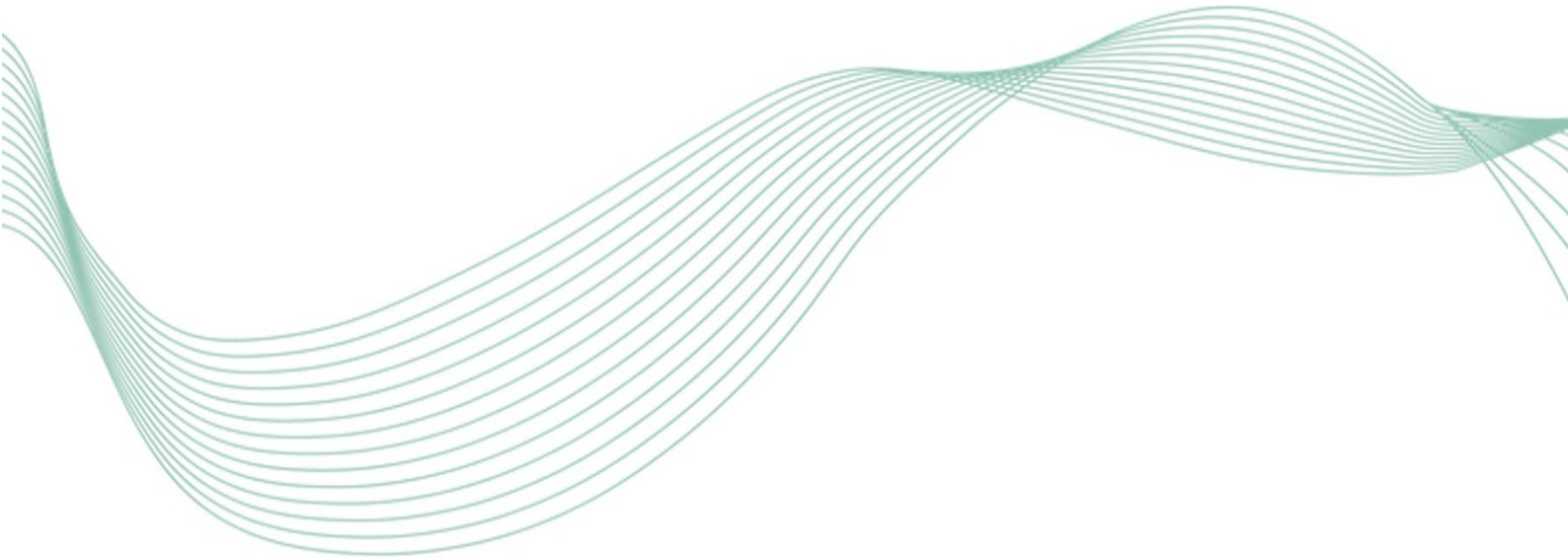
GIP Green Investment Principles

Transition Risks and Opportunities with a Focus on the Belt and Road



Swiss Re ICBC pwc

Preface

As the world recovers from the COVID-19 pandemic, global efforts from public and private sectors will be increasingly focused on dealing with green swan[1] events. With growing concerns about climate change risks, green/transition finance has an important role in facilitating the race to net zero. Financial system resilience is vital to support the low-carbon transition in the real economy. Collaboration across value chains will be increasingly important to address the risks and opportunities of this transition.

Ever since the Paris Agreement was signed on 12 December 2015, 196 of the world's economies adopted it and began to commit to the low-carbon transition[2]. So far, 192 countries have submitted nationally determined contributions (NDCs) to the United Nations[3]. Transition to a low-carbon world is necessary and will require massive reductions in greenhouse gas (GHG) emissions as well as the removal and permanent storage of remaining emissions. In addition, the world needs to produce net-negative emissions for the second half of the 21st century. Achieving these goals will require a thoughtfully planned decarbonization roadmap to ensure an orderly transition. As the financial sector recognizes its role in promoting decarbonization through its investing, lending and risk transfer activities, there are climate-related risks that the sector needs to integrate into its business strategy and risk management practices. Businesses, both in the financial sector and the real economy, need to be better equipped to plan for a low-carbon world, manage risks and create business opportunities to promote an early and orderly transition.

1 "Green swan" risks mean potentially extremely financially disruptive events that could be behind the next systemic financial crisis, including new climate-related challenges to central banks, regulators, and supervisors. https://www.bis.org/publ/othp31.pdf

2 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement; https://eciu.net/netzerotracker

3 https://www.climateaction.org/news/seven-countries-submit-new-2020-national-climate-plans-ndcs.

The Green Investment Principles for the Belt and Road (GIP)[4] was established in November 2018 to guide financial institutions to cope with the climate-related physical and transition risks and opportunities. At its second plenary meeting, the GIP announced "Vision 2023", its three-year plan to have its members play a more significant role in advancing green finance to decarbonize the countries along the Belt and Road[5]. The GIP now includes three working groups, respectively focused on (1) climate and environmental risk assessment, (2) ESG reporting and disclosure and (3) green finance innovation. Workgroup 1 (WG1) is focused on environmental and climate risk assessment, and in particular on advancing collaboration among private sector financial institutions to address the challenges of assessing and managing climate-related transition risks and opportunities.

To map out transition risks for financial institutions, a task force, collectively initiated by PwC, Swiss Re and ICBC, decided to publish a whitepaper on behalf of GIP WG1 to:

- Advocate for attention to climate-related risk and opportunity assessment, and
- Analyze potential transition risks and opportunities that will be faced by Belt and Road Initiative (BRI) countries.

Based on the paper's discussion, WG1 will work to maintain the momentum by:

- Assessing GIP members' exposure to transition risks in BRI countries and their understanding of and strategies to address related opportunities
- Promoting and sharing existing management tools and best practices to address transition risks and opportunities, and
- Advocating for financial institutions to identify and manage transition risks and opportunities.

4 Green investment principles official website. https://gipbr.net/

5 Green Investment Principles. https://gipbr.net/Content.aspx?id=308&type=211&m=8

Abbreviations

AF	Adaptation Fund
AIFC	Astana International Financial Centre
AOSIS	Alliance of Small Island States
BECCUS	Bioenergy carbon capture, utilization and storage
BRI	Belt and Road Initiative
CBIRC	China Banking and Insurance Regulatory Commission
CCUS	Carbon capture, utilization, and storage
CDM	Clean Development Mechanism
CSRC	China Securities Regulatory Commission
EBIT	Energy, building, industry and transportation
ESG	Environmental, social and governance
ETS	Emissions trading system
EU	European Union
FCEV	Fuel Cell Electric Vehicles
FCPF	Forest Carbon Partnership Facility
FYP	Five-year Plan
NDC	Nationally determined contribution
GEF	Global Environment Facility
GHG	Greenhouse gas
GIP	Green Investment Principles for the Belt and Road

IFRS	International Financial Reporting Standards
ISSB	International Sustainability Standards Board
MaaS	Metal as a Service
MEE	Ministry of Ecology and Environment
NAFMII	National Association of Financial Market Institutional Investor
NDRC	National Development and Reform Commission
NREAP	National Renewable Energy Action Plans
ICBC	Industrial and Commercial Bank of China
IRENA	International Renewable Energy Agency
INDC	Intended nationally determined contribution
IPCC	Intergovernmental Panel on Climate Change
R&D	Research and development
PBoC	People's Bank of China
PFSA	Polish Financial Supervision Authority
PPP	Public private partnership
PV	Photovoltaic
PwC	PricewaterhouseCoopers
SBP	State Bank of Pakistan
SFDR	Sustainable Finance Disclosure Regulation
TCFD	Task Force on Climate-related Financial Disclosures
UNEP	United Nations Environment Program
UNFCCC	United Nations Climate Change Conference
WEF	World Economic Forum

Table of Contents

1 Introduction

1.1 Physical risks and climate resilience

- The global urgency to address climate change

Climate risks originate from various chronic or acute hazards that can be induced by **continuous and excessive emission of GHGs**. Each of the last four decades has been successively warmer than any decade that preceded since 1850. Observed increases in GHG concentrations that cause global warming are unequivocally caused by human activities. Many meteorological changes will be increasingly exacerbated due to global warming, such as hot extremes, marine heatwaves, heavy precipitation, agricultural and ecological droughts, intense tropical cyclones, and reduction in Arctic sea ice, snow cover and permafrost. Furthermore, those changes resulting from past and future GHG emissions are mostly irreversible for centuries to millennia[6] .

According to the World Economic Forum's *Global Risk Report 2021*[7] , **four of the top five global risks by likelihood in the next decade are related to climate and environment. Prior to the outbreak of the COVID-19 pandemic, the top five global risks by likelihood were all environmental risks according to the 2020 survey results (Exhibit 1)**, demonstrating mounting concern of experts from all walks of life for the "Inconvenient Truth"[8], that human beings are pushing the planet towards a dangerous tipping point.

It is widely recognized that climate risks have not only caused permanent damage to nature and the environment that we rely on, but **have led to increasingly significant socio-economic loss**. According to the United Nations, the economic losses caused by climate change have almost doubled, from $1.63 trillion during the period of 1980 to1999 to $2.97 trillion from 2000 to 2019[9].

6 IPCC, Climate Change 2021 The Physical Science Basis (Summary for Policymakers) https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

7 World Economic Forum, The Global Risk Report 16th Edition https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf

8 Gore, Al. 2006. "An Inconvenient Truth. The Planetary Emergency of Global Warming and What We Can Do About It" https://www.osti.gov/biblio/20962137

9 Human Cost of Disasters 2000-2019. https://www.undrr.org/publication/human-cost-disasters-2000-2019

- Physical risks induce significant economic losses but create risk transfer and investment opportunities in building climate resilience.

According to the TCFD, there are two overarching climate risk categories: risks related to the physical impact of climate change, and risks related to the transition to a lower-carbon (and finally net-zero) economy.

Physical risks resulting from climate change can be either acute or chronic. Acute physical risks are related to increased severity of extreme weather events, such as cyclones, hurricanes or floods. Chronic physical risks, on the other hand, are related to long-term shifts in climate patterns (such as sustained higher temperatures) that may cause sea level rise or chronic heatwaves[10].

Although physical risks objectively pose substantive threats to the daily operation of financial institutions, by investing in climate-resilient public goods and providing insurance-based risk transfer solutions, forward-thinking financial institutions can unlock the potential of blended finance and transform upcoming risks into emerging business opportunities.

Exhibit 1 Top global risks by likelihood

	1st	2nd	3rd	4th	5th
2021	Extreme weather	Climate action failure	Human environmental damage	Infectious diseases	Biodiversity loss
2020	Extreme weather	Climate action failure	Natural disasters	Biodiversity loss	Human-made environmental disasters
2019	Extreme weather	Climate action failure	Natural disasters	Data fraud or theft	Cyberattacks
2018	Extreme weather	Natural disasters	Cyberattacks	Data fraud or theft	Climate action failure
2017	Extreme weather	Involuntary migration	Natural disasters	Terrorist attacks	Data fraud or theft

Environmental Geopolitical Societal Technological

Source: World Economic Forum, Global Risk Report 2021

10 TCFD, June 2017, Recommendations of the Task Force on Climate-related Financial Disclosures https://www.fsb.org/2017/06/recommendations-of-the-task-force-on-climate-related-financial-disclosures-2/

1.2 Transition risks and climate mitigation

- Transition risks are those related to the transition to a lower-carbon (and finally net-zero) economy.

According to the IPCC's estimates, global warming will exceed 1.5 °C or 2 °C during the 21st century unless deep reductions in GHG emissions occur over the coming decades[11]. In 2009, policymakers around the world gathered together at the United Nations Climate Change Conference (UNFCCC) in Copenhagen to prevent further environmental, social and economic meltdown. For the first time in human history, climate change was widely recognized as "one of the greatest challenges of our time". Governments stood in solidarity and raised the collective "strong political will to urgently combat climate change in accordance with the principle of common but differentiated responsibilities and respective capabilities"[12].

Six years later, world leaders reached the ambitious and universal Paris Agreement, which established a mechanism to integrate global efforts towards a net-zero world by requiring "each party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve". For the private sector, it sends a powerful signal to markets that it is the time now to transform into a low-emission economy.

However, the net-zero transition is not without challenges. The Paris Agreement also noted that parties should consider the concerns of countries whose economies are most affected by response measures during the transition process[13]. Transitioning to a low-carbon economy may entail a broad range of policy, legal, technology and market risks to address mitigation and adaptation requirements related to climate change[14].

11 IPCC, Climate Change 2021 The Physical Science Basis (Summary for Policymakers) https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

12 UNFCCC, 2009, Copenhagen Accord, https://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf

13 UNFCCC, Paris Agreement, 2015, https://unfccc.int/sites/default/files/english_paris_agreement.pdf

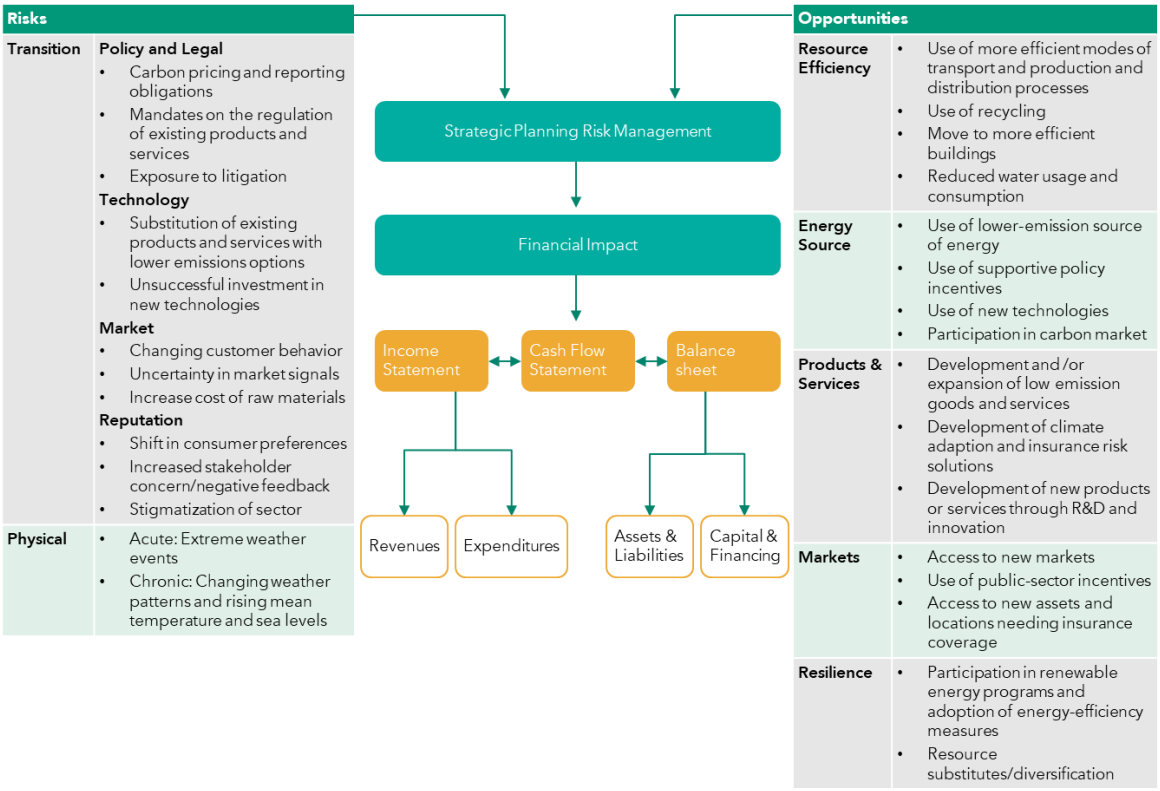
14 TCFD, Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures, 2017. https://www.fsb.org/2017/06/recommendations-of-the-task-force-on-climate-related-financial-disclosures-2/

- Climate change mitigation creates investment opportunities and provides risk transfer solutions in renewable energy and other green finance projects.

