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.
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**

**Narrower impact**

- **Duration**
  - Days
  - Weeks
  - Months
  - Years

- **Geographic scope & materiality**
  - Russia & Ukraine
  - Central & Eastern Europe
  - EU
  - Global

- **Sectoral scope & materiality**
  - Energy, Metals, Agrifoods
  - E.g., Automotive, machinery
  - Whole economy

**Broader impact**

- 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

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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

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

An estimated 1.5 - 2M refugees have returned to Ukraine, mostly from CEE countries; however, uncertainty remains over permanence
Summary snapshot | War in Ukraine global economic impact

Global Growth Outlook

<table>
<thead>
<tr>
<th>Country</th>
<th>Actual 2021</th>
<th>2022 Forecast World Bank</th>
<th>2022 Forecast Leading FIs</th>
<th>ΔCW-PreWar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>4.7%</td>
<td>5.3%</td>
<td>2.4%</td>
<td>-10.0%</td>
</tr>
<tr>
<td>Euro Zone</td>
<td>5.3%</td>
<td>3.9%</td>
<td>2.4%</td>
<td>-15.3%</td>
</tr>
<tr>
<td>Global</td>
<td>3.9%</td>
<td>4.1%</td>
<td>2.5%</td>
<td>-2.1%</td>
</tr>
</tbody>
</table>

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

Supply Chain Metrics

Deep Sea Cargo Bosporus
Strait Transits (Avg. #/day)
Pre-War | Prev. Wk | Curr. Wk | ΔCW-PreW
Northbound | 8.9 | 5.6 | 5.4 | -39%
Southbound | 9.6 | 6.0 | 6.0 | -63%

Deep Sea Cargo Port Calls (Avg. #/day)
Pre-War | Prev. Wk | Curr. Wk | ΔCW-PreW
Northbound | 4.5 | 0.0 | 0.0 | -100%
Southbound | 21.6 | 21.4 | 20.7 | -4%

Baltic Dry Index (Daily Avg)
Pre-War | Prev. Wk | Curr. Wk | ΔCW-PreW
BDI | 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 (Δ since previous)

<table>
<thead>
<tr>
<th>Category</th>
<th>Indiv.</th>
<th>Companies</th>
<th>Other entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>(+47)</td>
<td>4,848</td>
<td>508</td>
<td>578</td>
</tr>
</tbody>
</table>

Corporate Actions in Russia Market

Based on sample of +880 companies

<table>
<thead>
<tr>
<th>Action</th>
<th>Indiv.</th>
<th>Companies</th>
<th>Other entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit</td>
<td>(+1)</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Suspend operations</td>
<td>(+1)</td>
<td>390</td>
<td></td>
</tr>
<tr>
<td>Halt Shipment/Supply</td>
<td>(+1)</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>Curtail Access to Capital</td>
<td>(-)</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Suspend New Investment/Partnership</td>
<td>(+1)</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>Remain in Russia with significant exposure</td>
<td>(+28)</td>
<td>192</td>
<td></td>
</tr>
</tbody>
</table>

Commodity Prices

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Jan '22</th>
<th>Jun '22</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Oil</td>
<td>79.0</td>
<td>120.6</td>
<td>+53%</td>
</tr>
<tr>
<td>Gas</td>
<td>80.4</td>
<td>79.6</td>
<td>-1%</td>
</tr>
<tr>
<td>Coal</td>
<td>157.5</td>
<td>369.0</td>
<td>+134%</td>
</tr>
<tr>
<td>Wheat</td>
<td>274.0</td>
<td>380.3</td>
<td>+39%</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>728.5</td>
<td>782.8</td>
<td>+7%</td>
</tr>
<tr>
<td>Nickel</td>
<td>20,430.0</td>
<td>29,395.0</td>
<td>+44%</td>
</tr>
<tr>
<td>Palladium</td>
<td>1,826.0</td>
<td>1,955.7</td>
<td>+7%</td>
</tr>
</tbody>
</table>

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

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 65,000+ cbm & PCTCs 6,000+
3. Clarksons Research
4. Commodity price (actual, $)
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 reclassification 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

The World Bank reviewed its global forecast downwards to 2.9% on June 7.

