not provide legal or regulatory advice.

7.2M Ukrainians have crossed borders from Ukraine | Capacity constraints in Central Eastern Europe, future flows could add pressure on Western Europe

Movement from border to European countries

Indicative view on refugees flows until June 6th, 2022



- **~53%** entered the Schengen Area through **Poland** and **~13%** through **Hungary**
- **All other bordering countries** also facing capacity constraints
- **~50%** settling down in **Central Eastern Europe**
- **~50%** already flowing to other **countries (including non-EU countries)**
- **Limited flows to rest of the world**, with potential to increase long-term intake
- An estimated **1.5 - 2M refugees have returned** to Ukraine, mostly from CEE countries; however, **uncertainty remains over permanence**

Note: Actual number of "unique" refugees might be slightly lower as the crossing are not counted as per "unique" person, however at this point it is uncertain whether the return is permanent or temporary. Note: Indicative view; recent analyses indicate that onward travel from directly neighboring countries (particularly Poland, Hungary, Slovakia) and hence also inflow to not directly neighboring countries (particularly Germany, Italy, France) might be higher than stated. Note: These analyses represent only potential scenarios based on discrete data from one point in time. They are not intended as a prediction or forecast, and the situation is changing daily. Source: UNHCR; interviews with NGOS; survey among refugees, Government websites and statistics; BCG calculation & analysis

Summary snapshot | War in Ukraine global economic impact

Global Growth Outlook

GDP Forecasts[1]

	2021	World Bank 2022	Leading FIs 2022	
	Actual	Jan'22 Forecast	21 May – 08 Jun '22 Forecasts: Median	Minimum
Russia	4.7%	2.4%	-10.0%	-15.3%
Euro Zone	5.3%	4.2%	2.55%	2.1%
Global	3.9%	4.1%	3.05%	2.5%

Note: the World Bank slashed **global forecast to 2.9%** on 7 June

Commodity Prices[4]

Commodity price (actual, $)

Commodity	Jan 3 '22	Jun 7 '22	Change
Crude Oil ($/bbl)	79.0	120.6	+53%
Gas ($/MWh)	80.4	79.6	-1%
Coal ($/t)	157.5	369.0	+134%
Wheat (€/bu)	274.0	380.3	+39%
Rapeseed (€/t)	728.5	782.8	+7%
Nickel ($/t)	20,430.0	29,395.0	+44%
Palladium ($/oz)	1,826.0	1,955.7	+7%

Supply Chain Metrics

Deep Sea Cargo Bosporus Straits Transits (Avg. #/day)[2]

	Pre-War (Nov '21)	Prev. Wk (5/23-5/29)	Curr. Wk (5/30-6/5)	ΔCW-PreWar
Northbound	8.9	5.6	5.4	-39%
Southbound	9.6	6.0	6.0	-63%

Deep Sea Cargo Port Calls (Avg. #/day)[2]

	Pre-War (Nov '21)	Prev. Wk (5/23-5/29)	Curr. Wk (5/30-6/5)	ΔCW-PreWar
Ukraine	4.5	0.0	0.0	-100%
Russia	21.6	21.4	20.7	-4%

Baltic Dry Index (Daily Avg)[3]

	Pre-War (Nov '21)	Prev. Wk (5/24-5/30)	Curr. Wk (5/31-6/6)	ΔCW-PreWar
BDI[3]	2780	2913	2586	-7%

Sanctions & Policy Actions

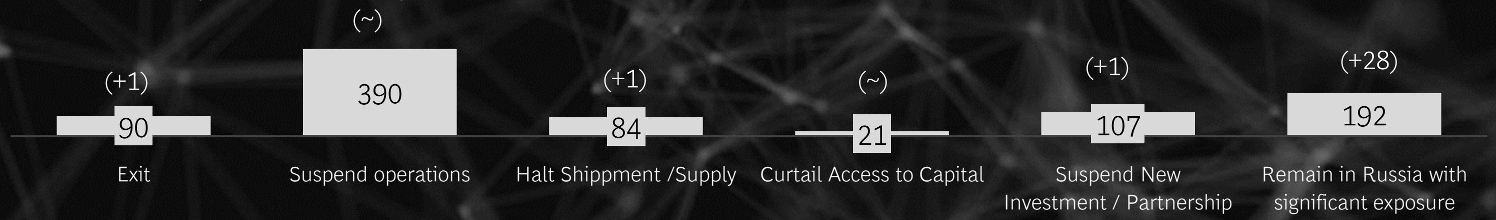
Updates since 22 May

- EU passes "6th Round": partial oil import ban, prof. services, RU media, further SWIFT restrictions, oligarchs, oil-ship insurance w/ UK agreement
- US blocks RU payments to US bondholders, bans additional individuals
- Russia bans 963 American citizens, including Biden & Harris, and ~20 Canadians from entering the country

Cumulative # WW Sanctions in-place[5] (Δ since previous)

Corporate Actions in Russia Market

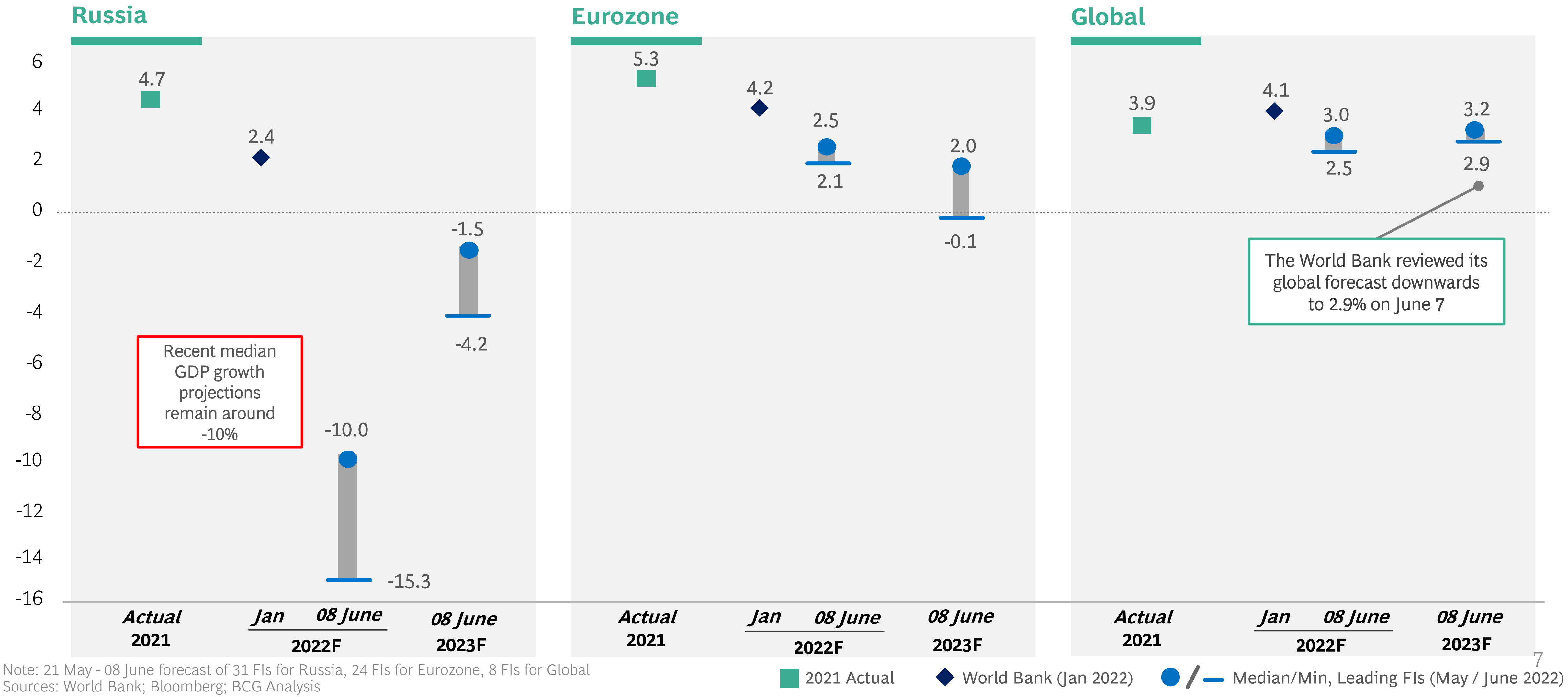
Based on sample of +880 companies[6]



