# BRI GREEN DEVELOPMENT OUTLOOK

BRI International Green Development Coalition (BRIGC)

# Preamble

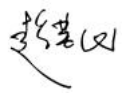
The year 2023 marked the 10th anniversary of the Belt and Road Initiative (BRI). Chinese President Xi Jinping has emphasized on many occasions the importance of facilitating high-quality cooperation under the BRI to ensure greenness a defining feature of Belt and Road cooperation. Over the past decade, aimed at high standards, sustainability and better lives and guided by the concept of green, open, and clean cooperation, the BRI has focused on key areas such as green infrastructure, renewable energy, and sustainable finance, and injected a strong impetus for the BRI countries to strive to protect environment, conserve biodiversity, address climate change, implement the UN 2030 Agenda for Sustainable Development and achieve a green and low-carbon transformation. Solid and fruitful results have been achieved.

With joint efforts from China and BRI countries, the Green Silk Road has made continuous progress. These advances have enhanced the “hard connectivity” of green infrastructure, the “soft connectivity” through harmonized rules and standards, and people-to-people bonds through green communication and cooperation. The exploratory efforts have forged a new path that balances economic development with environmental protection, integrating the concept of harmony between humanity and nature into all aspects and processes of the BRI. In 2019, the Ministry of Ecology and Environment (MEE), together with Chinese and international partners, launched the BRI International Green Development Coalition (BRIGC), which has so far attracted more than 170 partners from over 40 countries, including the environment and climate authorities of more than 20 BRI countries. Since its establishment, BRIGC has been organized nearly 100 high-level dialogues, released nearly 30 policy research reports, and proposed transition paths for green and low-carbon development of BRI countries on the themes of renewable energy development, biodiversity conservation, carbon market, etc. BRIGC has become an influential international cooperation platform for green BRI aiming to promote policy dialogues, joint research, capacity building and technology demonstration.

To systematically summarize the progress, achievements, experiences, and practices of the Green Silk Road, and to better align with the green development needs of BRI countries while envisioning the future of BRI`s green development, the BRIGC initiated the first phase of the BRI Green Development Outlook research in 2022, together with Chinese and international partners. The report has been

incorporated into the List of Multilateral Cooperation Deliverables and List of Practical Cooperation Deliverables of the Third Belt and Road Forum for International Cooperation in 2023, aiming at providing decision-making references and guidance for relevant parties to better recognize the needs of green development of BRI countries and promote international cooperation on environment and climate, at the same time to provide reference for the BRI countries themselves to promote green development in key areas.

Green development, which accommodates itself to nature's needs and promotes harmonious coexistence between humanity and nature, is a high-quality and sustainable development approach that has gained global consensus. The Green Silk Road aligns with the aspirations of the people in BRI countries for a better life and harmonizes with the United Nations' Sustainable Development Goals (SDGs), making green development a defining feature of the BRI. MEE and BRIGC, together with domestic and international partners, will continue to be committed to the development of the Green Silk Road. It will carry out joint research and publish the BRI Green Development Outlook series, timely analyzing, summarizing, and sharing relevant experiences and practices as well as the green achievements and progress of the BRI, with the objective of providing intellectual support and action recommendations for the continued advancement of the Green Silk Road.



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# Executive Summary

The world is undergoing profound changes of a scale unseen in a century, with numerous challenges such as sluggish economic growth momentum, imbalanced development, the challenges of non-traditional security have become more complex, posing a threat to the sustainable development of human society. The Global Risks Report 2024 published by the World Economic Forum highlights that extreme weather will rank among the top three risks in both the 2024 forecast and the predictions for the next two or ten years. Environmental risks have become the most severe risks over a decade-long time frame, making global cooperation for a green and low-carbon transformation across economic and social systems an urgency. The process of achieving the 2030 SDGs is halfway complete. The United Nations' mid-term assessment report of the Sustainable Development Goals Report 2023: Special Edition shows that of the approximately 140 specific targets that can be assessed, half are moderately or severely off-track. Among the SDGs related to green development, progress on SDG 7 (Affordable and Clean Energy) is too slow, with an estimated 660 million people still lacking access to electricity and nearly 2 billion people relying on polluting fuels and cooking technologies by 2030. Implementation of SDG 13 (Climate Action) is insufficient in scale and speed to effectively address climate change, requiring nearly a 50% reduction in emissions by 2030. Progress on SDG 14 (Life Below Water) and SDG 15 (Life on Land) is also limited.

**Riding the tide of history and following the right path will lead to a bright future.** Since its inception in 2013, China has worked hand in hand with various parties to promote the BRI, which has taken root and flourished. The BRI has become the largest international cooperation platform and a global public good widely welcomed by the international community, significantly promoting connectivity and enabling BRI countries to better integrate into global supply chains, industrial chains, and value chains, thereby providing strong impetus for developing countries to participate in the global governance system. It has played a significant role in filling the infrastructure and industrial investment gap in the Global South. China and BRI countries have stayed true to their original aspirations and worked hand in hand to advance BRI international cooperation from scratch, translating a general framework into concrete projects and achieving fruitful results. To date, China has signed over 200 BRI cooperation documents with more than 150 countries and 30 international organizations, covering two-thirds of the world's countries and one-third of the

world's international organizations. From 2013 to 2022, the total trade volume between China and BRI countries reached approximately $2.07 trillion, with a compound annual growth rate of 7.9%, far exceeding the compound annual growth rate of China's total foreign trade during the same period (4.7%); the total two-way investment with BRI countries exceeded $380 billion, with China's direct investment exceeding $240 billion; Chinese enterprises have established overseas economic and trade cooperation zones in BRI countries, creating 421,000 jobs for local communities. Belt and Road Economics: Opportunities and Risks of Transport Corridors, a report published by the World Bank, estimates that by 2030, the BRI is to lift 7.6 million people out of extreme poverty and 32 million out of moderate poverty in participating countries, while boosting trade by 6.2% globally and 9.7% for BRI economies, thereby increasing global income by 2.9%. According to Partnering for a Brighter Shared Future: Progress Report on the Belt and Road Initiative (BRI) in Support of the United Nations 2030 Agenda, published by the United Nations Department of Economic and Social Affairs, in September 2022, the BRI offers significant opportunities for advancing the 2030 Agenda, with substantial efforts and progress under the initiative contributing to the achievement of the SDGs.