Climate change mitigation refers to efforts to reduce or prevent carbon emissions and, moreover, to achieve a net zero emission by 2050. It brings opportunities for financial institutions to provide investment, banking and insurance products and services relevant to renewable energy and other green finance[15] projects.

Overall, climate-related risks and opportunities, as shown by the TCFD's table below, are two sides of the same coin. To reap long-term benefits and stand out in the marketplace, private companies need to consider suitable business strategies and the most efficient allocation of capital in light of the potential economic impacts of climate change (Exhibit 2).

Exhibit 2 Climate-related risks and opportunities



Source: Task Force on Climate-related Financial Disclosures Overview, March 2021

15 Intro to green finance. https://www.thegef.org/sites/default/files/events/Intro%20to%20Green%20Finance.pdf

1.3 Paving the way towards a net-zero world

Following the Paris Agreement, an increasing number of countries around the world have been committing to net zero. In this part, we will highlight BRI countries[16] that will play pivotal roles in limiting global warming to 1.5°C and discuss how financial institutions can both support and benefit from the transition.

- Rising transition risks and BRI countries at the crossroads

Many countries participating in the BRI are developing countries, characterized by relatively large populations and rapid population growth. Both the Human Development Index[17] and the Global Climate Risk Index[18] reflect how such features expose countries to significant transition risks. In addition, many economies lack a diversified economic base, potentially undermining their economic resilience during the net-zero transition. For example, some Southeast Asian Countries rely on the energy import for over 40% of the total energy supply, making them extremely vulnerable to the energy transition[19].

- Many BRI countries are at the frontline of net-zero transition

Despite the challenges, many BRI countries have taken concrete actions to facilitate the low-carbon transition.

32 BRI countries (22% of the BRI countries; 16% of the world's countries) have committed to a net-zero carbon goal by the end of 2021. Moreover, although most countries are not yet a part of the race to net zero, 92% BRI of them have submitted NDCs[20].

16 As of March 2022, about 140 countries have signed BRI MoUs with China. Source: Nedopil, Christoph (2022): "Countries of the Belt and Road Initaitive"; Shanghai, Green Finance & Development Center, FISF Fudan University. www.greenfdc.org (accessed April 2022)

17 https://hdr.undp.org/en/content/human-development-index-hdi

18 https://www.germanwatch.org/en/19777

19 https://www.pwc.com/sg/en/publications/assets/page/energy-transition-readiness-in-southeast-asia.pdf

20 NDC: NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, paragraph 2) requires each Party to prepare, communicate and maintain successive nationally determined conributions (NDCs) that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions https://newsroom.unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs/nationally-determined-contributions-ndcs

BRI countries were represented in many initiatives that drove momentum towards net-zero at the COP26 Glasgow Summit. For example, the Alliance of Small Island States (AOSIS), which includes BRI countries such as the Maldives, Papua New Guinea, Fiji and Guinea Bissau, is well-known for calling for the ending of fossil fuel subsidies and the scaling of climate mitigation[21].BRI countries such as Vietnam, the Philippines, Bahrain and Saudi Arabia joined the pledge to reduce global methane emissions by at least 30 percent by 2030[22]. China, Bangladesh, Indonesia, Kazakhstan and Pakistan, among others, committed to work collectively to halt and reverse forest loss and land degradation by 2030[23].

- Transition risks will trigger a profound transformation in the business world.

Inaction or belatedly addressing transition risks could bring substantive consequences to unprepared companies, undermining the resilience of business strategies and operational models.

One crucial component of transition risks is stranded assets. 'Stranded assets' are assets that have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities[24]. For example, a German utility brought its last new coal power plant online in 2020, shortly after Germany announced its 2038 exit from coal. Given the further tightening of German emissions-reduction targets and the new ambition to exit coal by 2030, the plant may have to shut down only 10 years into its 45-year lifespan[25].

Moreover, risks might be increased for businesses that do not integrate ESG factors (including climate change and the low-carbon transition) into their corporate strategy, product and service business models, operations, investment portfolio or other aspects. Consequences could arise from disruptive technology changes, demand substitutions and other transition-related developments.

21 Compiled from the official website of the Alliance of Small Island States (https://www.aosis.org/about/member-states/), and BRI countries statistics (https://greenfdc.org/countries-of-the-belt-and-road-initiative-bri/?cookie-state-change=1638941105288) by Green Finance & Development Center, Fudan University

22 European Commission and USA, 2021, Global Methane Pledge, https://www.ccacoalition.org/en/resources/global-methane-pledge

23 Glasgow Leaders' Declaration on Forests and Land Use, 2021, https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/

24 http:/www.smithschool.ox.ac.uk/research/stranded-assets/

25 https://www3.weforum.org/docs/WEF_Winning_the_Race_to_Net_Zero_2022.pdf

A wealth management service provider estimated the severity of transition risks that each industry faces by determining the industry's baseline position (cost curve, supply chain, etc.), resilience (including prices/margins and capital requirements), and approach to climate transitioning (Table 1)[26].

Among 24 sectors considered, the most impacted industries include capital goods, energy, materials, transportation, and real estate. One example of technology-driven disruption appears in the energy sector, where the mass production of solar photovoltaic (PV) components and wind turbines has led to rapidly declining prices and renewable energy's growing competitive advantage over fossil fuels.

Table 1 The industry groups most exposed to transition risks as identified by the Colonial First State

Sector	Capital intensity of product/asset	Embedded emissions of inputs to production process	Emissions intensity of production process	Substitutability of inputs/final products	Emissions intensity of product	Consumer preference driving change in demand
Consumer discretionary – Automobiles and components	√	√	√	√	√	√
Industrials – Capital goods	√	√	√	√	√	√
Energy	√		√	√	√	√
Materials	√		√	√	√	√
Utilities	√	√	√	√		√
Industrials – Transportation	√	√			√	√
Real estate	√	√		√	√	√
Consumer discretionary – Consumer durables and apparel		√		√	√	√

Source: Colonial First State Global Asset Management

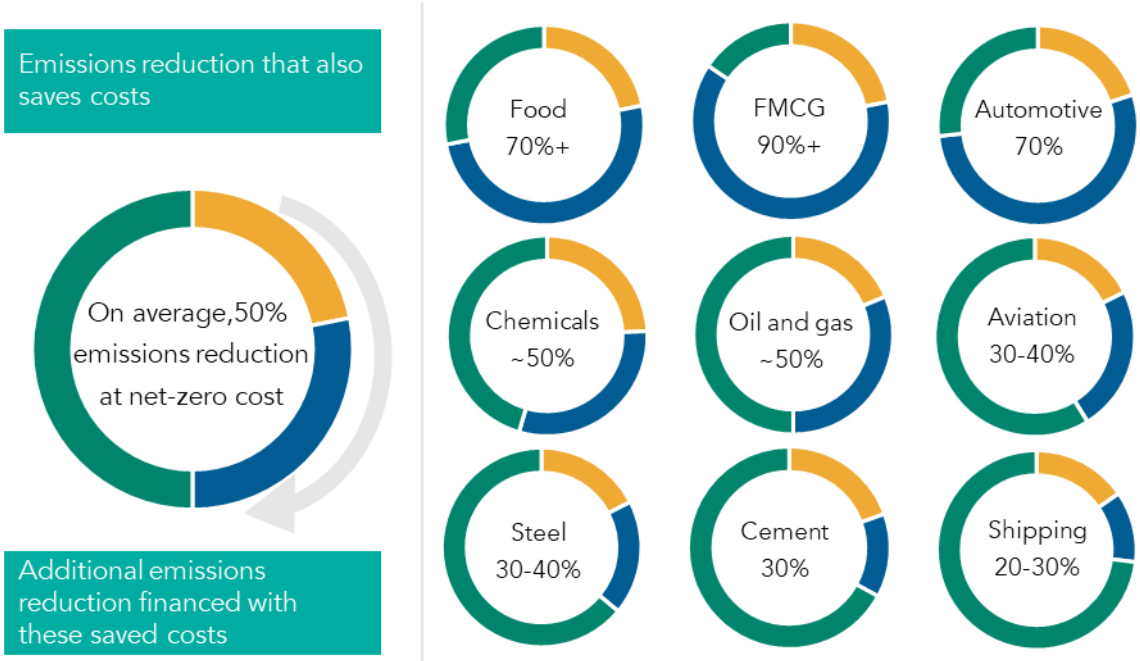
26 The risks and opportunities of climate change. Part 3 of 5: Business transition risks and opportunities. https://www.firstsentierinvestors.com.au/content/dam/cfsgam/documents/responsible-investment/reports/Climate-Change-Whitepaper-Transition-Risks.pdf

- Timely and orderly transition to net-zero brings competitive advantage

Forward-thinking companies can build competitive advantage by preparing for the transition to the low-carbon economy and leading the transformation of their respective industries.

First, taking timely action is critical to prevent significant losses from transition risks. For example, the value losses of concrete and cement producers could be in the range of 10–25% depending on the timing of policy measures such as emission reduction targets[27]. Furthermore, by improving energy efficiency and switching to lower-cost renewable power, companies can simultaneously reduce costs and emissions. According to World Economic Forum (WEF) analysis, nearly all companies can reduce their GHG emissions by at least 1/3 without incurring additional costs. Some companies could fully decarbonize at zero net cost (see Exhibit 3)[28].

Exhibit 3 Companies can reduce significant Scope 1 and 2 emissions at zero net cost



Source: World Economic Forum, The Race to Net Zero: The CEO Guide to Climate Advantage.

27 Swiss Re, 2021, The Economics of Climate Change: No Action Not An Option. swiss-re-institute-expertise-publication-economics-of-climate-change.pdf (swissre.com)

28 the Race to Net Zero: The CEO Guide to Climate Advantage https://www3.weforum.org/docs/WEF_Winning_the_Race_to_Net_Zero_2022.pdf

Second, the growing demand for climate-related financial disclosure and reporting of business' environmental impacts have sent an explicit signal to business leaders that ESG performance weighs heavily on a company's market capitalization and development prospects. At the request of G20 governments, the International Financial Reporting Standards (IFRS) announced the establishment of the International Sustainability Standards Board (ISSB), which is responsible for formulating a high-quality, understandable, enforceable and globally accepted sustainability disclosure standard. WEF analysis found a correlation, consistent across 10 sectors, showing that sustainability leaders secure lower-cost capital at an average of 100 basis points less than sector laggards. Likewise, climate leaders achieve higher total shareholder returns than laggards in the majority of sectors[29].

Third, to achieve net-zero carbon emissions, business leaders and policymakers need to cooperate to transform energy usage, financial systems and the real economy. Fossil fuel-dependent industries, such as electricity, manufacturing, transportation and building, will be most affected by the transition to a low-carbon economy. From the perspective of "stakeholder capitalism", companies that aim to retain or gain leading positions in those sectors should work in alignment with governments, investors, employees, NGOs, academia and other stakeholders to adjust their business strategy to pursue not only short-term economic profits, but also long-term value creation[30]. In particular, the financial sector can leverage its unique role to respond to real economy concerns related to low-carbon transformation, guide companies to construct sustainable risk management frameworks and provide fit-for-purpose financial services and products in pursuit of relevant ESG opportunities.

29 Winning the Race to Net Zero: The CEO Guide to Climate Advantage https://www3.weforum.org/docs/WEF_Winning_the_Race_to_Net_Zero_2022.pdf

30 Klaus Schwab and Peter Vanham, 2021, What Is Stakeholder Capitalism? https://www.weforum.org/agenda/2021/01/klaus-schwab-on-what-is-stakeholder-capitalism-history-relevance/

2 Understanding transition risks and opportunities for regions and countries

2.1 Mapping of transition risks

As policy and regulatory changes will impact the operating and business environment facing various industries, this Chapter provides case studies of four representative economies, exploring potential risk mitigation approaches.

Based on the World Bank Group's region classification, we selected four countries, each of which are from a different sub-region. The four countries were selected using a filtering method (section 5.1) with the following conditions:

1. The selected economies have made solid commitments to climate mitigation transition, demonstrating the existence of transition risks.
2. The selected economies face severe transition risks and have potential decarbonization opportunities, rendering their policy actions on decarbonization valuable enough to be investigated.
3. The selected economies are significant in their respective subregion, making their cases useful as references for countries at earlier stages of their transition journeys.