1. GDP forecasts from World Bank and FIs per Bloomberg database (8-34 FIs per forecast period) 2. Deep Sea Cargo: oil tankers MR & up, bulkcarriers Panamax & up, containerships 3,000+ TEU, VLGCs, LNG carriers 60,000+ cbm & PCTCs 6,000+ ceu. Clarksons Research (https://www.clarksons.com/) Clarkson Research Services Limited ("Clarksons Research"). © Clarksons Research 2021. All rights in and to Clarksons Research services, information and data ("Information") are reserved to and owned by Clarksons Research. Clarksons Research, its group companies and licensors accept no liability for any errors or omissions in any Information or for any loss or damage howsoever arising. No party may rely on any Information contained in this communication. Please also see the disclaimer at https://www.clarksons.net/Portal/disclaimer, which also applies. No further distribution of any Information is permitted without Clarksons Research's prior written consent. Clarksons Research does not promote, sponsor or endorse the content of this communication. 3. https://www.bloomberg.com/quote/BDIY:IND; Baltic Dry Index (BDI) is index of avg price paid for transport of dry bulk mat'ls across 20+ routes 4. S&P Capital IQ 5. Total sanctioned actions, incl. duplication. Source: corrective.org 6. Yale Chief Exec Leadership Inst.. Numbers in parenthesis () indicates increase /decrease since last update. Where there is a decrease this is because reclassification due to definitions, and company action recategorization from one to another. Note: BCG does not provide legal or regulatory advice

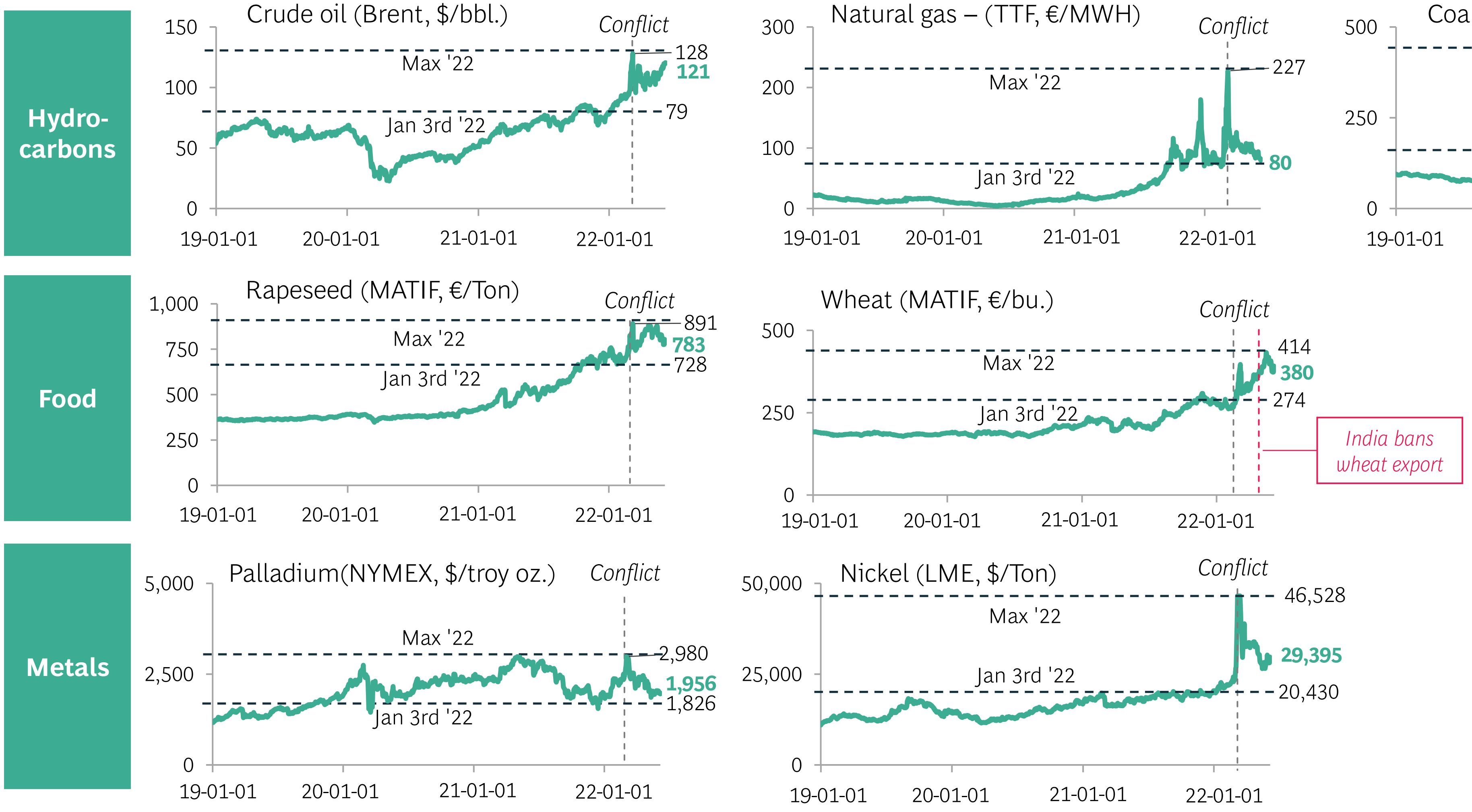
Leading Financial Institutions predict major decline in Russia GDP vs. World Bank Jan forecast; World Bank slashed its Global projection to 2.9%

GDP Growth (%), Selected Regions, 2021A – 2023F



Note: 21 May - 08 June forecast of 31 FIs for Russia, 24 FIs for Eurozone, 8 FIs for Global
Sources: World Bank; Bloomberg; BCG Analysis

Evolution of key commodity prices



Source: S&P Capital IQ,7 Jun 22; BCG analysis.

Key sanctions and policy actions currently in place

Current sanctions & policy actions (Key examples)

"Western" Allies

- Coordinated policy/sanctions programs
  - Limiting SWIFT access, removing "MFN" status, sanctioning gold[1]
  - Enforcing sanctions and export controls via global task force
  - Expelling diplomats, closing embassies/consulates, sanctioning govt officials
  - Limiting or banning energy/coal, key parts, alcohol, luxury goods, steel, etc.
  - Closing EU border crossings and ports, UK prohibits sale of landing rights
- US & UK ban professional services exports, some media outlets
- ! EU passes "6th Round" of sanctions: partial oil import ban, professional services, RU media, further SWIFT restrictions, oligarchs, oil-ship insurance w/ UK agreement
- ! US blocks Russia payments to US bondholders, bans additional individuals

Russia

- Bans "unfriendly" officials, Facebook and Instagram
- Seeks new buyers for oil and gas, demands payment in rubles rather than USD
- Seizes assets and luxury items, declares bankruptcy moratorium
- Threatens to revoke visas of US journalists in retaliation for latest US media sanctions
- Cuts gas supplies to Poland, Bulgaria, Finland, Denmark, and Netherlands
- ! Bans 963 Americans, including Biden & Harris, and ~20 Canadians from entry