**Those whose roots are lush will surely thrive; those in fertile soil will shine brightly.** Over the past decade, greenness has become a defining feature of BRI development. The Green Silk Road has opened a 'dream-building space' for the participating countries. In March 2015, China released the Vision and Actions on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road, which explicitly proposed the construction of a Green Silk Road. In May 2017, President Xi Jinping, at the 1st Belt and Road Forum for International Cooperation (BRF), advocated for green development, calling for a green, low-carbon, circular, and sustainable way of life and production, strengthening ecological and environmental cooperation, building an ecological civilization, and jointly achieving the 2030 SDGs. In April 2019, at the 2nd BRF, President Xi Jinping reiterated the significance of making greenness a defining feature of BRI through green infrastructure projects, green investment, and green finance, in a bid to provide green financing to protect the Earth which we all call home. In October 2023, at the 3rd BRF, President Xi Jinping announced eight major steps supporting the high-quality development of the BRI, with "promoting green development" being one of them, setting a new direction, vision, and momentum for BRI's green development.

**As days blend into months, a decade of achievement unfolds.** Driven by the joint efforts of China and other BRI countries, the Green Silk Road has made comprehensive progress. **In the field of biodiversity,** China actively responds to the urgent needs of developing countries to bridge the funding gap for biodiversity conservation. By taking the opportunity of chairing the fifteenth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP15), China has promoted the achievement of the landmark "Kunming-Montreal Global Biodiversity Framework" (hereinafter referred to as the "Kunming Framework"), officially launching the Kunming Biodiversity Fund with an initial investment of 1.5 billion yuan. This initiative is of landmark significance in global biodiversity governance.

**In addressing climate change,** China, as a proactive participant in global climate governance, has implemented a South-South cooperation action plan to support developing countries, especially the least developed, landlocked, and small island developing countries, in facing climate challenges. As of September 2024, China has signed 53 cooperation documents with 42 developing countries, hosted 62 South-South cooperation training sessions on climate change, training over 2,500 professionals from more than 120 developing countries. Furthermore, China announced the implementation of the "Africa Light Belt" project, aiming to help at least 50,000 electricity-poor households in Africa with lighting solutions over the next three years.

**In the field of energy transition,** China is vigorously promoting **the development of renewable energy.** In 2023, China's investment in energy transition reached $676 billion, making it the country with the highest investment in global energy transition. The global solar photovoltaic (PV) installed capacity reached a record 420 gigawatts in 2023, an increase of about 84% compared to 2022, with 261 gigawatts of new capacity deployed in China.[1]As the world's leading manufacturer of climate-friendly technologies, China provides 50% of the world's wind power equipment and 80% of solar PV components. The export of new "three items" such as electric vehicles, lithium batteries, and solar products has significantly reduced the global cost of renewable energy utilization and has made important contributions to global energy transition and emission reduction. China is collaborating on green energy projects with over 100 countries and regions. According to the China

[1] "Clean Energy Market Monitoring." International Energy Agency. March 2024.

Electricity Council, since 2013, the share of new energy projects in foreign direct investment by major Chinese power companies has been the **highest,** approximately 33%, **primarily focused on solar and wind power generation.** Especially since 2021, the number of new energy investment projects has significantly increased, maintaining a share of over 50%.[2] 。 In 2023, China's exports of wind and solar products helped other countries reduce carbon dioxide emissions by approximately 810 million tons.[3] 。 On the other hand, China's dual carbon goals and commitment to coal phase-out are increasingly significant on a global scale. Research by institutions such as the Rainforest Action Network shows that, in the face of some global financial institutions' backtracking on climate commitments and insufficient energy financing, fossil energy financing by major Chinese banks significantly decreased in 2023.

**In the field of green finance,** China's green finance market has grown from 8.9 trillion yuan a decade ago to 30 trillion yuan in 2022, becoming the largest green credit market in the world, with a continuous increase in the green content of economic development. Currently, the funding issue is key to achieving climate ambitions and is a core concern for developing countries. Research institutions such as the Center for Global Development (CGD), the World Resources Institute (WRI), the UK Overseas Development Institute, and Griffith University indicate that, **through efforts under the Belt and Road Initiative and South-South cooperation mechanisms, China has become a major provider of global climate finance.** Since the launch of the Belt and Road Initiative, from 2013 to 2021**,** China has provided approximately **$34.3 billion to $41 billion in climate-related funding through bilateral, regional, and multilateral channels, averaging about $3.8 billion to $4.5 billion per year, which is approximately 6.59% of the total climate finance from all developed countries.**[4] 。 The channels and methods for China to provide climate finance have diversified, covering bilateral public funds, multilateral public funds, export credits, and mobilized private funds. As a major developing country, China is gradually transforming into a net provider of climate finance, exceeding its "fair

[2] China Electricity Council. Annual Development Report on International Cooperation in the Chinese Power Industry. 2024. August 2024.

[3] "White Paper on China's Energy Transition." Published by the State Council Information Office. August 2024.

[4] Data Sources: China as a Contributor to International Climate Finance. Center for Global Development. September 2024; International Climate Finance Provided by China under the Framework of South-South Cooperation. World Resources Institute. September 2024. Data in this report have been slightly consolidated and only include information up to 2021, due to data availability and comparability.

share" of global climate finance, with bilateral climate finance provided by China being twice that of the United States during the same period.