Based on these conditions, we selected four countries: China, Pakistan, Kazakhstan, and Poland. With a focus on the comprehensive and orderly net-zero transition, we will discuss:

- How transition risks affect these countries,
- Opportunities/risks faced by the private sector, and
- How the affected industries can adapt while the country transitions to a low-carbon economy

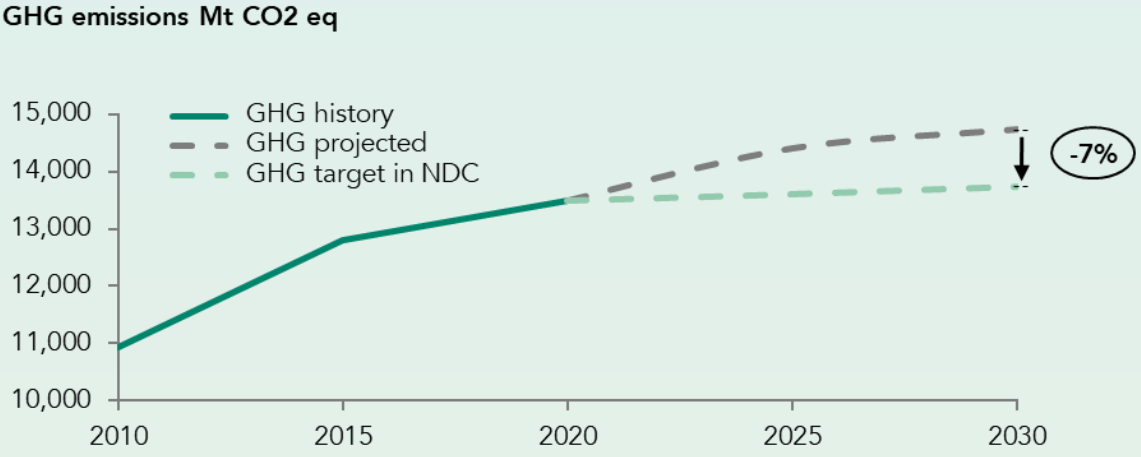
2.2 Case studies regarding transition plans

China

- The world's factory with the considerable GHG emissions has achieved a significant effect in the low-carbon transition

  According to China's 2021 NDC, the country's 2020 carbon intensity was only half that of 2005[31]. China, as a leading economic powerhouse, accounts for around a quarter of global GHG emissions. Since the 21st century, China's GHG emissions have grown by 10% annually on average (Exhibit 4)[32].In 2020, fossil fuels accounted for 84% of China's overall energy consumption and coal plays a dominant role (57%) in the country's energy mix[33]. With China's continuous GDP growth over the past 20 years (Exhibit 5), energy consumption in the country has skyrocketed. However, there are early signs of decoupling energy consumption from GDP growth.

Exhibit 4 Projected GHG emissions in China



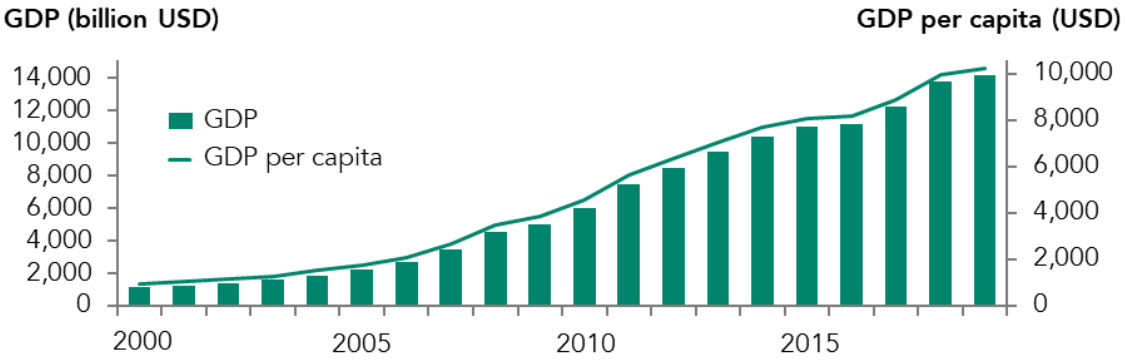
Source: UNFCCC

31 Responding to Climate Change: China's Policies and Actions, 2021 http://www.scio.gov.cn/zfbps/32832/Document/1715491/1715491.htm

32 Climate Action Tracker https://climateactiontracker.org/countries/china/

33 Responding to Climate Change: China's Policies and Actions, 2021 http://www.scio.gov.cn/zfbps/32832/Document/1715491/1715491.htm

Exhibit 5 China GDP from 2000 to 2020



Source: The World Bank

- Carbon neutrality, low-carbon transition and climate leadership

  In 2020, China announced its "double carbon" goals of achieving peak CO_2 emissions by 2030 and carbon neutrality by 2060[34]. During the Leaders Summit on Climate in April 2021, the president announced that China would strictly control coal-fired power generation projects, limit the increase in coal consumption over the 14th Five-year Plan (FYP) period (2021-2025) and phase down coal in the 15th FYP period (2026-2030)[35]. According to its 2021 NDC, China also aims to lower its carbon intensity by over 65% by 2030 from its 2005 level, increase the share of non-fossil fuels in primary energy consumption to around 25% by 2030, and increase the forest stock volume by 6 billion cubic meters by 2030 from the 2005 level[36]. To map the pathway to peak carbon and carbon neutrality, the government formulated the "1+N" policy approach. ("1" refers to the overarching working guidance[37], and "N" refers to various sector implementation plans, including energy, industry, urban and rural construction, transportation, agriculture and rural areas; and supporting plans in the areas of science and technology, fiscal funding, finance, pricing, carbon sinks, energy transition and coordination of pollution reduction, etc[38].)

  On top of the national commitments, several local governments have developed more ambitious decarbonization targets. Shanghai and Hainan, for example, plan to peak carbon emissions before 2025, while Beijing has already achieved peak emissions. Moreover, several energy-

34 http://chinaplus.cri.cn/recommended/1661/549277

35 http://www.xinhuanet.com/english/2021-04/22/c_139899289.htm

36 China's Achievement, New Goals and New Measures for Nationally Determined Contributions, 2021 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China%20First/China%E2%80%99s%20Achievements,%20New%20Goals%20and%20New%20Measures%20for%20Nationally%20Determined%20Contributions.pdf

37 State Council, 2021, Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy http://lawinfochina.com/display.aspx?id=36674&lib=law&SearchKeyword=&SearchCKeyword=

38 State Council, 2021, Circular of the State Council on an Action Plan for Peaking Carbon Emissions before 2030 https://chinaenergyportal.org/en/circular-of-the-state-council-on-an-action-plan-for-peaking-carbon-emissions-before-2030/

intensive corporations, such as Sinopec, PetroChina and Baowu Steel, aim to achieve carbon neutrality by 2050[39].

As the largest manufacturer of critical clean technologies such as solar panels and EV batteries, China has consolidated its worldwide leading position in low-carbon development. By 2020, China's installed PV power capacity had increased by a factor of more than 3000 compared with 2005, while installed wind power capacity grew by a factor of more than 200[40]. More than 70% of global battery manufacturing capacity in 2020 was dominated by China[41]. In addition, China also produces several key raw materials for clean technologies, including lithium (57% of global processing capacity), rare earth metals (60% of global processing capacity) and cobalt (65% of global processing capacity)[42].

China is also actively seeking suitable financial and market mechanisms to support decarbonization. Since 2011, seven provinces and municipalities have launched pilot projects for emissions trading systems (ETS)[43]. By the end of September 2021, their combined trading volume had reached 495 million tons of carbon dioxide equivalent, representing a total market value of around RMB12 billion[44]. In November 2021, the People's Bank of China (PBoC) rolled out the Supporting Tool for Carbon Reduction, sending an unequivocal policy signal to the market and upholding the concept of green development[45]. By the end of 2020, the balance of green loans in China reached RMB11.95 trillion, of which 27% was for clean energy loans. Moreover, China has issued a total of about RMB1.2 trillion worth of green bonds, with roughly RMB800 billion outstanding, making it the world's second-largest green bond market[46].

Furthermore, China is proactive in climate-friendly international cooperation and generating positive externalities in the race to zero. Besides ending funding for overseas coal projects in September 2021[47], China has accepted the Kigali Amendment to the Montreal Protocol and tightened regulation over non-CO_2 emissions[48]. During the Glasgow Climate Summit 2021, China and US issued a joint statement addressing the climate crisis, outlining a bilateral cooperation framework on several significant topics, such as renewable energy, green finance, methane reduction, etc[49]. In December 2021, China and the African Union issued a joint

39 http://www.100top1.com/index.php?m=content&c=index&a=show&catid=74&id=86568; https://baijiahao.baidu.com/s?id=1689453190429878747&wfr=spider&for=pc

40 Responding to Climate Change: China's Policies and Actions, 2021 http://www.scio.gov.cn/zfbps/32832/Document/1715491/1715491.htm

41 https://www.iea.org/reports/global-ev-outlook-2021/trends-and-developments-in-electric-vehicle-markets

42 IEA, 2021. An Energy Sector Roadmap to Carbon Neutrality in China https://iea.blob.core.windows.net/assets/6689062e-43fc-40c8-9659-01cf96150318/AnenergysectorroadmaptocarbonneutralityinChina.pdf

43 Seven provinces and municipalities include Beijing, Tianjin, Shanghai, Chongqing, Guangdong, Hubei, and Shenzhen. https://language.chinadaily.com.cn/a/202110/27/WS6179136aa310cdd39bc71a88_2.html

44 Responding to Climate Change: China's Policies and Actions, 2021 http://www.scio.gov.cn/zfbps/32832/Document/1715491/1715491.htm

45 Xinhua, 2021, China's Central Bank Rolls Out New Lending Tool for Carbon Reduction http://www.chinadaily.com.cn/a/202111/09/WS6189df35a310cdd39bc7439a.html

46 Responding to Climate Change: China's Policies and Actions, 2021 http://www.scio.gov.cn/zfbps/32832/Document/1715491/1715491.htm

47 State Council of the PRC, Full Text of Xi's Statement at the General Debate of the 76th Session of the United Nations General Assembly, 22 September 2021.

48 Remarks by H.E. Xi Jinping, President of the People's Republic of China at the Leaders Summit on Climate, 2021. https://language.chinadaily.com.cn/a/202104/23/WS6082197fa31024ad0bab9c28.html

49 U.S. Mission China, 2021, U.S.-China Joint Statement Addressing the Climate Crisis. https://china.usembassy-china.org.cn/u-s-china-joint-statement-addressing-the-climate-crisis/

declaration to cooperate on combatting climate change and "encourage financial institutions of both sides to implement the Green Investment Principles for the Belt and Road Initiative"[50].

Supported by a relatively clear political and policy direction, world-leading low-carbon technology manufacturing capacity, and international cooperation related to decarbonization, China has the potential to reinforce its leadership not only as an economic superpower but a champion for the planet.

50 Declaration on China-Africa Cooperation on Combating Climate Change, 2021, http://th.china-embassy.org/eng/zgyw/202112/t20211203_10461772.htm

- Energy and industry structure

  The Chinese central government transformed this dimension by deploying renewable energy and facilitating industrial optimization

  - ❖ 2005 –the Top-1000 Energy-Consuming Enterprises program which aimed to improve the energy efficiency in heavy industries[51]
  - ❖ 2007 – Elimination of outdated Production Capacity Project
  - ❖ 2009 – Golden Sun Demonstration Project[52]
    - Increased solar panel installations nationwide
  - ❖ 2013 – Low-carbon industrial parks and related assessments
  - ❖ 2016 – First NDC[53]
    - Peak carbon emission by 2030
  - ❖ 2020 – 2060 carbon neutrality goal announced in UN General Assembly
  - ❖ 2021 – Second NDC[54]
    - Non-fossil fuel energy consumption will reach 25% by 2030.
  - ❖ 2021 – "1+N" policy framework for carbon peak and carbon neutrality[55]

51 https://www.ndrc.gov.cn/xxgk/zcfb/tz/200604/t20060414_965934.html?code=&state=123

52 IEA. Golden Sun Programme. https://www.iea.org/policies/4992-golden-sun-programme

53 China's Intended Nationally Determined Contribution: Enhanced Actions on Climate Change, 2015 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China%20First/China's%20First%20NDC%20Submission.pdf

54 China's Achievement, New Goals and New Measures for Nationally Determined Contributions, 2021 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China%20First/China%E2%80%99s%20Achievements,%20New%20Goals%20and%20New%20Measures%20for%20Nationally%20Determined%20Contributions.pdf

55 "1" refers to top level overall guidance and "N" refers to policy packages for key action areas

- Regional low-carbon transition

  China mainly promotes low-carbon cities and local sustainable development

  ❖ 2002 – Clean Development Mechanism introduced into China[56]

  - Facilitated local sustainable development in a cost-efficient manner

  ❖ 2010 – Low-carbon city transitions pilot projects (8 cities)

  ❖ 2012-2017 – Regional Low-carbon Transition projects (29 provinces and 45 cities)

  ❖ 2013-2015 – 7 Provincial emission trading markets

- Green finance policies

  The central government has formulated policies calling for leading state-owned banks to take the initiatives in providing green finance services and projects and facilitating decarbonization.

  ❖ 2013 – CBRC's Green Credit Guidelines

  ❖ 2015 – NDRC's Guidelines for Issuing Green Bonds[57]

  ❖ 2016 – Seven ministries' (PBoC etc.) Guidelines for Establishing a Green Financial System[58]

  ❖ 2019 – Seven ministries' (NDRC etc.) Green Industry Guidance Directory

  ❖ 2020 – MEE, NDRC, PBoC, CBIRC and CSRC's Guidelines on Promoting Investment and Financing for Addressing Climate Change

  ❖ 2021 – China launched its national Emissions Trading System (ETS) in January[59].

  ❖ 2021 – NAFMII introduced the Sustainability-Linked Bond (SLB)

56 Warwick, C. (2010). Clean development mechanism in China: five years of experience (2004-09).

57 http://www.greenfinance.org.cn/displaynews.php?id=450

58 https://www.cbd.int/financial/privatesector/china-Green%20Task%20Force%20Report.pdf

59 The World Bank. 2021. Carbon Prices now Apply to Over a Fifth of Global Greenhouse Gases. https://www.worldbank.org/en/news/press-release/2021/05/25/carbon-prices-now-apply-to-over-a-fifth-of-global-greenhouse-gases

- ❖ 2021 – PBoC, NDRC and CSRC's Green Bond Endorsed Projects Catalogue (2021 version)[60].
- ❖ 2021 – PBoC rolled out a supporting tool for carbon reduction[61] which enabled banks to provide low-cost loans.
- ❖ 2021 – PBoC has set up a 200 billion yuan to support the coal's clean and efficient use. This plan can increase the stable funds for financial institutions and provide them with low-cost funds, which will help improve the green development[62].

- Low-carbon technology and carbon sinks

  Carbon capture, use and storage (CCUS) projects and EV development are the driving forces of this dimension

  - ❖ 2020 – EV and renewable energy subsidies, purchase tax exemptions[63]
  - ❖ 2021 – The Ministry of Industry and Information Technology issued the 14th Five-year Plan for Green Industrial Development, proposing to increase investment and financing support for energy conservation, environmental protection, new energy, carbon capture, utilization and storage[64].