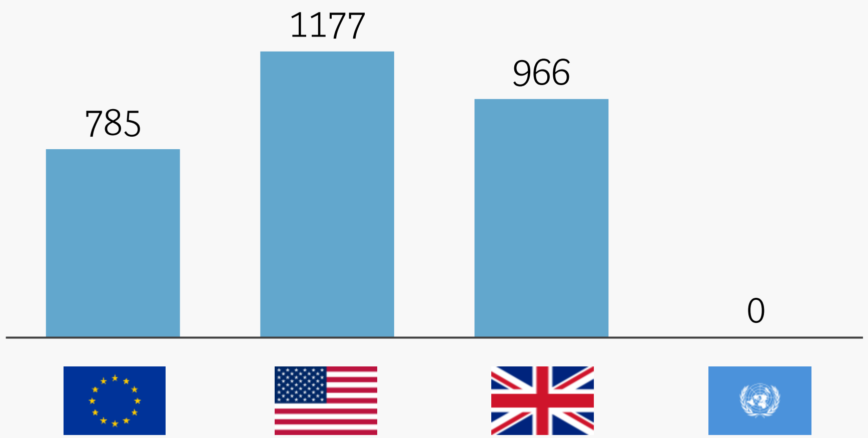
Large EMs

- So far, no sanctions imposed by this group of countries
- China to maintain normal economic and trade relations with RU
- China (& RU) voted against order to halt the invasion at ICJ[2] in The Hague
- China & India abstained at 25 Feb UN Security Council vote against invasion
- Indonesia in difficult position, as 2022 G20 host

! New

Current sanction actions by country and target

Sanction actions[4] in-place



Sanction targets[5] / Δ since last update

+ 47	+ 73	-36
4,848	508	578
Individuals	Companies	Other entities[5]

1. Intended to prevent selling gold reserves to finance war; 2. International Court of Justice. 3. ~ 50 embassies in process of re-opening in Kyiv Source: Government websites; Media reports; BCG analysis. Note: BCG does not provide legal or regulatory advice.

4. Total sanction actions, includes duplication. 5. Reduction = embassies re-opening
Source: www.correctiv.org

Recent developments beyond imposed sanctions

"Western" Allies

- EU set to **agree candidate status for Ukraine**, Moldova and potentially Georgia[1]
- Germany's lower **house approves €100B special defense fund** to modernize its army[2]
- German Chancellor Scholz says **Germany is ready to ramp up its military mission in Lithuania** in response to Russia's invasion[3]
- President Biden races to **expand coalition against Russia** across Latin American, Asian & African countries with limited success to date[4]
- **Japan & NATO** agree to step up **military cooperation & joint exercises** as Russia's invasion caused security concerns in Asia[5]
- President Zelensky announces that **~50 embassies in process of re-opening** in Kyiv[6]

Russia

- **Russia threatens to push the front line further into Ukraine** as UK and US pledge long-range rockets to help Kyiv[7]
- Russia says two major ports seized **by Russia are ready to resume grain shipments**[8]
- Russia's parliament **votes to remove legal liability for imports by unlicensed distributors** of goods and intellectual property[9]
- Russian Airline **"Aeroflot" plans to raise up to $3 billion in an emergency share issue** due to Western sanctions and airspace ban[10]
- President Putin signs a decree offering **fast track citizenship** to Ukrainians in occupied regions[11]

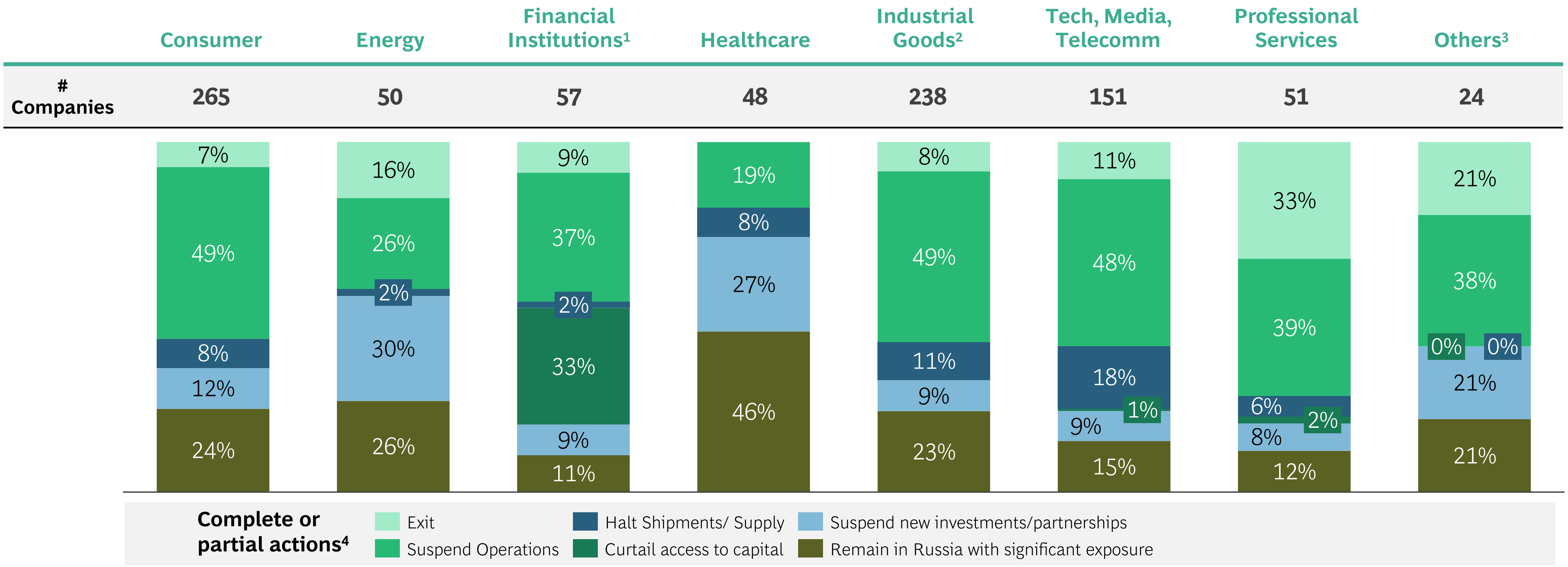
Large emerging markets

- China warns that USA's Cyber Operations could **lead to an escalation in the war**[12]
- **African Union warns EU** that Russia's blockade of Ukraine's ports risks "a catastrophic scenario" of food shortage and price rise[13]
- With war in Ukraine in its third month and Potassium prices tripling in the last year, interest in **mining potassium in the Brazilian** Amazon is being revived[14]
- India's External Affairs Minister claims narrative on India's oil imports from Russia is **unfair**[15]

1. Politico; 2. Financial Times; 3. Reuters; 4. NY Times; 5. AP News; 6. Washington Post 7. Daily Mail; 8. Reuters; 9. Reuters; 10. Reuters; 11. National Post; 12. FMPRC; 13. Guardian; 14. Al-Jazeera; 15. NDTV. Note: BCG does not provide legal or regulatory advice.

Overview of corporate actions

Company Announcements re: Russia Market per Yale School of Management tracking (8 June 2022)



1. Incl. Banks, Insurance & Investment companies; 2. Incl. IG, Infrastructure, Manufacturing; 3. Inc. Private Equity & Principal Investors, Insurance, Public Sector, and others. 4. Definitions: Exit (Includes Complete / Partial: Cease operations, divestment, discontinue, leave and withdraw business from Russia). Suspend Operations (Includes Complete / Partial: Suspension: Activities, JV, sale points, manufacture in Russia). Halt Shipments/Supply (Temporarily stop / freeze sales and transportation of goods/ services in, to and from Russia). Curtail access to capital (Financial Institutions(FI) restrict, reduce, cut, suspend, Russian access to capital provided by FIs). Suspend New Investments or Partnerships (Stop any new investments in Russia and suspend current sponsorships for Russian Athletes). Source: Yale School of Management; Press search; BCG analysis.