**The prelude is brilliant, and the future is promising. To address a series of global challenges, there is an urgent need to explore a new sustainable development model that leads economic and social development through green and low-carbon transformation. The construction of the Green Silk Road aligns precisely with this development model.** In advancing the Green Silk Road, it is necessary to align with the development strategies of BRI partner countries, analyze the current state, needs, and potential for green development in these countries, identify convergence points and areas of focus, and conduct targeted, pragmatic cooperation. To this end, the BRIGC, together with relevant partners, has compiled the BRI Green Development Outlook report, aiming to: (1) systematically review the achievements of the Green Silk Road since the inception of the BRI; (2) build a BRI Green Development Index System to quantitatively assess the current state and future potential of green development in BRI countries; (3) based on the assessment results, identify the current status, key issues, future opportunities, and cooperation priorities in the key areas of BRI green development; (4) summarize the typical project cases of China's cooperation with BRI partner countries in strengthening ecological and environmental governance, biodiversity conservation, and climate change response, showcasing the Green Silk Road's contribution to green and sustainable development in these countries, and extract replicable and scalable best practices; and (5) envision the development prospects of the Green Silk Road for the next golden decade and propose targeted action recommendations that meet the actual needs of BRI countries.

This report is divided into four sections: an introduction to the relevant background, green development assessment and case studies, identification of key areas, and future policy and action recommendations, which are subdivided into 14 chapters.

- **The first section** of the report provides an overview of the global green and low-carbon transition trends and the macro background of the Green Silk Road construction, elaborates the essential connotation of the Green Silk Road, identifies the needs, opportunities, and challenges of green development in various fields, showcases the green achievements made over the past decade of the BRI, and maps out a grand blueprint for future Green Silk Road construction. It is divided into two chapters.

## Chapter 1: Research Background

**This chapter explains the background and development process of the Green Silk Road.** In today's world, the green and low-carbon transition has become a new growth point for global economic recovery and a key guarantee for sustainable development. The Green Silk Road is highly aligned with the 2030 Agenda for Sustainable Development in terms of concepts, principles, and goals and is recognized by the international community as one of the solutions to promote the implementation of the Sustainable Development Agenda. Greenness has become the defining feature of the Belt and Road Initiative (BRI). The connotation of the Green Silk Road has been continuously deepened, with its concepts constantly innovated, fields continuously expanded, and importance increasingly elevated. This has provided new momentum for the sustainable development of participating countries, brought new opportunities for nations progressing toward modernization, and written a new chapter in the building of a community with a shared future for mankind.

## Chapter 2: Achievements of the Green Silk Road

- **This chapter unveils the beautiful picture of the Green Silk Road.** From laying foundations and building frameworks to taking root and achieving lasting development, the Green Silk Road has achieved remarkable results, yielding fruitful outcomes in key areas such as green infrastructure, renewable energy, eco-friendly transport, and sustainable finance. The Chinese government has demonstrated its 'strength' in the construction of the Green Silk Road through determined commitment and concrete actions: it has released a series of policy documents, strengthened the ecological and environmental protection work of the BRI, and continued to build international consensus on green development; by establishing environmental knowledge and information platforms, it has strengthened ecological and environmental services; by building platforms for technical exchange and transfer, China has strengthened ecological and environmental project cooperation under the BRI; by actively fulfilling international responsibilities to address climate change, China has supported capacity building for ecological and environmental protection in BRI countries; and by focusing on promoting ecological and environmental governance, it has driven the green development of overseas investments.
- **The second section of the report** constructs the BRI Green Development Assessment System, quantitatively assesses the current status and potential of

green development in BRI countries, and shares key national and case studies to demonstrate the role of the Green Silk Road in promoting green transitions in BRI countries. It is divided into three chapters.

**Chapter 3: BRI Green Development Assessment System**

**This chapter constructs the BRI Green Development Index System.** Considering the comprehensiveness of index data coverage, the continuity of index data over time, the participation of countries in the BRI, and the relevance of bilateral economic and trade activities, the report selects 44 key countries for evaluation based on publicly available databases from international organizations such as the United Nations, World Bank, International Energy Agency, and Organization for Economic Co-operation and Development (OECD), selecting green development indicator data for these countries from the period 2010–2020. This forms a Green Development Index that includes three dimensions: economic, social, and environmental, with 22 specific indicators, creating a Green Development Index for each country.

**Chapter 4: Green Development Assessment of BRI Countries**

**This chapter evaluates the green development-related situations in BRI countries based on the BRI Green Development Index.** The results indicate that from 2010 to 2020, most countries achieved overall growth in their Green Development Index, with particularly significant improvements in the environmental and social dimensions, far exceeding the progress made before the BRI initiative was launched. In 2020, the average environmental dimension index of the evaluated countries increased by 1.32% compared to 2013, while the average green development index of the social dimension rose by 3.97%. The study also reveals that regional disparities remain significant, and the level of development in the economic dimension is notably lower than that of the social and environmental dimensions, constituting a key bottleneck in the green development of BRI countries.

**Chapter 5: Country-Specific and Case Analysis of the Green Silk Road**

**This chapter qualitatively analyzes the role of the Green Silk Road in promoting green and sustainable development in BRI countries through representative cases,** focusing on five key aspects: environmental governance, resource utilization, trade facilitation, gender equality, and health and well-being. These cases vividly illustrate that greenness is a defining feature of the BRI. China, as

an active advocate, strong driver, and ongoing contributor, works alongside other countries to coordinate economic and social development with ecological and environmental protection. Chinese projects, technologies, and concepts are gradually helping BRI countries achieve green transformation and sustainable development. The Green Silk Road unites people across countries in the shared pursuit of a better world.