60 The Green Bond Endorsed Projects Catalogue (2021 Edition) was jointly announced by the People's Bank of China (PBOC), the National Development and Reform Commission (NDRC) and the China Securities Regulatory Commission (CSRC) on 21 April 2021. http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/4342400/20210916171800898 79.pdf

61 Xinhua, 2021, China's Central Bank Rolls Out New Lending Tool for Carbon Reduction http://www.chinadaily.com.cn/a/202111/09/WS6189df35a310cdd39bc7439a.html

62 http://www.gov.cn/zhengce/2021-11/21/content_5652308.htm

63 http://www.gov.cn/zhengce/zhengceku/2020-12/31/content_5575906.htm

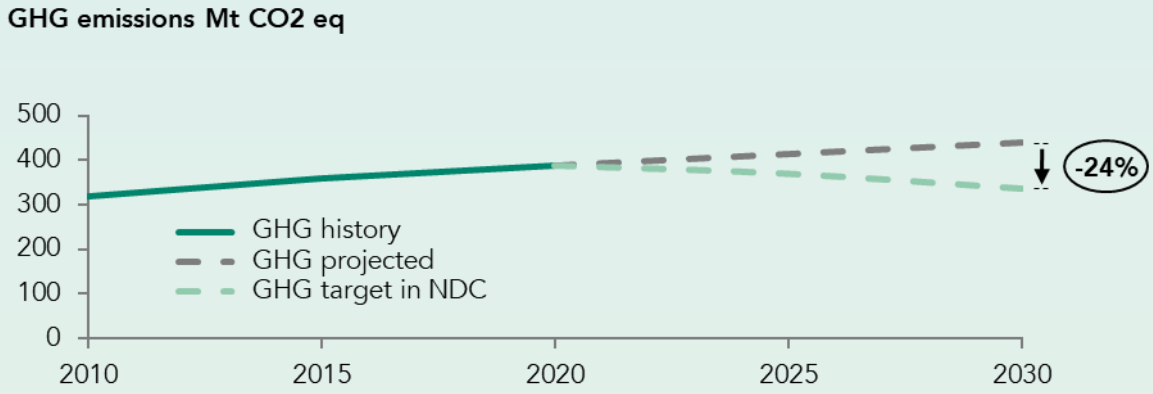
64 http://www.gov.cn/zhengce/zhengceku/2021-12/03/5655701/files/4c8e11241e1046ee9159ab7dcad9ed44.pdf

Kazakhstan

- A fossil fuel-dependent landlocked emerging economy

Kazakhstan's first NDC has a target of reducing GHG emissions 15%-25% by 2030 compared to its 1990 level (Exhibit 6). In 2020, the president of Kazakhstan announced that the country would become carbon neutral by 2060. However, as the largest oil producer in Central Asia, Kazakhstan's crude oil production hit a record high in 2019. Of the 863 TWh of energy which consumed in 2019, 96% came from fossil fuels.[65] Coal represents around half of Kazakhstan's primary energy mix (52.6% in 2020), followed by oil and natural gas (24% and 19% in 2020)[66]. Given its current energy structure, significant actions are needed to facilitate Kazakhstan's orderly and just transition.

Exhibit 6 Projected GHG emissions in Kazakhstan



Source: UNFCCC

65 Our World in Data https://ourworldindata.org/energy/country/kazakhstan
66 Our World in Data https://ourworldindata.org/energy/country/kazakhstan

- Kazakhstan's Decarbonization Blueprint

At the Glasgow climate summit, Kazakhstan vowed to increase energy production from renewables from 3% to 15% of its energy mix by 2030, to double the amount of energy produced from environmentally friendly sources from 20% to 38%, and to plant more than 2 billion trees to enhance carbon sequestration ability[67].

These commitments are supported by several favorable political and socio-economic conditions.

First, the government of Kazakhstan possesses a strong will to push forward the green transition. Kazakhstan's development strategy aims to make the country one of the world's 30 largest economies[68]. To advance towards this goal Kazakhstan has made efforts to learn from advanced economies in areas of economic and social development and to benchmark its performance against OECD standards, including progress towards a low-carbon economy. Its Ministry of Economy has expressed the country's hope to join OECD[69].

Second, Kazakhstan is not only a country with abundant fossil fuels but immense renewable energy potential. Kazakhstan receives 2,200-3,000 hours of annual sunshine, insolation (direct radiation from the sun) energy of 1,300-1,800 kWh/m2 /yr[70], and enjoys the highest per capita insolation in the world[71]. Moreover, Kazakhstan's wind energy potential far exceeds its annual energy consumption[72]. With these abundant wind and solar resources and vast land area, Kazakhstan has great potential to leverage foreign direct investment for green hydrogen development[73].

67 Zhanna Shayakhmetova, 2021, Kazakhstan Declares its Carbon Neutrality Targets at UN Climate Change Conference in Glasgow, The Astana Times https://astanatimes.com/2021/11/kazakhstan-declares-its-carbon-neutrality-targets-at-un-climate-change-conference-in-glasgow/

68 Bakhyt Yessekina et al., 2021, Modernisation of the Strategic Planning for Decarbonisation in Kazakhstan https://green-academy.kz/wp-content/uploads/2021/04/11308-27145-1-PB.pdf

69 Timur Suleimenov, 2017, Kazakhstan is getting closer to OECD membership https://www.euractiv.com/section/central-asia/opinion/kazakhstan-is-getting-closer-to-oecd-membership/

70 Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP), Kazakhstan and Kyrgyzstan Opportunities for Renewable Energy Development, November 1997

71 Jaquelin Cochran, Kazakhstan's Potential for Wind and Concentrated Solar Power http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.579.1363&rep=rep1&type=pdf

72 Amangeldi Dzhumagalievich Omarov et al., 2014, The analysis and development of alternative energy sources in Kazakhstan http://www.lifesciencesite.com/lsj/life1108s/096_24992life1108s14_433_438.pdf

73 Saniya Perzadayeva et al., 2021, Kazakhstan: Hydrogen "Greening" In Kazakhstan https://www.mondaq.com/renewables/1132218/hydrogen-greening-in-kazakhstan

Third, international actors are involved in joint efforts to push forward Kazakhstan's decarbonization. Both the European Bank for Reconstruction and Development (EBRD) and the World Bank have been proactively helping to accelerate the development of low-carbon energy in Kazakhstan[74] [75]. The GIP launched its first regional chapter in Kazakhstan, "to better understand local contexts in addressing environmental and climate challenges with financial tools, identify prospective GIP members, and collect green project information for existing GIP members to unlock potential green investment opportunities."[76]

Aiming to achieve carbon neutrality by 2060, Kazakhstan has made policy adjustments in the following four dimensions, with an emphasis on green finance.

74 Anto Usov, 2018, EBRD boosts green power generation in Kazakhstan http://seff.ebrd.com/cs/Satellite?c=Content&cid=1395277394357&pagename=EBRD%2FContent%2FContentLayout

75 World Bank, 2021, Supporting Kazakhstan's Green Growth https://www.worldbank.org/en/news/video/2021/11/19/supporting-kazakhstans-green-growth

76 Green Investment Principles, 2021, "First GIP Regional Chapter Inaugurated in Central Asia" https://gipbr.net/Content.aspx?id=330&type=21&m=8

- Energy and industry structure

  Aims to use nuclear power to replace and reduce fossil fuel consumption

  ❖ Nuclear power is considered a necessary option[77]

  ❖ 2002 – Kazakhstan Governmental Resolution #925[78]

  - Aims to transform the economy's energy mix by employing a high-tech, science-intensive, dynamically developing branch that focuses on nuclear power developments

- Regional low-carbon transition

  The urban sector, including heating, buildings, waste, and transport are prioritized for transition and accounts for 30% of the cumulative abatement potential[79]

  ❖ Sustainable Cities for Low-Carbon Development Project

  - Aiming to identify projects to reduce GHG emissions within urban infrastructure
  - Expected to evaluate financial resources for the implementation of various projects in 15 cities[80]
  - Aiming to establish Public private partnership (PPP), Energy Management Company or other appropriate institutions to implement low-carbon urban planning

77 IAEA https://www.pub.iaea.org/MTCD/Publications/PDF/cnpp2018/countryprofiles/Kazakhstan/kazakhstan.htm

78 IAEA. 2016. Country Nuclear Power Profiles 2018 Edition. https://www-pub.iaea.org/MTCD/Publications/PDF/cnpp2018/countryprofiles/Kazakhstan/kazakhstan.htm

79 UNDP. https://www.kz.undp.org/content/kazakhstan/en/home/projects/sdu/low_carbon_urban_development.html

80 UNDP. https://www.kz.undp.org/content/kazakhstan/en/home/projects/sdu/low_carbon_urban_development.html

- Green finance policies

  Kazakhstan's green finance market policies are leading the way in Central Asia, with emphasis on green bonds and emissions trading.

  ❖ 2013 – ETS (KazETS)[81]

  ❖ 2018 – The AIFC Green Finance Centre was created on June 1 with the aim of developing and promoting green finance in Kazakhstan and the Central Asian region[82].

  ❖ 2020 – Kazahkstan's first locally issued green bond issues

  - Damu Entrepreneurship Fund launched a 200 million tenge ($478,469) green bond, with proceeds to be invested in renewable energy and energy efficiency projects of renewables[83].

  - The ADB issued almost KZT14 billion (USD32 billion) of green bonds for climate change adaptation and mitigation projects[84].

  ❖ 2021 – Adoption of Green Taxonomy of the Republic of Kazakhstan

  ❖ 2021 – Sustainable finance market reached $250 million since 2020 (green, social bonds and loans)

81 ICAP.https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=46

82 The AIFC Green Finance Centre. https://gfc.aifc.kz/

83 AZAQ TV, "Damu Fund lists first green bonds on Kazakhstan's AIZ in the amount of US$478,469", 2020.

84 ADB, "ADB Issues Green Bonds in Kazakhstan Tenge", 2020.

❖ 2021 – National Allocation Plan [85] (Kazakhstan's ETS)

- Set a cap of 169.2 MtCO2 for the year.
- The next National Allocation Plan will be for the next four years

- Low-carbon technology and carbon sinks

Renewable energy technology is emphasized; forest restorations and protections are facilitated

❖ National Action Plan on Environment Protection – For Forest Protection[86]

- Forests are considered a carbon sink and three categories of forest management activities were identified as potentially decreasing CO2 emissions

❖ Amendments and additions to some legislative acts on the support and use of renewable energy sources[87]

- Aimed at stimulating investments in the renewable technology industry; provided compensation for 50% of the costs of an individual user for the purchase of renewable energy installations of no more than 5 kW

❖ 2021– Doctrine (strategy) of the Republic of Kazakhstan on achieving carbon neutrality until 2060 is being developed by the Ministry of Ecology, Geology, and Natural Resources[88].

85 https://www.thepmr.org/system/files/documents/Kazakhstan%20-%20Additional%20Funding%20Allocation%20PPT_fin.pdf

86 Yesserkepova, I. (2010). Concise report and summary of national publications on climate change dimensions and impacts. Forests and Climate Change in Eastern Europe and Central Asia, 62.

87 ConventusLaw https://www.conventuslaw.com/report/decarbinization-uzbekistan-and-kazakhstan-are/

88 https://conventuslaw.com/report/kazakhstan-doctrine-on-carbon-neutrality/

Poland

- A carbon-intensive high-income economy

Poland moved to the World Bank's high-income country classification a mere fifteen years after reaching middle income status[89]. Like many other economies in the EU, Poland has made progress in improving industrial energy efficiency, reducing the use of fossil fuels and increasing the deployment of renewable energy. It has decoupled its economic growth from emissions, with its GHG emissions staying flat between 2010 and 2020 during which time its GDP grew by about 24%[90] (Exhibits 7 and 8).

Poland remains, however, one of the EU's most carbon-intensive economies[91] and faces important regulatory challenges under the ambitious EU emission targets. Coal dominates Poland's energy consumption, accounting for 70% of its electricity production in 2021[92]. Based on its own situation, Poland attempts to align its domestic energy and industrial policies with the EU emission targets as a member of the supranational organization, which could require a nearly 95% reduction in its coal-fired generation from 2020 to 2050[93]. Although the Polish government submitted the National Recovery and Resilience Plan (RRP) in April 2021, which mainly emphasized the investments in the green transition, its green spending share was 28% which was still below the EU benchmark (37%)[94], implying a further plan to mitigate the current investment gap should be necessary. On the other hand, physical risks are likely to be driving the transition in Poland. Extreme precipitation events frequently happened in recent years, negatively impacting its energy sectors. For example, in 2020, the power price jumped suddenly because the flooding badly attacked one coal storage site in Poland causing an electricity outage[95]. Therefore, low carbon transition is key in the context of energy security and resilience. How to make an orderly and timely net-zero transformation is an unavoidable but outstanding question for Poland's policymakers and business leaders.