Selected emerging second- and third-order effects

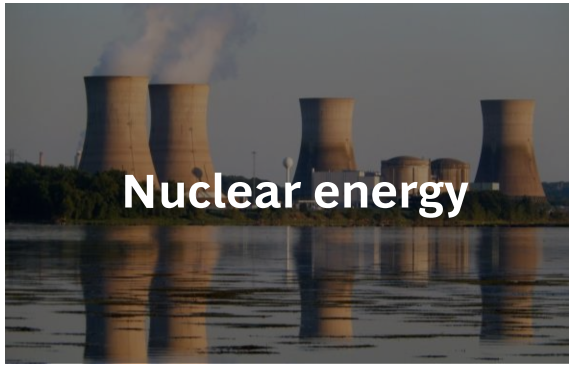
OPEC has **refused to substantially boost oil output. It only increased supply** by ~648k barrels/day in July & August. This small increase was **not as much as requested by** US, UK and the EU

Russia remains a member, but OPEC delegates recently expressed willingness of some **to explore suspending Russia** from oil-production deals

Parallel to the Ukraine conflict, long tail of attacks continue in the cyberspace

Microsoft estimated that Russian hackers have carried out **240 attacks on Ukraine's digital resources** since February

'AcidRain' malware on Europe's VIASAT network **disconnected about 3,000 - 5,800 wind turbines across Central Europe**



Energy supply crunch as a result of the conflict is affecting attitudes towards nuclear power

PM Boris Johnson announced the UK's intent to **build 8 new nuclear plants by 2030** to "not be blackmailed by people like Putin"

EU has **approved 'nuclear activities' as part of the EU Green Taxonomy** in green financing, adding to the momentum in nuclear adoption

Ukraine conflict revealed how modern **commercial technology could be repurposed** to supplement conventional military equipment

- **Space tech:** SpaceX, BlackSky, & others provided satellite internet terminal kits and high-revisit imagery to Ukraine
- **3D Printers**: 3D-printed bombs attached to drones were used as anti-tank grenades

Source: EU Complementary Climate Delegated Act; S&P Global; CSIS; Press clippings; BCG analysis.

War in Ukraine: Global Update and Energy Transition

AGENDA

Global economic impact of the war in Ukraine

Perspective on Energy Transition

- Global Energy Transition trends
- Selected region/country views
- Implications for leaders

Summary | Short-term risks but long-term acceleration potential for transition

Global trends

Energy Transition, or the shift from fossil fuels to low-carbon energy sources, faces new challenges; there was a significant emissions reduction gap to 1.5°C path prior to the Ukraine War and the **conflict has put the transition timeline at greater risk**

Transition decisions are shaped by the **Energy Trilemma**, a set of competing demands/dimensions for decision-makers:

Access/affordability | High costs and accessibility challenges trigger policy responses and social unrest

Security | Priority in import-dependent regions, esp. Europe, while resource-rich ones (e.g., North America, Middle East) increase exports

Environment | Near-mid term challenges risk transition ambitions, investments; opportunities for acceleration in long term

Selected region/ country views

Europe | Global energy transition leader focused on strengthening energy security, accelerating long-term emissions reduction

US | Key exporter of natural gas in global security efforts; direction on transition policy volatile but innovation, investment strong

Middle East | O&G revenues amid high-price environment provide opportunity to accelerate Greentech and renewables generation

China | Focus on affordability & security via coal production could slow short-term transition but commitment is strong in the long term

India | Ambiguous energy transition position; steps taken but potential slower transition given fossil fuel use, imports and subsidies

Implica-tions

Business leaders | Non-energy players should recalibrate their environment agenda to accelerate the long-term transition. Energy players face critical capital allocation decisions to invest fossil fuel cash

Policymakers | Policymakers face a complex set of Energy & Industrial policy choices with several levers to pull. Long-term decisions made today require balancing Energy Trilemma trade-offs

War in Ukraine: Global Update and Energy Transition

AGENDA

Global economic impact of the war in Ukraine

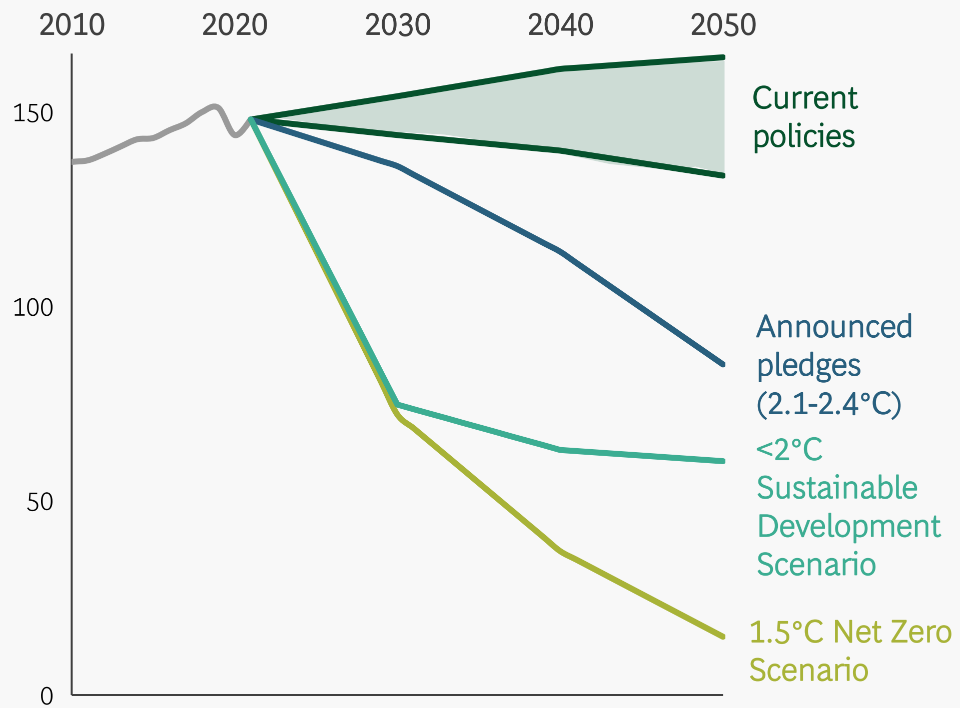
Perspective on Energy Transition

- **Global Energy Transition trends**
- Selected region/country views
- Implications for leaders