- **The third section** (Chapters 6-13), based on the analysis of the first two sections and considering the development strategies, opportunities, and challenges faced by BRI countries, identifies eight key areas: biodiversity conservation, climate change response, green finance, sustainable ocean development, sustainable transportation, green energy transition, green technology innovation, and regulatory standards connectivity. It provides current situation analysis, future outlook, and cooperation recommendations for each of these areas. The report points out that many regions and countries have sensitive and fragile ecological environments, rich biodiversity, and complex landforms and geographical conditions, making it essential to address the relationship between infrastructure construction under the BRI and ecological and environmental protection. Biodiversity conservation, climate change response, and ocean protection are key areas for sustainable regional development, directly linked to the SDGs and core concerns for some BRI countries. At the same time, green finance, as an important tool to unlock the potential of green development, sustainable transportation and green energy as key industries, and green technology innovation and harmonized rules and standards as drivers and essential safeguards, all provide great potential and solutions for promoting the green and low-carbon transition of the BRI.

### Chapter 6: Biodiversity Conservation

**As a Chinese saying goes, all beings flourish when they live in harmony and receive nourishment from Nature.** Chapter 6 finds that the BRI regions are rich in biodiversity resources, but are also the most threatened areas in terms of biodiversity. The Global Sustainable Development Report 2023 shows that only 3.2% of BRI countries have achieved the SDG 15 for terrestrial ecosystems and biodiversity. An analysis of the progress of BRI countries in implementing the Aichi Biodiversity Targets finds that more than 70% of countries have not met the two targets of halving

the rate of loss of natural habitats and controlling invasive alien species.[5]。 The report suggests that the implementation of the Kunming-Montreal GBF is crucial for current biodiversity conservation efforts. Given the significant infrastructure development needs in BRI countries, there is a need to focus on the biodiversity impacts of projects, enhance the biodiversity conservation capacity of BRI countries, and secure long-term and effective financial support. Additionally, to achieve the Target 15 of the Kunming-Montreal GBF, it is essential to strengthen project assessments and natural environment-related information disclosure, thereby reducing the biodiversity impact of BRI projects. Looking ahead, it is recommended to further align international rules and standards, leverage the role of financial institutions to actively guide green investments toward biodiversity conservation or biodiversity-friendly projects, develop financial instruments for biodiversity conservation, and promote nature-based solutions to synergize biodiversity conservation with climate change mitigation.

## Chapter 7: Response to Climate Change

**In the face of global climate challenges, humanity lives in a community with a shared future where we rise and fall together.** In the context of global "carbon neutrality", addressing climate change has become the most pressing need for BRI countries to achieve the goals of the Paris Agreement and the SDGs. On the one hand, many BRI countries have fragile ecosystems that are highly sensitive to climate change. Over the past few decades, many BRI countries have experienced severe extreme weather events. On the other hand, some countries have relatively extensive development models featuring high energy and carbon intensity. The major challenges in the climate domain for BRI countries include vulnerability to climate change, a large proportion of carbon-intensive industries, high fossil energy consumption, rising overall carbon emissions, insufficient climate adaptation funds and technology, and the compounding effects of pollution control and climate challenges. Research finds that climate adaptation is a key focus for BRI countries in building a Green Silk Road. The report suggests that China and BRI countries conduct carbon market exchange and cooperation, including designing cross-border carbon trading mechanisms, cooperation practices, and product innovation research. Relying on the BRI Eco-Environmental Big Data Service Platform, a database of typical cases

[5] According to the analysis of the sixth national reports submitted by the Parties to the Convention on Biological Diversity, 22 countries were selected as the focus of this chapter's study, taking into account various factors such as biodiversity richness, significance, and data availability.

for the synergic practices for pollution reduction and carbon reduction should be established to promote the reserve and dissemination of green technology.。

## Chapter 8: Green Finance

**Finance injects sustained impetus into BRI development.** Chapter 8 emphasizes the critical role of green finance in advancing the Green Silk Road. Funding is the core concern and key solution for the international community to collectively address climate change and other challenges. For example, various estimates based on the Paris Agreement's emission reduction targets and key greenhouse gas emission sectors indicate that the global demand for funds to support green development could reach hundreds of billions or even trillions of dollars annually. The analysis indicates that in recent years, green finance policies and markets in BRI countries have shown rapid development; however, challenges remain in areas such as the construction of green finance policy frameworks, information disclosure, and financing costs. It is recommended to enhance innovative green financing cooperation platforms, such as the Green Investment and Financing Partnership (GIFP); align China's green investment standards with international norms; explore the establishment of project preparation mechanisms to reduce financing costs for green projects; strengthen the green finance capacity of BRI countries; establish green evaluation mechanisms for investment and financing activities; and encourage private capital to enter the BRI green investment and financing market, thereby leveraging more funds for green development in BRI countries.

## Chapter 9: Sustainable Development of Oceans:

**The ocean holds immense potential for mitigating climate change, conserving biodiversity, and providing abundant food.** Chapter 9 outlines the specific practices and challenges faced by BRI countries in marine biodiversity conservation, climate change adaptation in oceans, marine protected area development, marine plastic waste management, and green shipping, green ports, and marine fisheries. The analysis highlights that BRI countries face multiple challenges including marine environmental pollution, biodiversity loss, ocean acidification, plastic waste discharge, climate warming and sea-level rise, mangrove destruction, and overexploitation of natural resources. Promoting ecosystem-based integrated

ocean management can not only address a series of marine ecological issues but also yield significant economic benefits. However, analysis related to the SDGs shows that the ocean-related goal (SDG 14) is the least funded among the SDGs. Recommendations include promoting China's innovative experiences in the “Blue Circle” marine plastic waste management model and mangrove conservation, tapping into the ocean's potential as the largest active carbon sink and climate change regulator, and working together to promote sustainable development of oceans.