89 World Bank, "Lessons from Poland, Insights for Poland", 2017

90 World Bank Open Data https://data.worldbank.org

91 Statista https://www.statista.com/statistics/986392/co2-emissions-per-cap-by-country-eu/

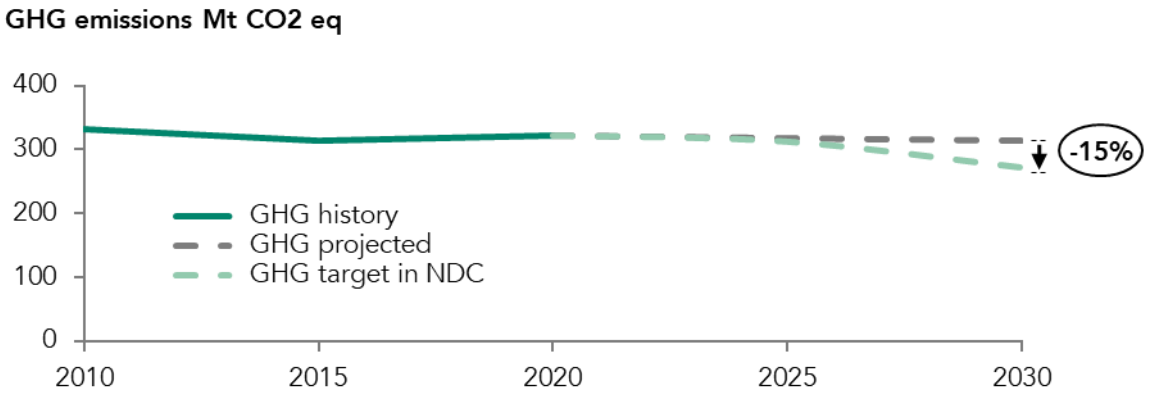
92 Our World in Data, Share of electricity production in Poland (accessed April 2022)

93 Carbon-neutral Poland 2050. https://www.mckinsey.com/~/media/mckinsey/industries/electric%20power%20and%20natural%20gas/our%20insights/carbon%20neutral%20poland%202050%20turning%20a%20challenge%20into%20an%20opportunity/carbon-neutral-poland-2050.pdf

94 https://www.greenrecoverytracker.org/country-reports/poland

95 https://www.iea.org/articles/poland-climate-resilience-policy-indicator

Exhibit 7 Projected GHG emissions in Poland



Source: UNFCCC

- Poland's decarbonization outlook

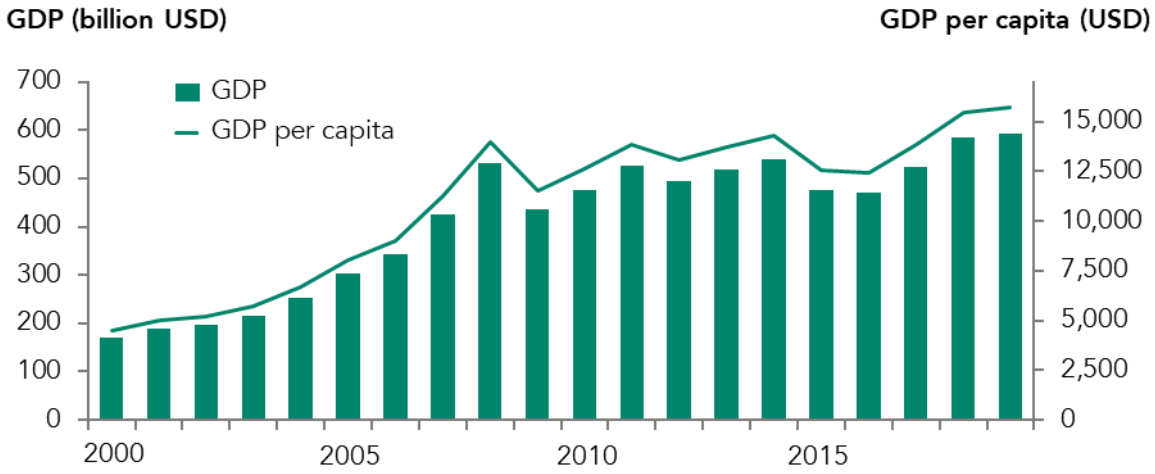
  Poland's energy policy until 2040 (PEP2040) was approved in 2021. The policy outlines several ambitious decarbonization targets, including a minimum 23% share of renewables in gross final energy consumption and a roughly 30% reduction of GHG emissions (compared to 1990) by 2030; introduction of nuclear energy by 2033, and a reduction of coal's share in power generation to 56% by 2030, with a conservatively (in comparison with other EU members) estimated phase out date of 2049[96].

  Poland's low-carbon transition could also bring business opportunities. Based on the countries capabilities, infrastructure and comparative advantages, several potential low-carbon areas for economic growth are essential, including manufacturing of EV components, electric heat pumps and electrified agricultural equipment, and the development and deployment of bioenergy carbon capture, utilization and storage (BECCUS) technology. In addition, the strong, stable winds and shallow waters of the Baltic sea provide favorable conditions to develop significant offshore wind power capacity[97].

96 IEA, "Energy Policy of Poland until 2040", 2022.

97 Carbon-neutral Poland 2050. https://www.mckinsey.com/~/media/mckinsey/industries/electric%20power%20and%20natural%20gas/our%20insights/carbon%20neutral%20poland%202050%20turning%20a%20challenge%20into%20an%20opportunity/carbon-neutral-poland-2050.pdf

Exhibit 8 Poland GDP



Source: The World Bank

The following are highlights of Poland's policies and practices to reduce carbon emissions in line with the EU targets.

- Energy and industry structure

  Polish energy policy is driven by EU directives and requirements.

  ❖ 2009 – Energy Policy of Poland until 2030[98]

  - Improve energy efficiency, diversify electricity generation by introducing nuclear power and increasing renewable energy, invest in grid modernization.

  ❖ EU 20/20/20 goals[99]

  - Limit GHG emissions in sectors not covered by the EU Emission Trading Scheme to 14% above 2005 levels. Reduce energy consumption by 20% of the projected 2020 level. Increase the share of renewable energy to 15%.

  ❖ 2021 – Energy Policy of Poland until 2040[100]

  - Ambitious decarbonization targets are driven by change in energy mix and improved energy efficiency

- Regional low-carbon transition

  The Polish government expects its local governments to take a leading role in the transitions. Some local-level initiatives include[101]:

  ❖ Pilot to define regulations on air quality

  ❖ Local carbon economy plans, emission mitigation plans and spending on energy efficiency, etc.

  ❖ Transport development strategy until 2020

  Sustainable and user-friendly local transportation system (the strategy also includes plans at the national, European, and global levels)

  ❖ Local renewable energy developments

98 Grantham Research Institute on Climate Change and the Environment, Energy Policy of Poland until 2030 and 2040 (PEP 2030 and PEP 2040).

99 https://www.europarl.europa.eu/euroscola/resource/static/files/20-20-20-targets-contribution.pdf.

100 IEA, "Energy Policy of Poland until 2040", 2022.

101 IEA https://www.iea.org/reports/energy-policies-of-iea-countries-poland-2016-review

- Green finance policies

  ❖ EU 2019/2088 Sustainable Finance Disclosure Regulation (SFDR)

  Financial institutions are required to disclose their sustainability-related financial information in investment portfolios, lending activities, and other financial activities.

  ❖ Polish Financial Supervision Authority (PFSA) guidelines are expected to be consistent with the European trend of stricter requirements, especially in sustainable financing, ESG risk, climate risks[102].

- Low-carbon technology and carbon sinks

  ❖ 2010 – The 1st National Renewable Energy Action Plan (NREAP)

  - Renewable energy projected to constitute 15% share in energy consumption, most utilizations of renewable energy are in electricity generation, heating and cooling, and transportation

  ❖ 2016 – Nuclear Technology Development Plan

  - Aimed to build nuclear power capacity for electricity generation to reduce the natural impacts of the energy sector[103].

102 PwC. https://www.pwc.pl/pl/pdf-nf/2021/Green_finance_in_Poland_PwC_ESG_report.pdf
103 https://gemini-initiative.com/wp-content/uploads/2020/11/3-Presentation-Jozef-Sobolewski.pdf

Pakistan

- Pakistan is highly vulnerable to climate change risks[104]

  Pakistan is a representative case for economies that contribute only a small portion of the global GHG emissions but are severely influenced by climate changes. Pakistan was one of the ten most climate-affected countries during 2000-2019[105]. Pakistan faces threats from various types of climate-related disasters, including floods, tropical cyclones, droughts, landslides, etc. According to government estimates, key areas impacted by climate change include the agriculture-food-water nexus and urban infrastructure[106]. In addition, there are significant risks for the overall financial sector and government budget. To facilitate the low-carbon transition and build resilience in Pakistan's economy, climate mitigation and adaptation measures are urgently needed throughout the whole country.

  At the same time, there are practical financing gaps facing Pakistan's transition to a low-carbon economy. The cost of energy transition alone would require an estimated USD101 billion by 2030 (and an additional USD65 billion by 2040) given the ongoing renewable energy projects, upgrading of the power transmission network, phasing out of coal, and the construction of hydropower plants[107]. Moreover, with 61 million people in Pakistan having no or limited access to electricity, an inclusive transition plan is needed[108].

  (Exhibit 9 & Exhibit 10)

104 United Nations. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Pakistan%20First/Pak-INDC.pdf

105 Germanwatch. https://germanwatch.org/en/19777

106 https://climateknowledgeportal.worldbank.org/sites/default/files/2019-06/CSA-in-Pakistan.pdf

107 Government of Pakistan, Pakistan Updated Nationally Determined Contributions2021. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Pakistan%20First/Pakistan%20Updated%20NDC%202021.pdf

108 Ali Tauqeer Sheikh, 2021, Cheap and Clean Energy. https://www.dawn.com/news/1665358

- Pakistan's climate leadership

In order to establish the country's leadership in combatting climate change and promoting decarbonization, the Pakistan Government outlined its climate mitigation targets in its 2021 NDC, targeting a 50% reduction of its projected emissions by 2030, with a 15% unconditional contribution and a 35% commitment that is conditional on additional international support.

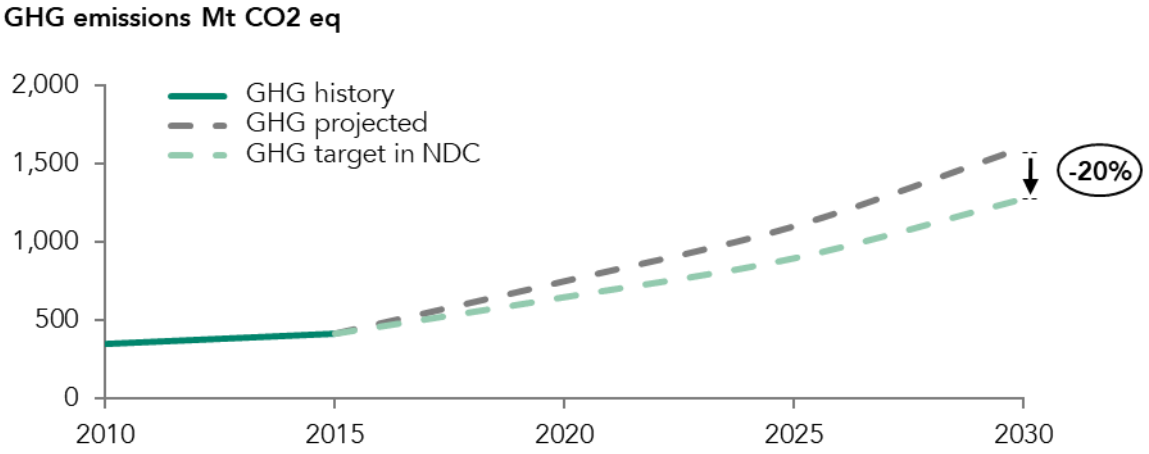
Pakistan aims to shift to 60% renewable energy and 30% EVs by 2030. From 2020, the government issued a moratorium on new coal projects and banned imported coal for power generation. Such an ambitious energy revolution depends on developing the country's massive renewable energy potential. According to the government's estimation, Pakistan has only developed 14% of its hydropower potential. Its natural solar potential would be more than sufficient to meet the country's total energy demand. In addition, the coastal areas of Sindh and Balochistan have significant untapped potential for wind power.

While adjusting its energy structure, Pakistan has launched several on-the-ground initiatives to promote carbon sequestration, create green jobs and mobilize private sector investment. In 2016, the Government of Pakistan initiated a flagship Ten Billion Tree Tsunami Program (TBTTP) to sequester 148.76 metric tons of carbon dioxide equivalent over 10 years. With USD120 million of financial support from the World Bank, Pakistan launched the Green Stimulus Initiative, focusing on restoring the ecosystem, improving urban sanitation and generating 200,000 jobs[109]. In addition, a Result Based Financing (RBF) pilot project in Sindh and Punjab was launched in 2019 to encourage private sector investment for off-grid solutions, addressing the needs of remote areas[110].

109 The News International, 2021, Ministry Makes Arrangements to Launch Green Stimulus Initiative in October. https://www.thenews.com.pk/print/893038-ministry-makes-arrangements-to-launch-green-stimulus-initiative-in-october

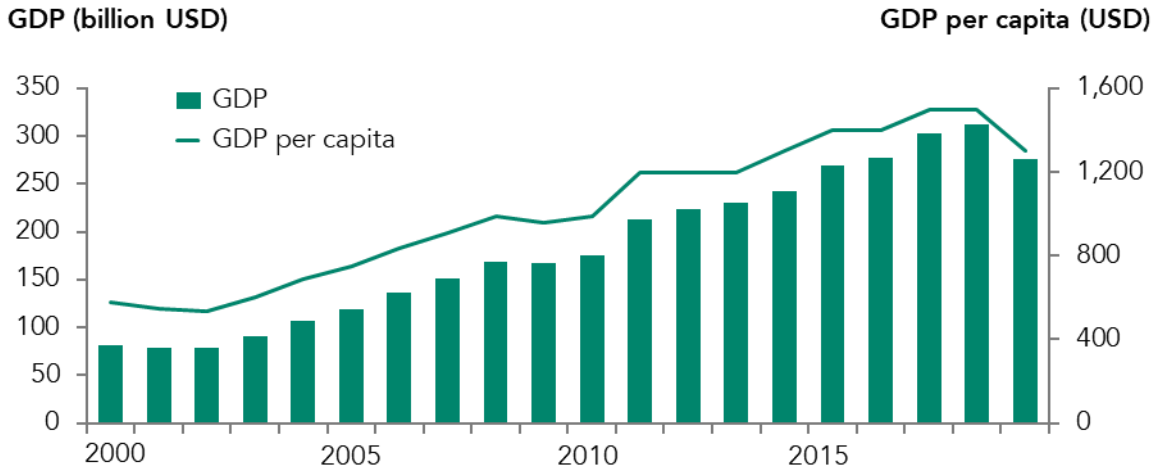
110 Government of Pakistan, Pakistan Updated Nationally Determined Contributions2021. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Pakistan%20First/Pakistan%20Updated%20NDC%202021.pdf

Exhibit 9 Projected GHG emissions in Pakistan



Source: UNFCCC

Exhibit 10 Pakistan GDP



Source: The World Bank

Aiming to achieve carbon neutrality before 2050, Pakistan has made policy adjustments in the following four dimensions to move towards a low-carbon economy.

- Energy and industry structure

  The government is promoting research in renewable energy and energy efficiency optimizations

  ❖ 2012-2015 – Climate Change Policy and INDC[111]

  ❖ 2020 – Moratorium on new imported coal-based power plants and generation of power through imported coal[112]

  ❖ 2021 NDC[113]

  - Overall, 50% reduction of projected emissions by 2030 (15% unconditional and 35% conditional)
  - 20% share of all energy to be provided by renewable energy resources including hydropower by 2025 and 60% by 2030
  - By 2030, 30% of all new vehicles sold in Pakistan in various categories will be EVs
  - Aim to increase energy efficiency with combined sectoral targets to achieve a total of 1.5% annual improvement in energy efficiency
  - Mitigation policy action is mainly implemented in the following six sectors: energy, transportation; agriculture; industrial processes; land use, land-use change, and forestry; and waste.