Significant emissions reduction gap to 1.5°C path prior to Ukraine conflict

120-150% expected gap between current policies and 1.5°C paths by 2050

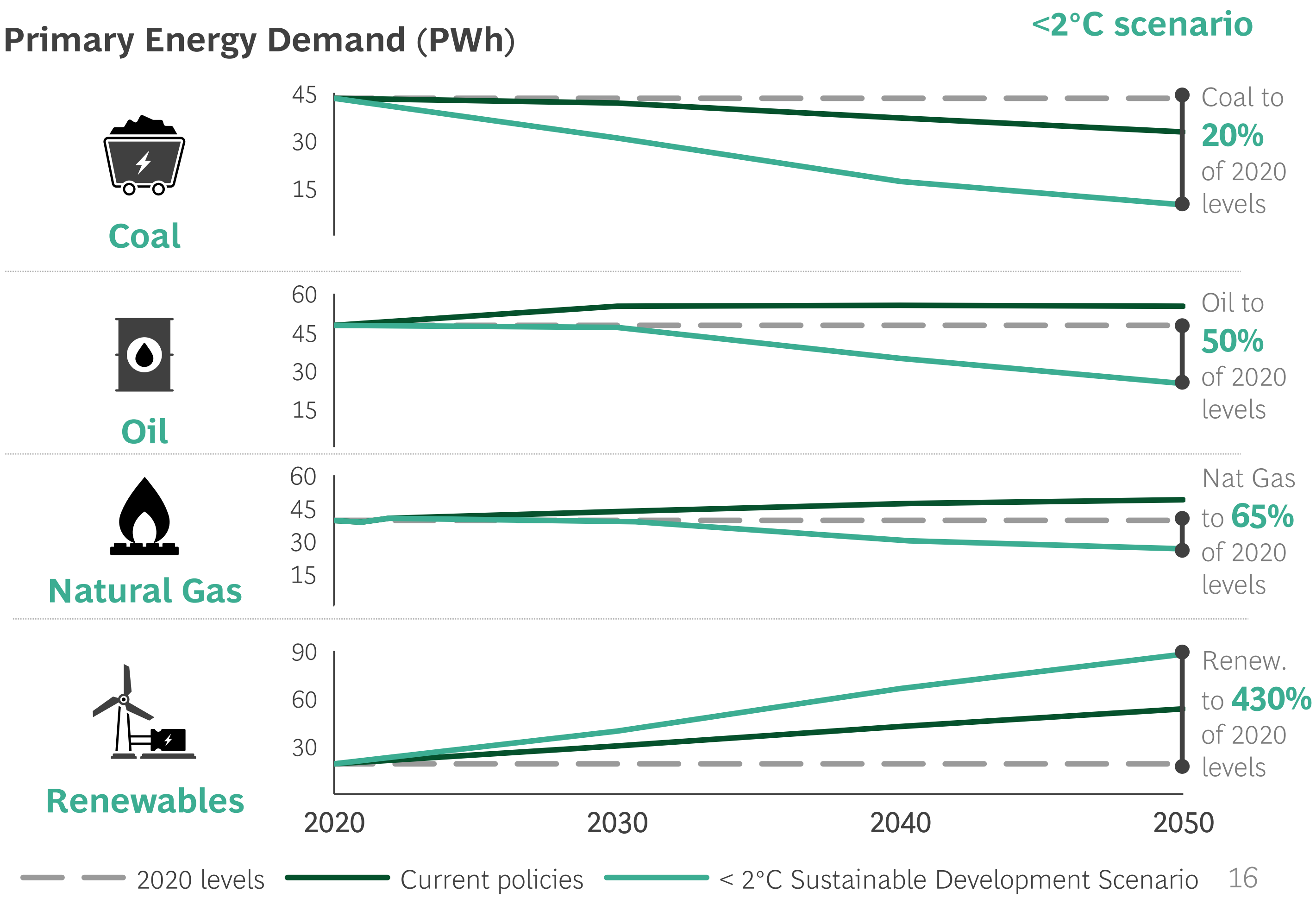
Global greenhouse gas emissions (% of 1990)



Source: IEA; Climate action Tracker; IEA WEO 2021; BCG analysis.

Below 2°C scenario path projects 2050 coal/oil demand at ~20-50% of today's level

Primary Energy Demand (PWh)



Transition decisions shaped by the Energy Trilemma

Trends detailed in next pages

The Ukraine War has **reoriented pressures** on the **Energy Trilemma**, shifting the balance **differently at the regional level** depending on resources and constraints

Energy Access/ Affordability

Access to energy supply to cover demand needs

Cost-competitiveness of energy supplies

Economics of energy production and distribution

Energy Security

Consistent energy supply and stockpiles hedged against geopolitical risks

Ability to pivot in crises and avoid large-scale shortages

Environment

Emissions reductions, including net zero targets, and other priorities (e.g., particulates, water)

Degree of economy-wide transition ambitions

Source: BCG experience.

Access/affordability | High costs and accessibility challenges trigger policy responses and social unrest; RUS trading partners benefit from low prices

Costs have increased sharply since 2021

Current vs 2021 average price

+81%	**Natural Gas, TTF**
+66%	**Oil, Brent**
+125%	**Coal, API2**
+89%	**Electricity[1]**

Policy responses

Italy
Approved cuts to household electricity rates, price of gasoline

Germany
Relief measures passed cutting taxes on petrol and diesel over summer months

South Africa
Fuel subsidy extended to August 2022

**Examples as of June 1, 2022*

Social unrest

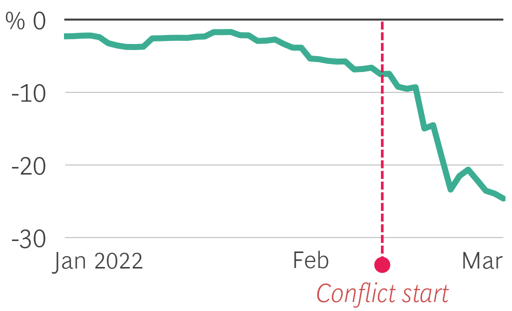
India
Protests disrupted planned liquid petroleum gas (LPG), diesel price hike

Poland
Motorists blocked petrol stations in protest of fuel prices

Thailand
Delivery drivers demanded a gas price cap

While Russian crude offered at a discount

Discount of Russian Ural crude (relative to price of Brent barrel as base)



Japan, South Korea, China and India buying Russian oil at a discount[4]

1. Average of wholesale electricity prices for select European countries (Germany, Netherlands, France, Poland, Spain, Italy) 2. Estimated cost impact - 12M forecast. 3. Baseline 2021 data for Russia. Note: 2019,2020, 2021 prices average for the year. 4. Nikkei Asia. *Current price as of June 6th 2022. Source: Bloomberg, EIA; BCG analysis.

Security | Priority in import-dependent regions, while resource-rich countries increase exports

Three observed actions in import-dependent regions

Strengthen domestic supplies and capacity

- Boost renewables capacity
- Build import-enabling infrastructure (e.g., Natural Gas regasification plants)
- Revamp capacity of existing infrastructure
- Increase domestic supplies (e.g., Natural Gas storage)

Revisit dependencies & import strategy

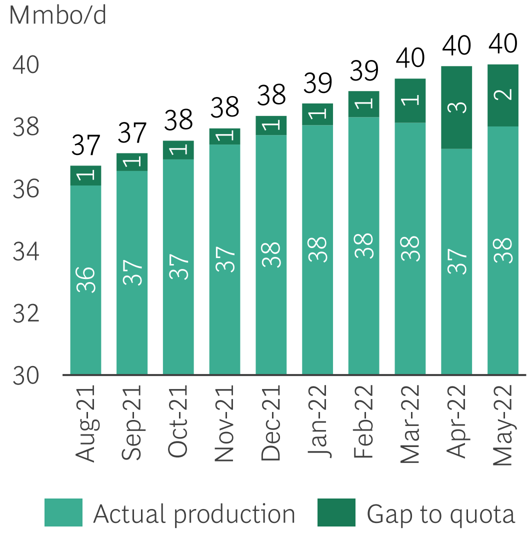
- Review import relations
- Diversify high dependencies with geopolitical allies
- Balance security with affordability of supplies to prevent price increases or volatility

Leverage demand reduction as hedge

- Adjust demand naturally with higher prices
- Leverage collective action to prevent shortages (e.g., curtailing heating/cooling)
- Introduce incentives for energy efficient infra. (e.g., REPowerEU Heat Pump ambitions)

While **resource-rich countries increase production & exports** to meet supply gaps and capitalize on high global prices

OPEC+ Production vs Quota



Source: AGSI; S&P Platts; Cedigaz; GlobalData; Bloomberg, EIA; BCG analysis.

Environment | Near-mid term challenges risk transition ambitions, investments; opportunities for acceleration in long term

Opportunity | Challenge

ILLUSTRATIVE - NON-EXHAUSTIVE

NEAR & MEDIUM TERM

- Opportunity: **Short-term cost shock** is significantly increasing the **economic attractiveness of renewables**
- Challenge: Diversifying from Russian supply could lead to **short-term recourse to emissions-intensive alternatives**
- Challenge: Relief measures and recession could **delay transition support to emerging markets** (e.g., COP $100B pledge)
- Challenge: **High key material costs** could hinder short-term **renewable capacity build-up** and **delay investment**
- Challenge: **Uncertainty** about pace and size of **interest rate tightening could delay investment**

LONG TERM

- Opportunity: **Policy action** supporting long-term transition **strengthened by security** (e.g., REPowerEU)
- Opportunity: **Revenues in resource-endowed countries** available to **invest in green technologies**
- Opportunity: Integration of **new energy markets & supply chains** could boost transition in **emerging markets**
- Challenge: Potential price **volatility & shortages** in raw materials could **hinder pace of transition**
- Challenge: **Higher interest rates** in mid-term could **crowd out long-term investments** in renewables

Source: BCG analysis and case experience.