## Chapter 10: Green Transportation

**Building roads and railways creates prosperity in all sectors.** Chapter 10 focuses on the transportation sector, a critical area of BRI’s connectivity of infrastructure, and analyzes the prospects for green transportation cooperation in BRI countries. To stimulate economic growth, connect domestic and international markets, and enhance investment competitiveness, BRI countries prioritize transportation infrastructure development, demand for which is the strongest among all BRI industries. For instance, in Africa, a report by the African Development Bank indicates that inadequate infrastructure for roads, railways, and ports has increased the cost of trade between African countries by 30%-40%. Meanwhile, the transportation sector is also a key area for environmental impact and climate change mitigation, in which green and low-carbon trend is imperative. The analysis shows that green transportation projects, such as the Mombasa-Nairobi Standard Gauge Railway, the China-Laos Railway, the Cambodia Phnom Penh-Sihanoukville Expressway, the Peljesac Bridge in Croatia, Mombasa Port in Kenya, and Colombo Port in Sri Lanka, have helped BRI countries achieve simultaneous improvements in environmental, economic, and social benefits. However, it should be noted that as the demand for transportation development in BRI countries continues to rise, challenges such as funding shortages, the need for optimization of the transportation structure, persistent emission reduction pressures, and biodiversity protection still exist. The report suggests that China and BRI countries strengthen cooperation in green smart transportation infrastructure, new energy vehicle collaboration, and the promotion of multimodal transportation structures.

## Chapter 11: Green and Low-Carbon Energy Transition

**Energy transition has become central to global climate action and green**

**development.** Chapter 11 outlines the blueprint for green and low-carbon energy transition cooperation between China and BRI countries. From a regional perspective, ASEAN countries have set a collective target of reducing energy intensity by 32% by 2025 compared to 2005 levels, achieving a 23% share of renewable energy in total primary energy supply and a 35% share in total installed power generation capacity.[6] Over 90% of African countries have submitted their Nationally Determined Contributions (NDCs) under the United Nations Framework Convention on Climate Change, with 70% of countries having specific renewable energy targets and over 25% committing to net-zero emissions goals.[7] Strengthening energy transition cooperation can help these regions achieve the above goals and address the dual challenges of economic development and environmental protection. Looking to the future, it is recommended to continue strengthening policy dialogue on new energy cooperation between China and developing countries, identifying the policy, financial, and technological needs for green energy transition in developing countries; exploring innovative climate-friendly project financing mechanisms to reduce financing costs for renewable energy projects, accelerating efforts to bridge the green energy investment gap; focusing on industries that align with the needs of developing countries, such as electric vehicles, microgrids, and green manufacturing, encouraging more Chinese enterprises to increase foreign investment and cooperation, and promoting Chinese equipment, technology, and standards to contribute to the green and low-carbon energy transition of other countries.

## Chapter 12: Green Technological Innovation

**Scientific and technological innovation is the primary driver of green development.** Green and low-carbon technological innovation has become a crucial means to achieve a win-win situation between economic and social development and ecological and environmental protection. For example, most BRI countries are severely affected by climate change and urgently need to acquire climate change adaptation technologies from other countries. Chapter 12 assesses the significant role of technological innovation in advancing the Green Silk Road by systematically analyzing the technology needs submitted by various countries for climate change adaptation, identifying the priority technology needs for mitigation and adaptation in different countries and their distribution characteristics, thus providing a basis for

[6] ASEAN Plan of Action for Energy Cooperation 2016-2025 (APAEC). ASEAN Centre for Energy. November 2020.
[7] According to the national contributions (NDCs) submitted by African countries to the United Nations Framework Convention on Climate Change (UNFCCC).

China to strengthen climate technology cooperation with BRI countries. The analysis reveals that energy, green agriculture and forestry, water resources, transportation, and solid waste management are the five most urgent categories of green technology needs for these countries. In the future, these areas can be aggregated, relying on platforms like the “Belt and Road” Environmental Technology Exchange and Transfer Center (Shenzhen), innovating cooperation models for environmental technology exchange, promoting the exchange and transfer of environmental technologies, and ensuring cooperation across the entire chain of incubation, investment, collaboration, and transformation. At the same time, leveraging the digital economy to promote the diffusion of emerging green technologies can help realize the vision of empowering green development through innovation.

### Chapter 13 Connectivity of Green Regulations and Standards

**“Soft connectivity” of green rules and standards is an essential guarantee for the deep and fruitful advancement of the Green Silk Road.** Chapter 13 analyzes the progress in green rule and standard connectivity. Strengthening the “soft connectivity” of ecological and environmental laws, regulations, policies, and standards, actively promoting the alignment of environmental regulations and standards with BRI countries and integrating them with international standards and guidelines to establish high-level environmental rules and standards can effectively reduce the potential environmental impacts of project construction, gain recognition from the people of BRI countries, enhance the international image of Chinese enterprises, and exemplify the high standards, benefit for the people, and sustainability of the Belt and Road Initiative. This chapter proposes policy recommendations to strengthen mutual recognition of green and low-carbon standards, leverage demonstration projects to drive standard cooperation, and promote the implementation of high environmental standards through green finance.

### Chapter 14 Policy and Action Recommendations

The final chapter of the report looks to the future, analyzing the overall situation and development trends for advancing the Green Silk Road, and provides directional recommendations for policy and action. In September 2023, the SDG Summit adopted a political declaration aimed at accelerating the achievement of sustainable development. The commitment to sustainable development among nations remains strong, and green and low-carbon development has become mainstream consensus

and action. The global industrial system and supply chain are showing trends toward green transformation, technological innovation continues to provide new impetus, green finance is on the rise, and the opportunities for advancing the Green Silk Road outweigh the challenges, with limitless prospects and a promising future. It is recommended to promote deeper integration of the Green Silk Road with the UN 2030 Sustainable Development Agenda by creating high-quality signature projects and accelerating the implementation of small-scale yet impactful projects to support the green and low-carbon sustainable development of the BRI.