111 United Nations. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Pakistan%20First/Pak-INDC.pdf

112 Government of Pakistan, Pakistan Updated Nationally Determined Contributions 2021. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Pakistan%20First/Pakistan%20Updated%20NDC%202021.pdf

113 Government of Pakistan, Pakistan Updated Nationally Determined Contributions 2021. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Pakistan%20First/Pakistan%20Updated%20NDC%202021.pdf

- Regional low-carbon transition

  The federal government supports regional climate adaption practices, including:[114]

  - ❖ Off-grid electrification pilot projects in Sindh and Punjab to encourage private sector investment in off-grid solutions
  - ❖ Bus rapid transit systems have been introduced to five cities. Karachi has developed a bus rapid transit system zero-emission metro line and the city's circular railway is underway.
  - ❖ The government supports regional research groups in developing region-specific research that support climate mitigation.

- Green finance policies

  - ❖ 2017-State Bank of Pakistan (SBP) launched Green Banking Guidelines[115]to enhance the risk management in banks
  - ❖ Green Climate Fund, Clean Development Mechanism (CDM), Adaptation Fund (AF), Global Environment Facility (GEF), Forest Carbon Partnership Facility (FCPF) of the World Bank Water and Power Development Authority launched 10-year green bonds and raised USD500 million for a hydro-energy project[116].
  - ❖ Other financial initiatives that Pakistan has embarked upon include nature performance bonds, carbon pricing instruments blue carbon, and a sustainable finance framework[117]

114 Coalition for Urban Transitions. https://ledsgp.org/wp-content/uploads/2018/06/The-Economic-and-Social-Benefits-of-Low-Carbon-Cities-A-systematic-review-of-the-evidence.pdf

115 https://www.sbp.org.pk/smefd/circulars/2017/C8-Annex.pdf

116 https://developing.pk/2021/05/28/pakistan-wapda-raises-500-million-in-countrys-first-green-bond-issuance/

117 Abridged Version of Updated Pakistan NDCs, 2021.

- Low-carbon technology and carbon sinks
  - ❖ Encouraging forest restoration and national park expansion[118] [119]
    - Initiating projects using nature-based-solutions to sequestrate carbon, such as Eco-system Restoration Initiative (2020-2030), Reduced Emission from Deforestation and forest Degradation-Payments for Environmental services, Ten Billion Tree Tsunami Program, etc.

118 United Nations, Reducing Emissions from Deforestation and Forest Degradation – Pakistan https://unfccc.int/climate-action/momentum-for-change/activity-database/reducing-emissions-from-deforestation-and-forest-degradation

119 https://sustainabledevelopment.un.org/content/documents/233812019_06_15_VNR_2019_Pakistan_latest_version.pdf

2.3 Transition risks and opportunities in the selected BRI countries

China, Kazakhstan, Poland and Pakistan have issued various policies relevant to their low-carbon transitions. Although they are at different levels of economic development and each faces a unique set of decarbonization challenges, they recognize the urgency and necessity of rapidly reducing the fossil fuel consumption and facilitating the comprehensive low-carbon transition.

Countries face a variety of different challenges on the path toward decarbonization. Those essential transition risks often include an energy mix that consists mainly of fossil fuels, a lack of green investment and public-private synergy, potential long-term policy inconsistency, uncertainty of technology development, international reputation damage if target setting and implementation are perceived as insufficient, etc.

On top of that, rising inflations and energy shortages deriving from Ukraine-Russia conflict, weaken the momentum of recovery in BRI countries as the adverse impact of COVID-19 pandemic has not yet faded away[120]. Many countries adopted short-term measures to address national energy security, which might deteriorate their energy reliance on fossil fuel and thereby hampering low carbon transition[121]. However, the incident also sends a clear message that diversifying sources of energy and doubling down on renewable energy, which can generate electricity through solar and wind in domestic market, could be a better option to safeguard energy supply than putting all eggs in fossil fuel producing countries. On the other hand, numerous common or country-specific transition opportunities shed light on possible net-zero strategies for business leaders. The table below summarizes our findings for the four selected countries:

	Transition Opportunities[122]
China	• Manufacturing of low-carbon technologies, including EVs, solar PV and wind turbines • Central and local government planning • Active in participation in global climate governance • Nature-based solutions
Kazakhstan	• Abundant solar and wind resources • Government policy support • Financial support from multilateral development banks and donors • Afforestation plan
Poland	• Significant offshore wind potential • Geographic and intellectual advantages in shaping Europe's green value chain • Sufficient natural resource potential for developing bio-energy and BECCUS
Pakistan	• Ambitious NDC • Significant solar and wind resources • Large untapped hydropower, solar and wind potential • Afforestation plan

120 Victoria Masterson, 2022, This chart shows how much Ukraine and Russia export to the world https://www.weforum.org/agenda/2022/04/world-bank-ukraine-food-energy-crisis/

121 United Nations, 2022, UN Secretary-General: Ukraine can have major implications for the climate /

122 Although nuclear is a source of energy that could contribute to reducing carbon emissions, its unresolved waste disposal, long-tail catastrophic and governance risks make it hard to be purely identified as an opportunity

3 Understanding the transition risks and opportunities in the private sector

Energy, building, industry and transportation (EBIT) sectors emit around 34 Gt CO2e /year[123], offering tremendous opportunities for emission reductions as these sectors decarbonize. Financial institutions shape developments in the real economy through their risk management, lending, investment and insurance decisions and products. With land and the ocean playing dual roles as carbon sinks and emission sources, there are opportunities to optimize the balance between harnessing their carbon sequestration potential and inclusively supporting people's livelihoods and sustenance. This chapter spotlights those sectors with the highest carbon footprints as well as those with the most potential to gain from the net-zero transition. In addition to market and policy-driven risks and opportunities, emerging innovations and technologies are likely to drive change for decades. Key technologies and innovations include:[124]

- Efficiency improvements to continuously bring down the cost of renewable energy (e.g. wind and solar)
- Energy storage (e.g., hydrogen, flow batteries)
- Carbon removal technologies (e.g., nature-based solutions, BECCUS, direct air capture)
- Cheaper and higher performance heat pumps for green buildings
- Direct electrification and use of clean hydrogen, including industrial (e.g., electric arc furnaces) and transport uses (e.g., fuel cell electric vehicles (FCEV), — maritime shipping, aviation)
- Improvements to power line capacity and optimization of existing transmission and distribution assets
- Digitized and smart grid
- Material collection, sorting and recycling practices, enabling a circular economy

123 Energy Transition Commission, 2021, Reaching Climate Objectives: the Role of Carbon Dioxide Removals https://www.energy-transitions.org/wp-content/uploads/2021/05/ETC-NegEmiss-White-paper-v4-Final.pdf

124 Energy Transition Commission, 2021, Making Clean Electrification Possible: 30 Years to Electrify the Global Economy https://www.energy-transitions.org/wp-content/uploads/2021/04/ETC-Global-Power-Report-.pdf

3.1 Real economy sector[125]

3.1.1 Energy sector

Table 2 Risk analysis for the energy sector

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
Transition	Market/ behavioral	• Potential asset devaluation for companies highly dependent on fossil fuels				
		• Higher or more volatile prices for critical minerals (e.g. lithium, cobalt, nickel) could impact energy companies' decarbonization plans				
		• Lack of clear market signals for low-carbon energy sources could disrupt deployment plans				
		• Falling renewable energy prices could reduce demand for fossil fuels or increase competitive pressure on fossil-fuel-dependent companies, e.g. electric utilities				
		• With financial institutions tightening their policies for carbon-intensive activities, fossil fuel-dependent energy firms could face higher borrowing and insurance costs, or could find that funding and or insurance are unavailable for some activities and assets				
	Reputational	• Negative public image of companies with GHG-intensive or activities				
		• Negative public image for companies with significant emissions of other environmentally harmful or health-threatening pollutants				
	Policy, legal and litigation	• Increased carbon/GHG emission prices due to ETS, carbon taxes or other GHG emissions pricing approaches				
		• Growing demands for a proper methane emissions management				
		• International and domestic policies requiring energy companies to adopt operational practices that reduce GHGs emissions				
		• Increasing costs of compliance with growing climate-related information disclosure requirements				

125 Partial content quote from Energy Transition Commission (2020), Making Mission Possible Delivering a Net-Zero Economy. https://www.energy-transitions.org/wp-content/uploads/2020/09/Making-Mission-Possible-Full-Report.pdf

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
		• Litigation for failure to manage climate-related risks, insufficient climate-related disclosures, or failure to comply with climate-related laws and regulations		■		
	Technology and innovation	• Increased costs from retiring, retrofitting or repurposing unabated fossil fuel plants, e.g. installation of CCUS		■		■
		• Investment in low-carbon energy sources, e.g. nuclear energy, hydrogen/ammonia or renewables				■
		• Risks of technologies that manage the intermittency and variability associated with growing share of renewable energy in grid power sources, e.g. intelligent power grid and energy storage technologies		■		■

1 Reduced revenue

2 Increased costs

3 Early retirement of assets/asset write-offs/repricing of assets

4 R&D/Investment costs

Transition Opportunities:

In energy sector, main technological opportunities remain to be wind, solar, intelligent power grid, energy storage, and fossil fuel plants with the installation of CCUS. Energy companies which double down on low carbon transition would be able to build up good image for investors, lenders, clients and consumers, thereby reaping the excessive financial benefits due to their climate leadership. Public investment in green power R&D and scale-up would enable energy companies to tremendously reduce long-term risks of climate and environmental disclosure.

For BRI countries' energy sector, embracing low-carbon transition can facilitate cross-border technology transfer and boost local economy. Low carbon energy sources such as green hydrogen can be generated in local market, thereby guaranteeing the energy security for those BRI countries which are highly dependent on global energy market at the moment.

3.1.2 Carbon-intensive industry sectors

Table 3 Risk analysis for typical carbon-intensive industries: cement and steel

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
Transition	Market/ behavioral	• Shift in consumer preferences toward steel/cement produced using greener production methods	■		■	
		• Company valuations that depend on conventional steel/cement production methods could be impacted by stranded asset risk	■		■	
		• Decreased overall demand for steel/cement due to downstream low-carbon transition (e.g., greener designs for buildings, vehicles and machinery)	■			
		• Increased costs or reduced availability of lending, investment and insurance for companies with carbon-intensive activities		■	■	
	Reputational	• Negative public image for firms failing to adopt/develop greener manufacture methods	■			
		• Negative public image for the overall steel/cement sector	■			
		• Negative public image for firms that partner with downstream emissions-heavy businesses, e.g., construction firms that fail to adopt green building standards	■			
	Policy, legal and litigation	• Increased carbon/GHG emission prices (due to ETS, carbon taxes, etc.)		■	■	
		• Higher energy optimization expectations could lead to higher operational or R&D costs		■		■
		• Increased costs due to climate and environmental disclosure/compliance requirements		■		
		• Domestic and international policy requirements for shifting away from coal will catalyze the massive application of low-carbon technologies in the cement and steel industries		■	■	■
		• Litigation for failure to manage climate-related risks, insufficient climate-related disclosures, or failure to comply with climate-related laws and regulations		■		

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
	Technology and innovation	• CCUS technology integration in the cement and steel manufacturing process				■
		• Emerging technologies to shift away from coal, e.g., electric arc furnaces (EAF) and natural gas/hydrogen-based direct reduced iron (DRI) in steel production, and improved kiln efficiency, clinker alternatives and bioenergy use in cement production.		■		■
		• Risks in scrap metal recycling		■		■

1 Reduced revenue

2 Increased costs

3 Early retirement of assets/asset write-offs/repricing of assets

4 R&D/Investment costs

Transition opportunities:

For carbon intensive industries such as cement and steel, the technological innovation opportunities lie in CCUS' application in manufacturing process, emerging technologies (such as EAF, DRI, improved kiln efficiency) and scrap metal recycling. Public investment in those technologies would dramatically reduce long-term risks of climate and environmental disclosure. The increasing carbon prices and domestic and international policy requirements for shifting away from coal will catalyze the massive application of low-carbon technologies in the cement and steel industries. Decreasing demand for steel and cement is a business opportunity for those first movers in circular economy. Carbon intensive companies which actively facilitate the net-zero transition cultivate their reputation value among investors, lenders, clients and consumers, thereby reaping the excessive financial benefits due to their contribution to climate.

3.1.3 Transportation sector

Table 4 Risk analysis for transportation sector

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
Transition	Market/ behavioral	• Growing consumer appetite for greener vehicles (e.g., EVs, low-carbon air travel, low-carbon shipping) and voluntary behavior change towards lower emissions	■		■	
		• Transition to low-carbon transportation could face more difficult challenges in some developing countries, e.g. high EV prices, insufficient charging infrastructure, weak or unreliable power grids, etc.		■		■
		• Increased societal acceptance of MaaS products could increase competition in the market	■		■	
		• Potential for upstream supply chain disruption across all modes of transportation		■	■	
	Reputational	• Negative public image for those firms that fail to develop greener transportation pathways	■			
		• Negative public image for firms that partner with emissions-intensive upstream businesses, e.g. fossil fuel providers	■			
		• Negative public image for firms that establish the local infrastructure that causes significant regional pollution, e.g., poorly managed air transport infrastructure	■			
		• Negative public image for firms that establish transportation pathways that negatively impact natural habitats	■			
	Policy, legal and litigation	• Increased carbon/GHG emission costs (from ETS, carbon taxes, etc.)		■	■	
		• Government regulations in favor of low-carbon transportation, e.g., EV subsidies, higher fuel efficiency standards or policy frameworks for regulating second-hand sales of inefficient models	■		■	
		• Higher energy efficiency requirements could lead to increased operational or R&D costs		■		■
		• Increased costs due to climate and environmental disclosure/compliance requirements		■		

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
		• Litigation for failure to manage climate-related risks, insufficient climate-related disclosures, or failure to comply with climate-related laws and regulations		■		
	Technology and innovation	• Energy efficiency improvement technologies , such as improved engines, aerodynamics and tire design (heavy/light-duty vehicles), automated trains, ship/aircraft design etc.		■		■
		• Risks of adopting lower-carbon energy sources in transportation, such as FCEV, sustainable aviation fuels, ammonia-fueled maritime shipping, etc.		■		■

1 Reduced revenue
2 Increased costs
3 Early retirement of assets/asset write-offs/repricing of assets
4 R&D/Investment costs

Transition Opportunities:

For transportation sector, prospective business opportunities might arise in technologic advance in energy efficiency improvement and adapting lower-carbon energy sources such as hydrogen, methanol and ammonia. Forward-thinking companies in transportation sector would seize the opportunity to accelerate low-carbon transition, so that they can build up good image among consumers and passengers and make use of public spending and preferential policies to alleviate the transition costs in the long run.