War in Ukraine: Global Update and Energy Transition

AGENDA

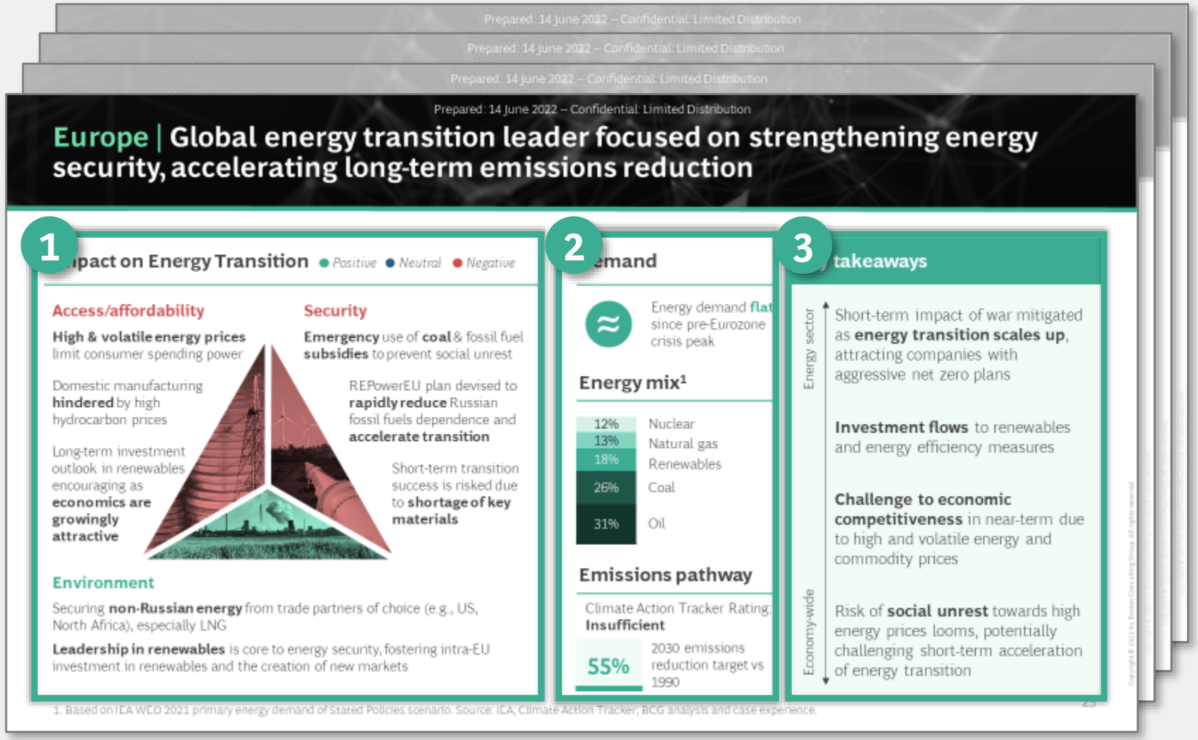
Global economic impact of the war in Ukraine

Perspective on Energy Transition

- Global Energy Transition trends
- **Selected region/country views**
- Implications for leaders

Impact of global events post-Feb 2022 assessed in Regional Dashboards

Regional/Country Views Dashboards



1 **Evaluated impact of post-February 2022 global events on Energy Trilemma dimensions**

- **Positive** | Events improved the outlook for the dimension
- **Neutral** | The situation did not change significantly
- **Negative** | Events could hinder the outlook for the dimension

2 **Metrics integral to assessing impact on transition**

Demand | Mid-to long-term energy demand expectations

Energy mix | Range of energy sources and respective shares (%)

Emissions pathway | Climate action performance as assessed by Climate Action Tracker and public commitments set

3 **Distilled region- and country-specific takeaways to support decisions**

Europe | Global energy transition leader focused on strengthening energy security, accelerating long-term emissions reduction

Impact on Energy Transition

Positive *Neutral* *Negative*

Access/affordability

High & volatile energy prices limit consumer spending power

Domestic manufacturing **hindered** by high hydrocarbon prices

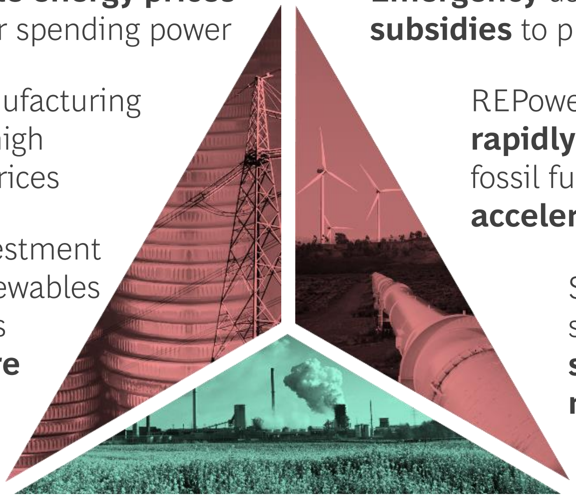
Long-term investment outlook in renewables encouraging as **economics are increasingly attractive**

Security

Emergency use of **coal** & fossil fuel **subsidies** to prevent social unrest

REPowerEU plan devised to **rapidly reduce** Russian fossil fuels dependence and **accelerate transition**

Short-term transition success at risk due to **shortage of key materials**



Environment

Securing **non-Russian energy** from trade partners of choice (e.g., US, Canada, North Africa), especially LNG

Leadership in renewables is core to energy security, fostering intra-EU investment in renewables and the creation of new markets

Demand

≈ Energy demand **flat** since pre-Eurozone crisis peak

Energy mix[1]

12%	Nuclear
13%	Natural gas
18%	Renewables
26%	Coal
31%	Oil

Emissions pathway

Climate Action Tracker Rating: **Insufficient**

55% 2030 emissions reduction target vs 1990

Key takeaways

Energy sector ↕ Economy-wide

Short-term impact of war mitigated as **energy transition scales up**, attracting companies with aggressive net zero plans

Investment flows to renewables and energy efficiency measures

Challenge to economic competitiveness in near-term due to high and volatile energy and commodity prices

Risk of **social unrest** towards high energy prices looms, potentially challenging short-term acceleration of energy transition

1. Based on IEA WEO 2021 primary energy demand of Stated Policies scenario. Source: IEA; Climate Action Tracker; BCG analysis and case experience.

US | Key exporter of natural gas in global security efforts; direction on transition policy volatile but innovation, investment strong

Impact on Energy Transition

● Positive ● Neutral ● Negative

Access/affordability

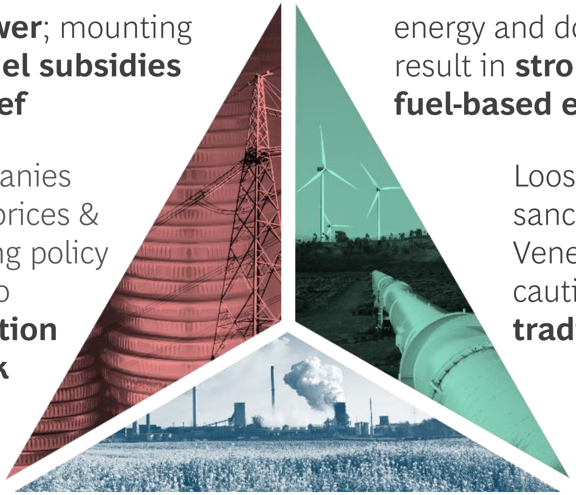
High prices reduce household **spending power**; mounting pressure for **fuel subsidies & gas tax relief**

US O&G companies leverage high prices & accommodating policy environment to **boost production and fast-track LNG capacity**

Security

Limited reliance on Russian energy and domestic resources result in **strong security of fossil fuel-based energy supply**

Loosening of some minor sanctions against Iran & Venezuela signals slow and cautious **reevaluation of trading partners**



Environment

Climate policy uncertain, volatile due to political differences

Reducing methane emissions in O&G production is a priority due to economic & climate benefits

Environmental **momentum at risk** due to negative public sentiment given high prices & inflation

Demand

Slowing demand due to demographics and potential recession

Energy mix[1]

10%	Nuclear
34%	Natural gas
11%	Renewables
11%	Coal
34%	Oil

Emissions pathway

Climate Action Tracker Rating: **Insufficient**

50-52% 2030 emissions reduction target vs 2005

Key takeaways

Energy sector

Economy-wide

Natural gas benefits from short- to mid-term price advantage as drilling ramps up

US to expand **hydrocarbon export capacity** in bid to support allies' energy security

US climate policy volatile and subject to partisanship with differences among states

Market forces to drive transition as focus on innovation through government investment and market signals strengthens

1. Based on IEA WEO 2021 primary energy demand of Stated Policies scenario. Source: IEA; Climate Action Tracker; BCG analysis and case experience.