Greenness is an indispensable condition for ensuring lasting and sustainable development of humanity and an essential pursuit of a better life. The Chinese nation has always adhered to the natural view of "following the laws of nature and achieving harmony between humanity and nature" and practiced the ecological view of "fishing without a net, hunting without shooting at resting birds," tirelessly pursuing the harmony between humans and nature. Learning from the past to understand the future, China continues to work hand in hand with BRI countries, focusing on key areas such as green infrastructure, green ecology, renewable energy, eco-friendly transport, and green finance, making positive contributions to global sustainable development. Looking ahead, the second golden decade of the BRI has begun. The construction of the Green Silk Road will aim for high standards, sustainability, and benefits for the people, continue to align closely with the UN Sustainable Development Agenda, promote the green and low-carbon transformation of developing countries, enhance the global environmental governance system, actively address medium- and long-term climate change, and encourage countries worldwide to walk together on the road to prosperity, writing a new chapter in building a community with a shared future for humanity.

# Contents

# Section I Background

# Chapter 1 Research Background

## 1. An Irresistible Trend: Green and Low-Carbon Transition as Global Consensus and Collective Action

### 1.1 As Global Economic Recovery Stalls, Green Development Emerges as a New Growth Driver

Currently, the global economy continues to face challenges such as volatility, inflation, and geopolitical economic fragmentation, impacting growth rates, unemployment, trade, and foreign direct investment (FDI). The World Bank's Global Economic Prospects report from June 2023 warns of bleak economic prospects, especially for many emerging and developing countries. According to World Investment Report 2023 released by the United Nations Conference on Trade and Development in September 2023, global FDI declined by 12% in 2022 due to escalating geopolitical crises, surging food and energy prices, and soaring public debt, making 2022 the worst year for foreign investment since 2009, apart from the year 2020 when the world was mired in the COVID-19 outbreak.

Global economic growth remains slow and uneven. The International Monetary Fund (IMF) forecasts that in the coming years, the global economy will grow at an annual rate of around 3%, below the average annual growth rate of 3.8% over the past two decades. Disparities are also evident. On the one hand, growth in developed economies is stabilizing, while the pace at which developing countries are catching up with developed economies showing signs of slowing down. On the other hand, there are significant differences in the performance of emerging markets and developing countries. In terms of trade, global trade growth is sluggish, impacted by slow economic growth, rising trade protectionism, and economic fragmentation. The IMF analysis shows that the global trade volume of goods and services in 2023 grew by only 0.8%, far below the global economic growth rate.

However, new opportunities for global economic development are also emerging. The new paradigm of high-quality green development is rapidly advancing, creating millions of new jobs and expanding market size. According to the International Renewable Energy Agency (IRENA), investments in photovoltaic power generation, onshore wind power, and offshore wind turbines reached $500 billion in 2022, with

electric vehicle sales continuing to rise. The World Economic Forum recently mapped out trade and climate scenarios that by 2030, 15% of global trade will consist of low-carbon goods. New technologies are rapidly advancing at an unprecedented pace, with the "new manufacturing" industry and cutting-edge technologies injecting new vitality into future industries. A wave of disruptive products and technologies will reshape production, work, and lifestyle, while the integration of the green economy and digital economy is expected to unleash new momentum, leading to breakthroughs and development in the global economy.

China's green industries are becoming a key driver of economic growth. Since 2024, various international organizations have successively raised their growth forecasts for China's economy, with the IMF increasing its 2024 growth forecast for China to 5%, indicating that China's economy is demonstrating strong resilience and vitality.

### 1.2 Increasing Environmental and Resource Pressures Pose Severe Challenges for Climate Governance

The world is in the midst of a triple development crisis of climate change, biodiversity loss, pollution and waste. As population growth, urbanization, and industrialization continue to accelerate, all types of environmental impacts from resource use are on the rise. The Global Resources Outlook 2024, released by the United Nations Environment Programme (UNEP) in March 2024, identifies the growth in resource consumption as a major driver of the ecological crisis. For example, the extraction and processing of material resources (mainly fossil fuels, minerals, non-metallic minerals, and biomass) account for more than 55% of greenhouse gas emissions and 40% of the health impacts associated with particulate matter.

According to The UN Sustainable Development Goals Report 2023: Special Edition, of the approximately 140 targets that can be evaluated, half of them show moderate or severe deviations from the desired trajectory. Furthermore, more than 30% of these targets have experienced no progress or, even worse, regression below the 2015 baseline. Of the SDGs related to green development, SDG 7 (affordable and clean energy) is not progressing fast enough, and at the current rate, about 660 million people will still lack access to electricity by 2030, and nearly 2 billion people will still be dependent on polluting fuels and cooking technologies. SDG 13 (climate action) is

not being implemented at a pace and scale that is at all sufficient to effectively address climate change. Increasingly frequent and intense extreme weather events are already affecting every region of the planet. Emissions must be cut by nearly half by 2030, seven years from now. Although SDG 14 (life below water) has made some progress in expanding marine protected areas, combating illegal, unreported, and unregulated fishing, banning fisheries subsidies, and supporting small-scale fishers, the pace and scale of these actions are still insufficient to meet the target. Similarly, SDG 15 (life on land) has seen some advancements in sustainable forest management, protected areas, national biodiversity values, and natural capital accounting, but most of the progress remains limited.

The Global Risks Report 2024 released by the World Economic Forum notes that countries are struggling to cope with the impacts of record-breaking weather extremes and that the type, scale, and intensity of climate-related events that are already occurring are outstripping the efforts and resources that countries are able to mobilize to address climate change. Two-thirds of Global Risks Perception Survey (GRPS) respondents rank extreme weather as the top risk most likely to present a material crisis on a global scale in 2024. It is expected that the warming phase of the El Niño cycle will intensify and continue until May of this year. Almost all environmental risks ranked as the top 10 risks for the long term.