Recent median GDP growth projections remain around -10%.
Evolution of key commodity prices

Crude oil (Brent, $/bbl.)
- Max '22
- Jan 3rd '22
- Conflict

Natural gas – (TTF, €/MWH)
- Max '22
- Jan 3rd '22
- Conflict

Coal (Newcastle, $/Ton)
- Max '22
- Jan 3rd '22
- Conflict

Rapeseed (MATIF, €/Ton)
- Max '22
- Jan 3rd '22
- Conflict

Wheat (MATIF, €/bu.)
- Max '22
- Jan 3rd '22
- Conflict

Palladium (NYMEX, $/troy oz.)
- Max '22
- Jan 3rd '22
- Conflict

Nickel (LME, $/Ton)
- Max '22
- Jan 3rd '22
- Conflict

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

Current sanction actions by country and target

<table>
<thead>
<tr>
<th>Sanction actions(^4) in-place</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sanction targets(^5) / (\Delta) since last update</strong></td>
</tr>
<tr>
<td><strong>Individuals</strong></td>
</tr>
<tr>
<td>+47</td>
</tr>
<tr>
<td>4,848</td>
</tr>
</tbody>
</table>

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
- Germany’s lower house approves €100B special defense fund to modernize its army
- German Chancellor Scholz says Germany is ready to ramp up its military mission in Lithuania in response to Russia’s invasion
- President Biden races to expand coalition against Russia across Latin American, Asian & African countries with limited success to date
- Japan & NATO agree to step up military cooperation & joint exercises as Russia’s invasion caused security concerns in Asia
- President Zelensky announces that ~50 embassies in process of re-opening in Kyiv

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

### Large emerging markets
- China warns that USA’s Cyber Operations could lead to an escalation in the war
- African Union warns EU that Russia’s blockade of Ukraine’s ports risks “a catastrophic scenario” of food shortage and price rise
- 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
- India’s External Affairs Minister claims narrative on India’s oil imports from Russia is unfair

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Overview of corporate actions

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

<table>
<thead>
<tr>
<th></th>
<th>Consumer</th>
<th>Energy</th>
<th>Financial Institutions¹</th>
<th>Healthcare</th>
<th>Industrial Goods²</th>
<th>Tech, Media, Telecom</th>
<th>Professional Services</th>
<th>Others³</th>
</tr>
</thead>
<tbody>
<tr>
<td># Companies</td>
<td>265</td>
<td>50</td>
<td>57</td>
<td>48</td>
<td>238</td>
<td>151</td>
<td>51</td>
<td>24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complete or partial actions⁴</th>
<th>Exit</th>
<th>Halt Shipments/ Supply</th>
<th>Suspend Operations</th>
<th>Curtail access to capital</th>
<th>Suspend new investments/partnerships</th>
<th>Remain in Russia with significant exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7%</td>
<td>16%</td>
<td>26%</td>
<td>37%</td>
<td>8%</td>
<td>49%</td>
<td>33%</td>
</tr>
<tr>
<td>8%</td>
<td>2%</td>
<td>20%</td>
<td>42%</td>
<td>8%</td>
<td>49%</td>
<td>33%</td>
</tr>
<tr>
<td>12%</td>
<td>30%</td>
<td>26%</td>
<td>37%</td>
<td>8%</td>
<td>49%</td>
<td>33%</td>
</tr>
<tr>
<td>24%</td>
<td>26%</td>
<td>20%</td>
<td>37%</td>
<td>8%</td>
<td>49%</td>
<td>33%</td>
</tr>
</tbody>
</table>

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.
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 |

### Implications

- **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
Global economic impact of the war in Ukraine

**Perspective on Energy Transition**

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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

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

Global greenhouse gas emissions (% of 1990)

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
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<tbody>
<tr>
<td>Current policies</td>
<td>150</td>
<td>100</td>
<td>50</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Announced pledges (2.1-2.4°C)</td>
<td>100</td>
<td>75</td>
<td>45</td>
<td>22.5</td>
<td>15</td>
</tr>
<tr>
<td>&lt;2°C Sustainable Development Scenario</td>
<td>75</td>
<td>50</td>
<td>25</td>
<td>12.5</td>
<td>10</td>
</tr>
<tr>
<td>1.5°C Net Zero Scenario</td>
<td>50</td>
<td>25</td>
<td>12.5</td>
<td>6.25</td>
<td>3.75</td>
</tr>
</tbody>
</table>