Middle East | O&G revenues amid high-price environment provide opportunity to accelerate Greentech and renewables generation

Impact on Energy Transition

● *Positive* ● *Neutral* ● *Negative*

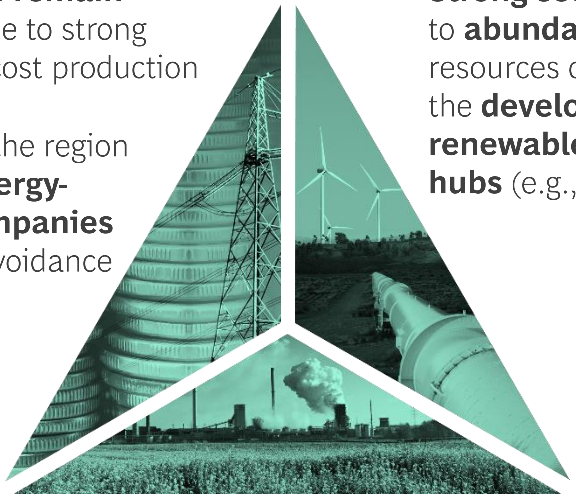
Access/affordability

Energy prices remain affordable due to strong domestic low-cost production

Re-shoring to the region can attract **energy-intensive companies** seeking cost avoidance

Security

Strong security position due to **abundance** of hydrocarbon resources complemented by the **development of renewable capacity and hubs** (e.g., in green hydrogen)



Environment

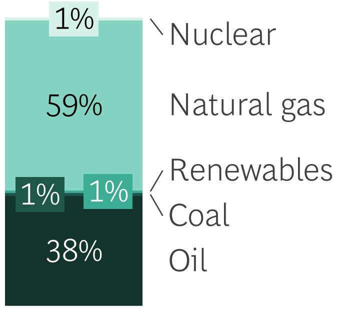
The region **remains a fossil-fuel powerhouse** and leading exporter

Hydrocarbon revenues available to boost to **low-carbon technologies investment** (e.g., green hydrogen, solar)

Demand

Slowing demand due to demographics and higher efficiency

Energy mix[1]



Emissions pathway

Climate Action Tracker Rating: **Critically Insufficient**

0-24% 2030 emissions reduction target vs "business as usual"

Key takeaways

Energy sector

Natural gas and oil benefit from price advantage as the region will remain a hydrocarbon export leader

Key role supporting price stability in global oil & gas markets through increased production

Revenue available to invest in Greentech innovation, domestic capacity and the creation of hubs

Renewables can become a source of **foreign investment** and **economic diversification**

Economy-wide

1. Based on IEA WEO 2021 primary energy demand of Stated Policies scenario. Source: IEA; Climate Action Tracker; BCG analysis and case experience.

China | Focus on affordability & security via coal production could slow short-term transition but commitment is strong in the long term

Impact on Energy Transition

Positive *Neutral* *Negative*

Access/affordability

The government enacted policies (e.g., subsidies) to mitigate impact of rising prices on households

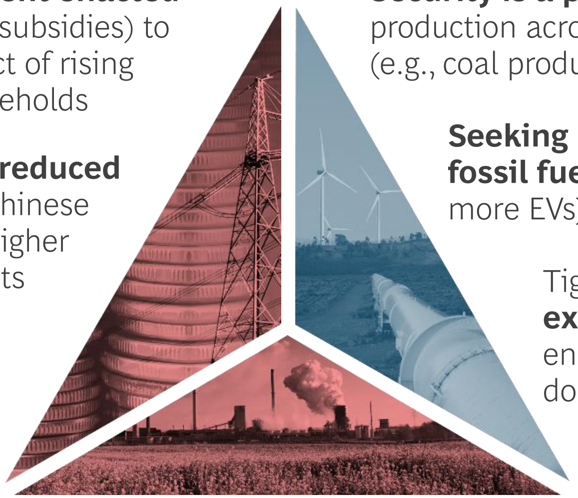
Potential for reduced demand for Chinese goods due to higher production costs

Security

Security is a priority, boosting production across all energy sources (e.g., coal production, renewables)

Seeking less reliance on fossil fuels (e.g., push for more EVs)

Tighter control of **energy export volumes** to ensure sufficient domestic supply



Environment

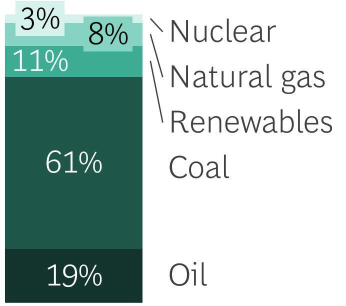
The recent pivot to **coal production** could offset short-term emissions reduction efforts

China is committed to emissions reduction even if **lower priority** than smog, particulate pollution, or GDP growth

Demand

Growing demand on the back of slower-but-sustained economic growth

Energy mix[1]



Emissions pathway

Climate Action Tracker Rating: **Highly Insufficient**

>65% 2030 reduction in carbon intensity vs 2005

Key takeaways

Energy sector

Short-term pivot in domestic coal production as energy security is paired with longer term climate ambitions

Continued effort to build capability to **supply/export needed materials and advanced Greentech** for global renewable energy scale-up

Economy-wide

Amid near-term price pressures and other environmental priorities, China **committed to emissions reduction**

1. Based on IEA WEO 2021 primary energy demand of Stated Policies scenario. Source: IEA; Climate Action Tracker; BCG analysis and case experience.

India | Ambiguous energy transition position; steps taken but potentially slower transition given fossil fuel use, imports, and subsidies

Impact on Energy Transition

● *Positive* ● *Neutral* ● *Negative*

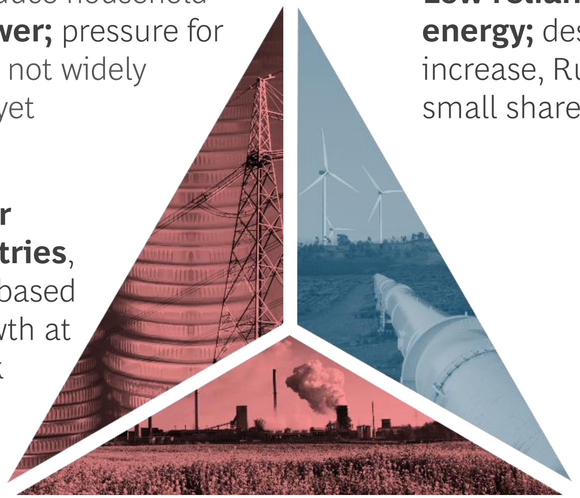
Access/affordability

High prices reduce household **spending power;** pressure for **subsidies** but not widely implemented yet

Fuel access prioritized for energy industries, putting broad-based economic growth at short-term risk

Security

Low reliance on Russian energy; despite imports increase, Russian oil still a small share of energy mix



Environment

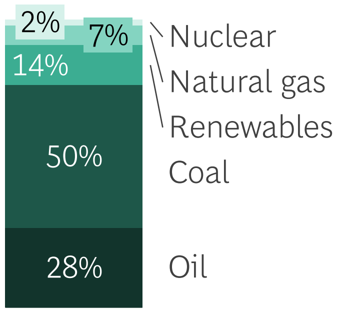
Energy transition to slow due to increase coal use to minimize import dependence; stalled COP $100B funding could affect all emerging markets

Large-scale renewables plan in motion; impetus could focus on upstream Greentech segments to **secure supplies** (e.g., batteries, solar PV cells, etc.)