In particular, BRI countries are in urgent need of green transportation infrastructure to meet the increasing demand of local community, and businesses can help BRI countries to leapfrog straight to green growth in transportation sector. Moreover, low carbon energy sources such as green hydrogen can be generated in local market, tremendously relieving the uncertainty from the volatile prices of global oil and gas market.

3.1.4 Building sector

Table 5 Risk analysis for the building sector

Risk Type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
Transition	Market/ behavioral	• Changes in the cost of carbon-intensive raw materials could affect profitability				
		• Increased energy prices will impact operational costs for the building sector				
		• As consumers become more aware of the impacts and benefits, greater demand for greener buildings and development practices could disrupt value chains				
		• Potential increase in taxes or penalties for buildings with poor efficiency ratings				
		• Retrofitting buildings could entail risks, including disruption to occupants, split incentives between tenants and building owners, long payback period, etc.				
		• Reduced economic activity in markets vulnerable to the effects of extreme weather events				
	Reputational	• Negative public image for firms with high GHG emissions				
		• Negative public image for firms that occupy and develop lands with the high climate-related natural capital value				
	Policy, legal and litigation	• Increased costs due to climate and environmental disclosure/compliance requirements				
		• Mandatory low-carbon building energy codes which account for not only direct emissions from building operation, (e.g., bans on new installations of fossil-fuel boilers), but also indirect and embodied emissions, (e.g. limiting certain carbon-intensive materials, such as cement)				
		• Capital investments required to comply with stricter regulations				
		• Higher energy efficiency requirements could lead to increased operational or R&D costs				
		• Litigation for failure to manage climate-related risks, insufficient climate-related disclosures, or failure to comply with climate-related laws and regulations				
	Technology and innovation	• Low-carbon transition in the building sector, especially in developing countries, depends on electrification and switching to renewable energy.				

Risk Type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
		• To curb residential emissions, efficiency improvement is required in space heating (e.g., insulation and double glazing), cooking, air conditioner and lighting.				
		• Risks from technologies, such as electric heat pumps, resistive electric heating, combustion of hydrogen or biomethane, solar thermal water heating, etc.				

1 Reduced revenue

2 Increased costs

3 Early retirement of assets/asset write-offs/repricing of assets

4 R&D/Investment costs

Transition Opportunities:

The net-zero transition of building sector is reliant on electrification, massive application of renewable energy, efficiency improvement other key technologies such as heat pumps. With the decreasing prices of renewable energy and increasing frequent of extreme weather, the need for green building would continuously grow up, especially for those residents who care about the planet. Retrofitting buildings could unlock additional business opportunities from existing real estate whose residential facilities have not yet outlived their usefulness. Regulatory change to address the climate change would provide public spending and preferential policies to those first movers in real estate and bring down the transition costs in the long run. From a broader perspective, climate friendly real estate businesses can rally up like-minded upstream and downstream companies and reshape the ecology of the whole industry.

3.1.5 Agriculture, land and ocean use

Table 6 Risk analysis for the agriculture, land and ocean use

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
Transition	Market/ behavioral	• Changing consumer preferences toward greener products (e.g., fertilizer-free/insecticide-free foods) and plant-rich diet	■		■	■
		• Global population growth could increase pressure on limited forestry resources, disrupting raw material supplies		■		■
	Reputational	• Increased stakeholder's focus on business' climate-related decisions and actions	■			
		• Negative public image for firms that do not take measures to prevent deforestation or do not support afforestation/reforestation measures	■			
		• Negative public image for firms that prioritize business resilience over climate resilience for the community	■			
	Policy, legal and regulatory	• Increased pricing of GHG emissions, e.g., through ETS or carbon taxes		■		
		• Regional GHG pricing schemes could change the competitive balance between companies	■			■
		• Requirements to provide detailed environmental information at the product level	■	■		
		• Increased operational costs due to limits on agricultural expansion		■		■
		• Increased logging taxes in producing countries		■		
		• Litigation for failure to manage climate-related risks, insufficient climate-related disclosures, or failure to comply with climate-related laws and regulations		■		
	Technology and innovation	• nature-based carbon offset or removal solutions, including deforestation prevention, reforestation, restoration of coastal peatlands and wetlands, improved forest management, and agroforestry		■		■

Risk type	Risk sub-type	Potential impact	Potential consequences			
			1	2	3	4
		• Risks related to GHG reduction technology development, including animal diet change, improvement in fertilizer and pesticide application efficiency, genetically modified crops, digital technology for supply chain monitoring and management, synthetic/plant-based meat alternatives	■			■
		• Alternative ocean carbon sequestration practices, such as iron fertilization, urea fertilization, mixing layers, seaweed, etc.		■		■

1 Reduced revenue
2 Increased costs
3 Early retirement of assets/asset write-offs/repricing of assets
4 R&D/Investment costs

Transition opportunities:

For agricultural, land and ocean use, business opportunities might appear in the nature conservation (forest, peatland, wetland, etc), agricultural technology improvement, ocean carbon sequestration practices and consumer preference shift. Increasing regulatory demand for halting deforestation, restricting human land use and soil change and safeguarding blue carbon ecosystem would help to distinguish stellar companies which perform better in promoting climate friendly technologies, adopting nature-based solutions, facilitating wood-based circular economy, mainstreaming green consumption for stakeholders. In BRI countries, the livelihood of local community (including a large number of farmers, fishers, herders and indigenous people) is heavily dependent on the sector. In collaboration with local community, private sector could help to explore business model to realize the value of natural capital, offset residual carbon in operation and/or portfolio level to fulfill the net-zero commitment, and advance well-being of marginalized group thereby improving the overall corporate sustainability performance.

3.2 Financial sector — banking, insurance sectors

Similar to the real economy, the financial sector faces a variety of transition risks and opportunities. The low-carbon transition will create new growth engines in areas such as renewable energy, infrastructure development, energy, and material efficiency, low-carbon transport, resource-efficient low-emission agriculture, and emerging carbon removal solutions. At the same time, local and international financial institutions that are keen to pursue BRI-related business opportunities should be mindful of the following transition risks while stepping into a net-zero world.

There may be a massive and sudden devaluation of assets in sectors with a high carbon footprint in the transition to a low-carbon economy. Financial institutions need to look forward and assess their exposures to potentially stranded assets and manage risks associated with a potential rush to liquidate those assets. The devaluation of assets in fossil fuel-dependent sectors could also lead to increased credit and market risks for financiers and investors. (Exhibit 11)

The economic and business environment could become more challenging for financial institutions. Changes in the availability of capital and its costs could impede effective investment in low-carbon transitions[126]. The IEA estimates that the cost of capital in emerging market and developing economies (EMDEs) is up to seven times more than in developed economies[127].

126 Making Mission Possible Delivering a Net-Zero Economy https://www.energy-transitions.org/wp-content/uploads/2020/09/Making-Mission-Possible-Full-Report.pdf

127 IEA, World Energy Outlook 2021, https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf

Inflationary pressures that arise from a global transition to a low-carbon economy could generate risks for financial institutions. In the run-up to, during, and after COP26, an increasing number of countries raised their ambitions for decarbonizing energy and other hard-to-abate industries. But decarbonization policies, such as carbon pricing and subsidies for low-carbon technologies, could contribute to inflationary pressures[128]. WEF has pointed out that the speed of progress in renewable energy technologies has been consistently underestimated. Future energy costs could be significantly lower than the consensus projections[129] that are commonly used by companies at the moment[130].

Investors are willing to facilitate more mature low-carbon technologies, such as wind and solar power, but often overlook nascent but promising end-use decarbonization technologies, such as CCUS.[131] If financial institutions proactively cooperate with the public sector and promote well-designed and innovative financial products to nurture infant industries, they could potentially unlock more new business opportunities for years to come.

The fragmented and fast-evolving policy and regulatory landscape increase compliance risks for financial institutions with cross-border operations and exposures. Different net zero commitments, constantly evolving regulatory landscape for climate risk modeling, and the inconsistent definitions of green and brown assets across various jurisdictions might generate tremendous uncertainty for financial institutions, which operate around the world. Policymakers and regulators need to work together across jurisdictions towards aligning green finance taxonomies and requirements, improving the comparability and decision-usefulness of climate-related financial disclosures, and expanding the range of opportunities for cross-border green investment.

128 Financial Times. 2022, ECB Executive Warns Green Energy Push Will Drive Inflation Higher https://www.ft.com/content/80cbd05f-d722-411f-9bbe-155cd8c06f7e

129 Consensus projection: a combination of existing forecasts that are based on different methodologies.

130 Winning the Race to Net Zero: The CEO Guide to Climate Advantage

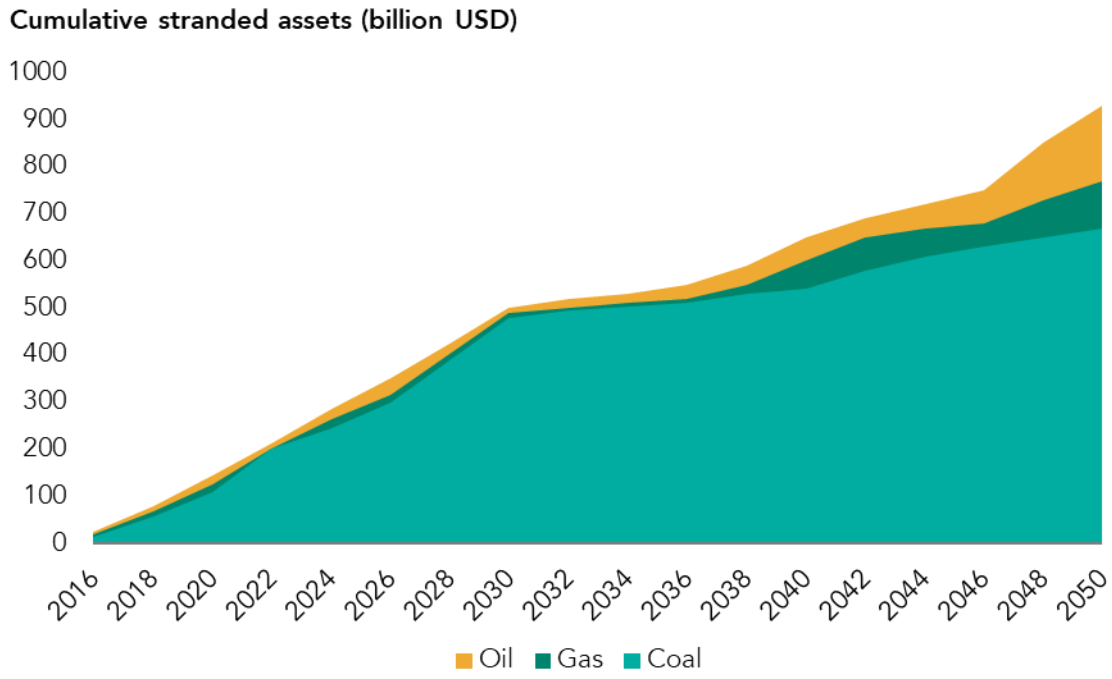
https://www3.weforum.org/docs/WEF_Winning_the_Race_to_Net_Zero_2022.pdf

131 IEA, World Energy Outlook 2021. https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf

Moreover, banks, investors, and insurance providers can engage with emissions-intensive companies and economies on the development of credible transition plans. Some financial institutions make lending, investing, and/or underwriting decisions which are contingent on the availability of clear decarbonization plans by their client companies. Collective participation with peers and clients in climate related initiatives, including SBTi, PCAF and TCFD can encourage the capacity building and know-how transfer in areas of science-based target setting, carbon accounting and climate-related financial disclosure which are necessary for an orderly transition.

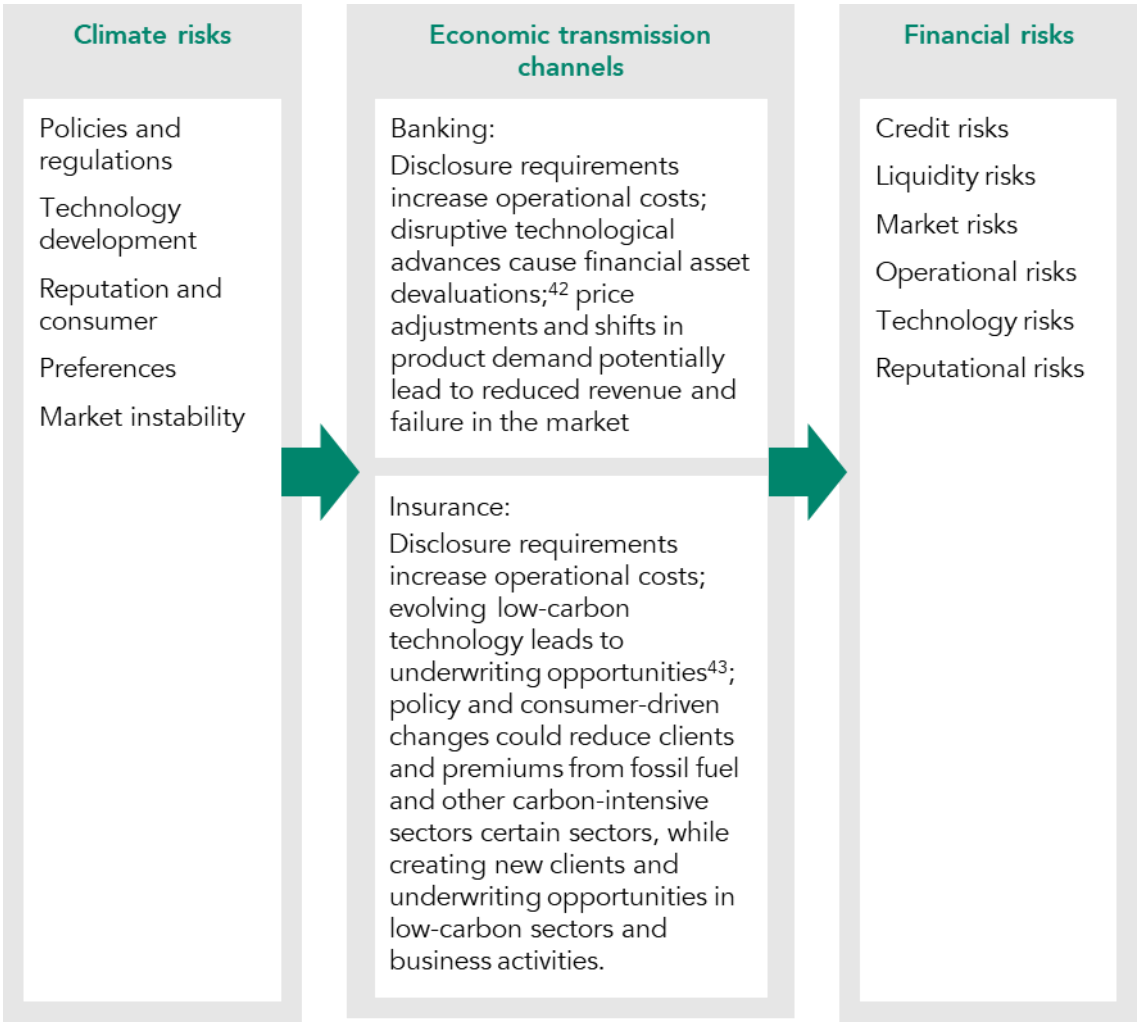
(Exhibit 12)

Exhibit 11 IRENA's estimates of stranded assets due to climate transitions



Source: IRENA

Exhibit 12 Risk transmission channels for banking and insurance industry



Source: The World Bank

In an uncertain market environment, financial institutions need to understand potential decarbonization pathways for the various sectors of the real economy and re-design their policies to identify new low-carbon transition growth drivers while managing and mitigating the associated transition risks.