**(1) Climate Change Challenges Are Urgent**

The damage caused by extreme weather events associated with climate change is increasing by the day. Combating global warming is urgent, and the international community needs to face up to the challenge and takes immediate action to mitigate the effects of climate change. Since 1990 when the Intergovernmental Panel on Climate Change (IPCC) released its 1st Climate Assessment Report, global temperature records have been updated and extreme weather events around the world, ranging from floods and landslides to heatwaves and wildfires, have made climate change a real threat to the survival and development of humankind. In 2023, the world's average temperature reached its highest on record. Several regions in China experienced record heat waves and severe flooding. This year, the effects of climate change have become increasingly evident across the globe, from deadly heat waves in Asia and Europe to devastating floods in Pakistan and a multi-season drought in the Horn of Africa. According to State of the Global Climate 2022, the annual report

published by the World Meteorological Organization (WMO), extreme weather events, caused by a combination of greenhouse gases and El Niño, will worsen over the next few years, impacting food security and affecting millions of people.

Since the summer of 2024, the global "alert" for extreme heat has rung continuously. Record-breaking temperatures in many countries have been accompanied by frequent heat waves, droughts, floods, fires, and other disasters, which have caused varying degrees of environmental damage and property loss. High temperatures have also impacted production, life, and public health in various countries, dragging down local socio-economic growth and in turn affecting the process of world economic recovery. Globally, the economic losses caused by extreme weather events have significantly risen. According to a study, in 2022 alone, the global economic losses caused by all types of extreme weather events were worth about $264 billion, 23% higher than the figures from 2010 to 2014. A paper on the website of Nature, a renowned British journal, suggests that global supply chains amplify the economic costs of future extreme heat risks. A model analysis of the socio-economic impact of extreme heat shows that, due to the combined effects of health costs from extreme heat, the lost labor productivity, and the chain reaction of economic disruptions triggered by the supply chain, the cumulative rate of global economic loss is expected to reach between 0.6% and 4.6% by 2060, with supply chain disruptions having a more widespread impact, which would deal a severe blow to major manufacturing countries.

There is now a global consensus that fossil fuels such as coal, oil, and gas are the biggest contributors to climate change. The International Energy Agency (IEA), in its 2023 update to the Net Zero Roadmap by 2050, has reaffirmed that if the global energy system is to achieve net-zero emissions by 2050, there will be no need for new long-lead time upstream oil and gas projects, or new coal mines, in addition to those that have already been committed to in 2021. The COP28 Conference reached the historic UAE Consensus, agreeing on "transitioning away from fossil fuels in energy systems in a just, orderly, and equitable manner". A growing body of research suggests that there is no new room for fossil energy assets in future carbon budgets.

**(2) Slow Progress of Biodiversity Conservation**

The 2020 International Union for Conservation of Nature (IUCN) assessment shows that 41% of amphibians, 26% of mammals, and 14% of birds are threatened

globally and that the situation of generalized threats to global biodiversity continues to worsen. Globally, $44 trillion of economic output (more than half of global GDP) is moderately or highly dependent on biodiversity and its services. Yet a population of 7.6 billion people, representing only one ten-thousandth of the planet's total biological weight, is responsible for the loss of 83% of wild mammals and half of all plants.

The Global Assessment Report on Biodiversity and Ecosystem Services, published by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), states that since 1970, human activities have altered 75% of the terrestrial environment and 40% of the marine environment, and that the planet has lost 100 million hectares of tropical forests and 87% of wetlands; that a quarter of the world's terrestrial species are threatened with extinction. One-third of marine fish stocks are overfished. These will ultimately threaten sustainable human development.

The 6$^{th}$ (COP6) and 10$^{th}$ (COP10) meetings of the Conference of the Parties to the Convention on Biological Diversity (CBD) set global biodiversity conservation targets for 2010 and 2020, respectively. Despite the positive actions taken by the international community, the actual progress has been less than satisfactory. The loss of ecosystems, species, and genetic diversity is still ongoing, and the pressure on biodiversity has not decreased. As the host country for COP15, China has made significant efforts in global biodiversity conservation. During the first phase of the conference in October 2021, China announced the establishment of Kunming Biodiversity Fund (KBF) and adopted the Kunming Declaration. At the second phase of the conference in December 2022, the Kunming-Montreal Global biodiversity framework was approved, and the KBF was officially launched in 2024.

**(3) Slow Progress in Addressing Global Plastic and Air Pollution**

Currently, plastic pollution has become a global environmental pollution issue second only to climate change, posing a great challenge to global sustainable development. Plastic pollution in the oceans and other environments is characterized by trans-regional transfer, and no country or region is immune to it. In March 2022, the fight against global plastic pollution was top on the agenda of the second part of the 5$^{th}$ session of the United Nations Environment Assembly (UNEA 5.2), and the General Assembly adopted the Draft Resolution on Ending Plastic Pollution, which

proposes to start intergovernmental negotiations and strive to reach a legally binding agreement by the end of 2024. The Resolution was the most important international multilateral environmental resolution since the Paris Agreement.

A report released by the UNEP in 2021 shows that between 1950 and 2017, the world produced a cumulative total of about 9.2 billion tons of plastics, of which less than 10% were recycled, and about 7 billion tons became plastic waste. It is expected that by 2040, about 710 million tons of plastic waste will be discarded into the natural environment globally every year. The US magazine Science Progress warned that by 2050, there will be more than 13 billion tons of plastic garbage on Earth, and the blue Earth may become a "Plastic Planet".

Air Quality Guidelines (AQGs) of the World Health Organization (WHO) released new air quality standards in September 2021, lowering the guideline value for $PM_{2.5}$ from 10 μg/$m_3$ to 5 μg/$m_3$. IQAir's 2021 World Air Quality Report shows that only 3% of the world's cities and no countries as a whole have achieved compliance with the new WHO $PM_{2.5}$ standards.