Demand

Accelerating with economic growth, potentially at risk by inflation pressures

Energy mix[1]



Emissions pathway

Climate Action Tracker Rating: **Highly Insufficient**

33-35% 2030 reduction in carbon intensity vs 2005

Key takeaways

Energy sector ↕ Economy-wide

Short-term boost in coal production for domestic, non-industrial use as energy affordability is top concern

Slower transition given coal and fossil-fuel intensive rural economy and expected economic growth

Demand for **greater subsidies** could **limit** government's ability to invest in **upstream Greentech segments** & **alternative fuels** (e.g., green hydrogen, biofuels)

Social concern as air quality, other environmental issues worsen

1. Based on IEA WEO 2021 primary energy demand of Stated Policies scenario. Source: IEA Climate Action Tracker; BCG analysis and case experience.

War in Ukraine: Global Update and Energy Transition

AGENDA

Global economic impact of the war in Ukraine

Perspective on Energy Transition

- Global Energy Transition trends
- Selected region/country views
- **Implications for leaders**

Overall, eight key trends impact the Energy Transition outlook

ILLUSTRATIVE - NON-EXHAUSTIVE

- **Supply shocks** are not easy to recover from - energy **prices** remain difficult to manage, **volatile** for years
- Governments enact **near term protective energy policies** that affect **investment and pace of the transition long term**
- Companies and governments assess **expanding hydrocarbon capacity** as a hedge against **volatility**, with potential decades-long impact
- Companies face **capital allocation** decisions in an environment of **high interest rates and increased fiscal and regulatory uncertainty**
- **Sustained high prices spread 2nd and 3rd order effects** across industrial and transport sectors, exacerbating **inflationary pressures**
- **Energy access in the developing world** continues to be an important **issue**, building upon negative Covid impact
- **Supply chains remain constrained**, impacting availability & cost of clean energy materials
- **Security concerns** on origins & sourcing of **rare earths & metals** (e.g., cobalt, lithium, nickel) gain relevance as central to the transition

Source: BCG analysis and case experience.

Energy Transition priorities emerge for players across sectors

Implications for business leaders

Non-energy players

- Strengthen **climate strategy and transition investments**
  - Recalibrate energy mix/imports to reflect security and net zero goals / priorities
  - Assess economic attractiveness of renewables for energy-intensive investments (e.g., hydrogen vs gas-based heat generators)
  - Boost Green electrification, efficiency measures
- Advocate home markets' **adherence** to net zero targets as affordability & security are prioritized
- Engage with ecosystem players, including supply chain partners and authorities, to **co-invest and backstop large-scale renewables build-up and transition**

Energy players

- Recalibrate **capital allocation & investment strategy**, **deaveraging per region**
  - Oil & Gas: assess exploration/production opportunities to replace Russian supply
  - Power generators: maximize capacity of existing energy sources to improve efficiency
  - Proactively & responsibly allocate capital to transition business toward low-carbon output
- Invest in **renewables-focused** capabilities, knowledge development, and new markets entry (e.g., through partnership-building)
- Build **supply chain resilience / localization** for key energy transition materials

Source: BCG analysis and case experience.

Policymakers also face a complex set of Energy & Industrial policy choices with several levers to pull

Implications for policy leaders

Energy policy

- **Provide targeted financial relief** to low-income households; direct-to-pocket transfers best suited to limit further stimulating demand for fuel
- **Consider demand-side measures** to curtail emissions impact and maximize efficiency
- **Encourage continued investment** in clean energy infrastructure (e.g., tax incentives), remaining committed to net zero targets and transparent about progress
- Press on with plans for needed **energy policy reform including carbon pricing,** roll out gradually as short-term price pressures on businesses, households subside

Industrial policy

- **Design investment incentives** (e.g., fiscal benefits, special zones, etc.) to push the transition across the **industrial base**, foster **green production/tech,** and **decarbonize** (e.g., carbon pricing)
- Invest in a **clean energy workforce**, including **upskilling** current workers, cultivating **local** talent, and attracting **foreign-trained** workers with experience in energy transition
- Build **cross-border partnerships** between developed and less developed countries to facilitate transfer of energy transition know-how
- Support **relocation of production and trade agreements** to strengthen **supply chain resilience** in sourcing key components & materials

Source: BCG analysis and case experience.

Complex policy choices made today require balancing Energy Trilemma trade-offs

Measures	Potential execution complexities	Impact
Fuel price & tax cuts to protect consumers	• **Discretionary** tax cuts to lower prices at pump, irrespective of household income differences • **High-income consumer demand** incentivized • Environment impacted as **emissions** increase	
Recourse to coal to prevent geopolitical exposure	• **Emergency pivot to coal** as alternative to exposed cleaner supplies (e.g., Russian natural gas) • Coal **plant life extension** creates **further committed emissions** • May **reduce short-term investment** in renewables	
Renewables scale-up with **potentially insecure supply chains**	• Scale-up in renewable capacity requires **minerals and key components** sourced from **new trade partners** • Higher demand and supply chain bottlenecks drive **price and supply volatility** • Risks in mineral supplies **could hinder access**	

Impact of policy execution on Trilemma dimension: *Positive* *Neutral* *Negative*

Source: BCG analysis and case experience.

Teams across BCG are actively monitoring impact

Global Advantage Practice Area

Nikolaus Lang
Managing Director & Senior Partner
Practice Area Leader, Global Advantage
E: Lang.Nikolaus@bcg.com

Marc Gilbert
Managing Director & Senior Partner
Global Lead, Geopolitics & Trade Impact
E: Gilbert.Marc@bcg.com

Michael McAdoo
Partner & Director
Global Trade & Investment
E: McAdoo.Michael@bcg.com

Kasey Maggard
Global Practice Management Director
Global Advantage
E: Maggard.Kasey@bcg.com

Ken Carlstedt
Associate Director
Global Trade Risk & Compliance
E: Carlstedt.Ken@bcg.com

Leandro J. Urbano
Consultant
E: Urbano.Leandro@bcg.com

Energy Practice Area & Center for Energy Impact

Pattabi Seshadri
Managing Director & Senior Partner
Practice Area Leader, Energy
E: Seshadri.Pattabi@bcg.com

Maurice Berns
Managing Director & Senior Partner
E: Berns.Maurice@bcg.com

Anders Porsborg-Smith
Managing Director & Partner
E: Porsborg-Smith.anders@bcg.com

Jamie Webster
Partner & Associate Director, CEI
E: Webster.Jamie@bcg.com

Leo Weitzenhoff
Partner
E: Weitzenhoff.Leo@bcg.com

Miles Fuller
Principal
E: Fuller.Miles@bcg.com

Betsy Winnike
Lead Knowledge Analyst, CEI
E: Winnike.Betsy@bcg.com

Climate & Sustainability Practice Area

Hubertus Meinecke
Managing Director & Senior Partner
Practice Area Leader, Climate & Sustainabilty
E: Meinecke.Hubertus@bcg.com

Jan Philipp Bender
Managing Director & Partner
EMESA Leader, Climate & Sustainability
E: Bender.Jan.Philipp@bcg.com

Patrick Herhold
Managing Director & Partner
E: Herhold.Patrick@bcg.com

Jens Burchardt
Partner & Associate Director
E: Burchardt.Jens@bcg.com

Stefan Schönberger
Principal
E: Schoenberger.Stefan@bcg.com

Disclaimer