4 Recommendations

To ramp up action to address climate change, governments and businesses are setting short-, mid- and long-term low-carbon transformation targets that ultimately aim to achieve net-zero GHG emissions. The race to net-zero is challenging the traditional way of doing business and creates opportunities for governments and businesses alike. With a focus on climate and environmental risk assessment, GIP WG1 would like to raise awareness, promote best practices and advocate for robust fit-for-purpose frameworks among financial institutions and other stakeholders to promote their investment, financing and risk transfer solutions for green and low-carbon activities, especially in key regions and countries of the BRI. As the baseline report of our proposed research plan, we have analyzed the potential transition risks and opportunities of four BRI countries and key industry sectors.

Meanwhile, with their essential roles in advancing green finance, it is important for financial institutions to improve their understanding of how the transformation to a low-carbon economy will affect their business and operations. Regulators have started taking actions to encourage financial institutions to improve their understanding, identification, assessment, management and disclosure of climate-related and other environment-related risks. Leading organizations in the banking and insurance industries have put in place robust governance and risk management frameworks, policies and tools to identify, assess and mitigate these risks, and to better capture the opportunities presented by the decarbonization agenda. International institutions such as the UNEP have also convened leading financial institutions to develop industry best practices on topics such as climate-related risk management.

Each country, however, has its unique development and transition path. Financial institutions must actively monitor the development of relevant policies, regulations and market conditions in the countries and regions where they have operations and/or exposure. Therefore, we propose a four-pillar approach[132] (Exhibit 13) for financial institutions to manage and control potential transition risks.

132 https://assets.bbhub.io/company/sites/60/2021/10/TCFD_Booklet_FNL_Digital_March-2021.pdf

1. Pillar one is formulating a clear strategy to support the transition of sectors in the real economy. Industry pledges, net-zero commitments and quantitative analysis (e.g., Paris-aligned climate scenario analysis, stress testing, etc.) are meaningful approaches. For example, net-zero pledges supported by concrete targets and tangible transition finance commitments can help provide clarity around transition ambitions and plans, while providing financial sector solutions for real economy counterparties. By doing this, institutions will build up experience and trust with key stakeholders which in turn can help set a clear direction for internal business lines and departments to navigate and support the transition to a low-carbon economy.

2. Pillar two is designing appropriate governance mechanisms for top-down management oversight around climate-related risks and opportunities. It is vital to ensure clear roles and responsibilities as well as a suitable oversight mechanism within the organization. The establishment of a cross-functional team is also key as it is necessary to tackle climate-related transition risks in a holistic manner, as their impact will cut across multiple services, products and functions. Expertise and relevant experience will be gradually built through internal collaboration and innovation. Finally, it is important to have the appropriate senior management and board committees involved in the decision-making around climate-related risks and opportunities.

3. Pillar three is risk management. This includes all processes used by the organization to identify, assess and manage climate-related risks. Both qualitative and quantitative approaches should be leveraged, depending on factors, such as data availability, the time horizon of assessment, and types of risk. For example, qualitative scenario analysis can help raise risk awareness and steer high-level strategic business and investment decisions despite uncertainties and data gaps. Data availability and calculation methodology are the key elements for a more thorough and potentially quantitative climate risk assessment. Currently, many financial institutions are having difficulties collecting climate-relevant data at the institutional level, let alone at the asset- or product-level. There are several international initiatives to develop and standardize metrics and methodologies, including the development of new standards for "financed emissions" and "insurance-associated emissions" by the Partnership for Carbon Accounting Financials (PCAF) in collaboration with the Net Zero Banking Alliance (NZBA) and Net Zero Insurance Alliance (NZIA), respectively. More quantitative assessment of transition risks will be possible after methodologies for calculating financial institutions' Scope 3 (in particular downstream) emissions are finalized, tested and adopted.

4. Pillar four is to actively disclose current progress and future work plans including concrete metrics and targets, based on a recognized disclosure framework. Transparency is the building block for financial institutions to realize their core business values and vision. Financial institutions need to develop approaches and practices for climate risk reporting, based on the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) or other standardized disclosure programs.

Exhibit 13 The four-step approach to managing transition risks for financial institutions

Strategy	Governance	Risk Management	Disclosure
Ambition Clarification • Issue public net-zero and green/transition finance targets to demonstrate commitment and provide clarity on ambition and plan	**Top-down Approach Design** • Engage senior leaders to set up the internal management structure and team for climate risk assessment (both physical and transition)	**Data Availability Assurance** • Determine availability of climate-relevant asset-level data • Regularly refine the data granularity	**Disclosure Plan Design** • Develop approaches to standardize disclosures • Understand expectations around TCFD disclosures • Draft TCFD disclosures
Climate Scenarios Selection • Explore the range of mainstream, credible climate scenarios • Identify scenario differences and key assumptions • Match with the declared ambitions and targets	**Cross-function Team Set-up** • Train staff in relevant business lines and nominate responsible person in each function • Develop cross-functional team to conduct assessments	**Methodology Creation** • Create a comprehensive risk taxonomy across sectors and geographies • Develop best practices around sector and geographic assessments	**Matrix & Target Formulation** • Develop practices for creating an internal climate risk program to set KPIs for relevant departments

Source: TCFD

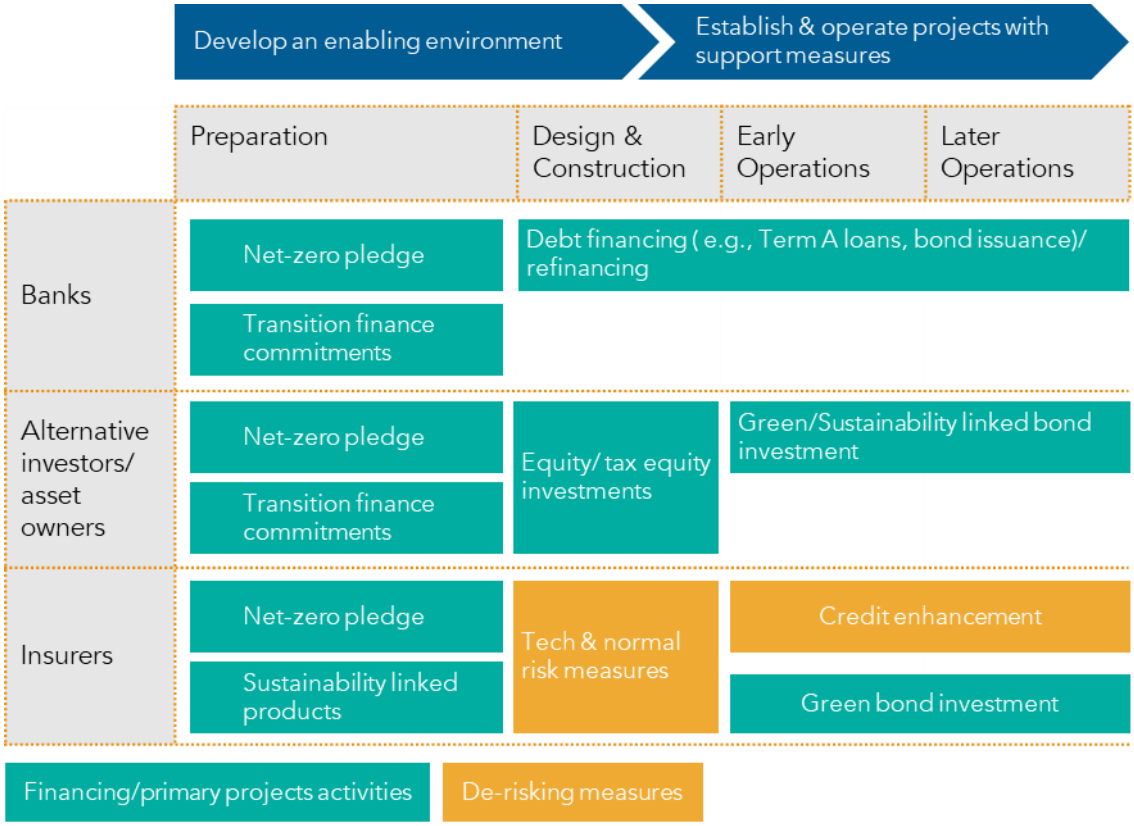
Financial institutions will require differentiated approaches specific to their business models and portfolios:

- Banks (both public and private sector) are the main providers of debt financing for EMDE green infrastructure and will need to strengthen internal capabilities for borrower-level climate risk assessment.
- Insurers play a unique dual role as institutional investors and providers of risk transfer solutions. While several insurers have made net-zero commitments for each of those roles, and are financing sustainable/green bonds, there is also a growing focus on the potential for climate-related underwriting activities. There is potential for a green protection gap to develop in the absence of insurance covers to de-risk real economy activities (including technology-related risks) and investments – both of which are essential to attract capital and expertise.
- Asset owners/managers have a major role to play with over USD 100 trillion in assets[133] and long-term investment horizons. They could engage at the strategic level and through targeted initiatives to help scale transformative financial structures and business models.

133 PwC, Asset and Wealth Management Revolution: The Power to Shape the Future, December 2020

At the project level, each participant needs to manage the potential transition risks throughout the investment, risk transfer and execution processes. The table below contains examples of project-level transition-risk management measures for the major categories of financial institutions. (Exhibit 14)

Exhibit 14 Transition risk management at project level



Source: UNEP

Appendix

Selection of the representative countries for case studies

BRI countries face different combinations of transition risks primarily due to differences in the energy mix, so it is crucial to select several countries with different representative profiles for a more detailed examination. Representative countries were selected based on case significance, commitment to the transition, exposure to the transition risks, and diversity. We selected the representative countries from each of the four Eurasian geographic areas using the following sequence:

1. Select BRI countries with net-zero commitments as well as NDCs to ensure that their current transition efforts and effectiveness are available for evaluation. Among these with commitments, select the economies among the world's largest 75% based on GDP. Eliminate countries for which insufficient data is available.

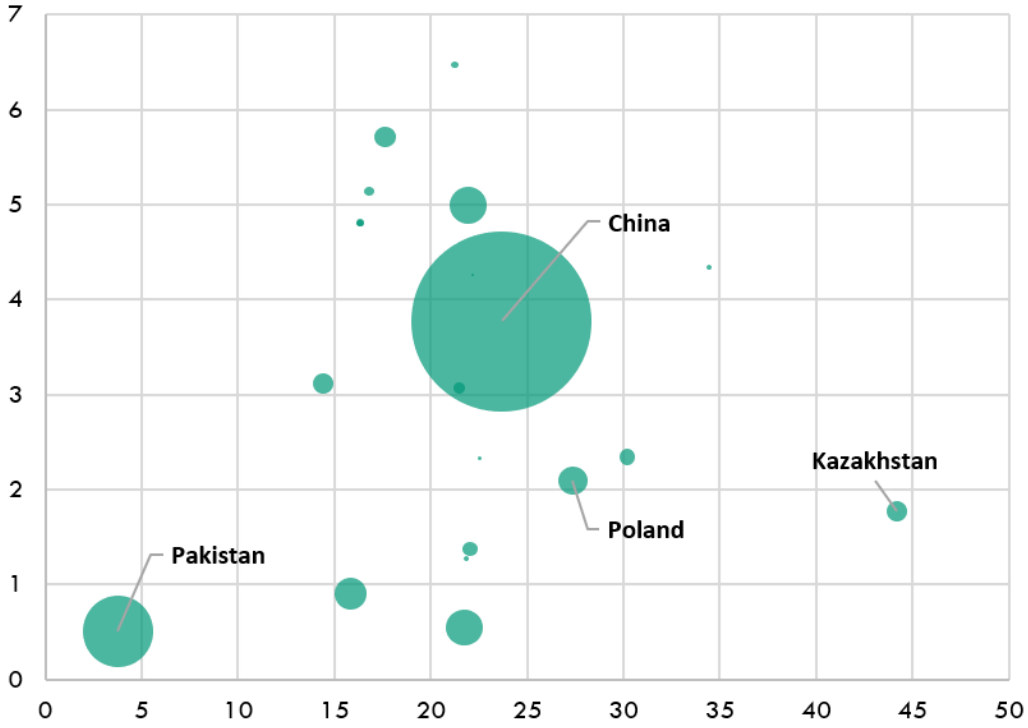
2. Make a four-quadrant diagram (Exhibit 15) with per-capita fossil fuel consumption on the x-axis and per-capita renewable energy consumption on the y-axis[134]. The x-axis former illustrates the extent to which a country depends on fossil fuels and thus the anticipated degree of disruption from the transition to a low-carbon economy. The y-axis shows how the economy has developed renewable energy as an alternative energy source and serves as an indicator of the capability to adapt to the low-carbon transition. We aimed to select the countries in the lower part because they are less developed in terms of employing renewable energy and thus face the most severe transition risks[135].

3. Finally, among the shortlisted question, we prioritized select economies with varied geographical locations in Eurasia (East Asia, South, and Southeast Asia, Middle East and Central Asia, and Europe).

134 Our World in Data. https://ourworldindata.org/energy-mix

135 The x axis is the fossil fuel consumption per capita (in MWh), and the y axis is the renewable energy consumption per capita (in MWh). Overall, the countries in the third and fourth quadrant are considered more fragile and are more in need of guidance facing transition risks as their renewable energy employment is less developed.

Exhibit 15 The four-quadrant diagram



Source: Our World in Data

X-axis: the fossil fuel consumption per capita (in MWh)

Y-axis: the renewable energy consumption per capita (in MWh)

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