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

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Transition decisions shaped by the Energy Trilemma

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

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas, TTF</td>
<td>+81%</td>
</tr>
<tr>
<td>Oil, Brent</td>
<td>+66%</td>
</tr>
<tr>
<td>Coal, API2</td>
<td>+125%</td>
</tr>
<tr>
<td>Electricity</td>
<td>+89%</td>
</tr>
</tbody>
</table>

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

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)

*Examples as of June 1, 2022*
Security | Priority in import-dependent regions, while resource-rich countries increase exports

Three observed actions in import-dependent regions

1. 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)

2. 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

3. 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

Mmbo/d

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

**NEAR & MEDIUM TERM**

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

**LONG TERM**

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

Source: BCG analysis and case experience.
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

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

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

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

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

Key takeaways
- 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

Demand
- Energy demand flat since pre-Eurozone crisis peak

Energy mix

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>12%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>13%</td>
</tr>
<tr>
<td>Renewables</td>
<td>18%</td>
</tr>
<tr>
<td>Coal</td>
<td>26%</td>
</tr>
<tr>
<td>Oil</td>
<td>31%</td>
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</tbody>
</table>

Emissions pathway
- Climate Action Tracker Rating: Insufficient
- 2030 emissions reduction target vs 1990: 55%

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

Impact on Energy Transition

Access/affordability
- High prices reduce household spending power; mounting pressure for fuel subsidies & gas tax relief

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

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

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Energy Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>Nuclear</td>
</tr>
<tr>
<td>34%</td>
<td>Natural gas</td>
</tr>
<tr>
<td>11%</td>
<td>Renewables</td>
</tr>
<tr>
<td>11%</td>
<td>Coal</td>
</tr>
<tr>
<td>34%</td>
<td>Oil</td>
</tr>
</tbody>
</table>

Emissions pathway

Climate Action Tracker Rating: Insufficient

- 2030 emissions reduction target vs 2005: 50-52%

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

Key takeaways

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

Impact on Energy Transition

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).

Key takeaways

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.

Demand

Slowing demand due to demographics and higher efficiency.

Energy mix

- Natural gas: 59%
- Renewables: 1%
- Coal: 1%
- Oil: 38%

Emissions pathway
Climate Action Tracker Rating: Critically Insufficient

- 2030 emissions reduction target vs "business as usual"

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**

**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.

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

### Energy mix

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>% of Total Energy Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>8%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>61%</td>
</tr>
<tr>
<td>Renewables</td>
<td>11%</td>
</tr>
<tr>
<td>Coal</td>
<td>19%</td>
</tr>
<tr>
<td>Oil</td>
<td>3%</td>
</tr>
</tbody>
</table>

### Emissions pathway

- Climate Action Tracker Rating: Highly Insufficient
- 2030 reduction in carbon intensity vs 2005: >65%

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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

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

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.)

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

Energy sector

Key takeaways

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

Demand

Accelerating with economic growth, potentially at risk by inflation pressures

Energy mix

<table>
<thead>
<tr>
<th>Energy mix</th>
<th>Nuclear</th>
<th>Natural gas</th>
<th>Renewables</th>
<th>Coal</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2%</td>
<td>7%</td>
<td>Neutral</td>
<td>14%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Emissions pathway

Climate Action Tracker Rating: Highly Insufficient

33-35% reduction in carbon intensity vs 2005

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**

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

Source: BCG analysis and case experience.
Energy Transition priorities emerge for players across sectors

**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

**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.

**ILLUSTRATIVE – SELECTED EXAMPLES**

<table>
<thead>
<tr>
<th>Measures</th>
<th>Potential execution complexities</th>
<th>Impact</th>
</tr>
</thead>
</table>
| **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 | ![Impact](image) |
| **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 | ![Impact](image) |
| **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](image) |

Source: BCG analysis and case experience.
Teams across BCG are actively monitoring impact

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