### 1.3 Insufficient Green Transition Funding and Imbalanced Low-Carbon Investment Between Nations

While the ripple effects of climate change on social and economic stability are emerging, finance is becoming increasingly crucial in addressing climate change and mitigating its impacts. Finance is a cornerstone for implementing climate action and scaling up ambition, and has been a focus of the UNFCCC process and the Paris Agreement negotiations. The outcome of COP26 in 2021 reaffirmed the central catalytic role of finance in advancing the various global climate agendas. At the COP27 climate summit in 2022, climate finance was identified as one of the conference's four key themes, alongside climate mitigation, climate adaptation, and synergistic cooperation. At COP28 in 2023, the Loss and Damage Fund, focusing on helping developing countries that are most vulnerable to climate change, was successfully launched. Adequacy and predictability of climate finance are key to achieving the goals of the Paris Agreement. Currently, there is a lack of global funding in key areas of climate actions including mitigation, adaptation, and loss and damage. Developing countries are the biggest victims of climate change and relatively weak in their capacity to cope with climate change due to insufficient financial, technological and capacity-building support they receive. Developed countries bore

historical, legal, and moral responsibility for climate change, and at the 2009 UN Climate Summit in Copenhagen, developed countries had pledged to provide $100 billion per year in climate finance to developing countries, a commitment reaffirmed in the Paris Agreement, but regrettably, no substantive progress had yet been made.

The United Nations Conference on Trade and Development (UNCTAD), in its Least Developed Countries Report 2023, emphasized that the least developed countries (LDCs), which bear little responsibility for the climate crisis, are the most vulnerable to the impacts of climate change. In 2020, the least developed countries and regions account for 18 of the 20 countries and regions which are the most vulnerable and least prepared to cope with the impacts of climate change. It is difficult for LDCs and regions to leverage investment for adaptation action. Therefore, more fiscal space is needed for adaptation investment and financing to compensate for loss and damage caused by extreme weather events.

In addition, there is a significant imbalance in the scale of financial flows to both mitigation and adaptation, with only about one-fifth of total climate finance going to adaptation, and inefficient use of climate finance. The COP28's Global Stocktake (GST) Resolution predicts that developing countries will face a financing gap of $5.9 trillion by 2030. The resolution also emphasizes the financial needs of developing countries for climate change adaptation and clean energy investments. By 2030, it is projected that developing countries will need between $215 billion and $387 billion per year for adaptation funding, $430 million per year for clean energy investments, and $5 trillion per year thereafter, to achieve net-zero emissions by 2050.

Banks have taken steps to facilitate transition to net-zero emissions, but much more is needed to hit the desired target, with some major financial institutions continuing to provide huge sums of money to the fossil fuel industry, delaying the low-carbon transition to renewable energy. The Banking on Climate Chaos 2024, published by the Rainforest Action Network and Bankwatch, among others, found that by the end of 2023, eight years after the Paris Agreement was reached, a total of 60 banks around the globe had provided the fossil energy sector with $6.9 trillion in funding, with nearly half of that ($3.3 trillion) going to companies that are still expanding their fossil energy businesses. Meanwhile, 2023 saw a significant decline in fossil energy financing by major Chinese-funded banks, highlighting the global leadership of China's "dual carbon" goals and coal phaseout commitments.

Time is running out for global climate action. To achieve temperature control goals, banks and other financial institutions must use their leverage to drive energy system change. A significant increase in investment of renewable energy systems in developing countries is critical for the world to achieve its climate goals. According to World Investment Report 2023 published by the United Nations Conference on Trade and Development (UNCTAD), international investment in renewable energy has tripled since the adoption of the Paris Agreement, but most of the growth has been concentrated in developed countries. However, the financial needs for energy transition in developing countries are much higher than that in developed countries. To achieve their energy transition goals, developing countries need $1.7 trillion per year in renewable energy investment, but renewable energy projects in developing countries attracted only $544 billion in foreign direct investment in 2022, less than one-third of the total need.

In September 2021, China made a commitment to "stepping up support for other developing countries in developing green and low-carbon energy, and not building new coal-fired power projects abroad", emphasizing that accelerating the deployment of renewable energy and withdrawing from coal power projects are two indispensable pathways for the energy transition in developing countries. China has become a leader in renewable energy, with the clean energy sector contributing 40% of China's GDP growth in 2023. As the largest producer of wind and solar energy, China has invested almost as much in decarbonization infrastructure as the world has invested in fossil fuels. By building the Green Silk Road, China is cooperating extensively with developing countries in the field of green and sustainable development. China's technological advantages in new energy development and its strength in overseas investment can help developing countries realize the green energy transition faster.

According to the Energy Transition Investment Trends 2024, the research report published by Bloomberg New Energy Finance (BNEF), global investment in the low-carbon energy transition totaled a record $1.8 trillion in 2023, up 17% year-on-year. Although investments in clean energy are growing rapidly, they are still far from meeting the targets. To achieve net-zero emissions globally by 2050, energy transition investments need to average $4.8 trillion annually from 2024 to 2030-three times the actual investment total in 2023. Policymakers are urged to take decisive action to fully harness the momentum for transformative progress.

In its World Energy Investment 2024, released in June 2024, the IEA projected that global energy investment is set to exceed USD 3 trillion for the first time in 2024, with USD 2 trillion going to clean energy technologies and infrastructure, twice as high as investment in fossil fuels. The world is now investing almost twice as much in clean energy as in fossil fuels. Among it, China will account for the largest share of clean energy investment, with $675 billion, while Europe will account for $370 billion and the United States for $315 billion. More is being spent globally on solar photovoltaic (PV) than on any other power generation technology, with investment growing to $500 billion by 2024. However, there is a significant imbalance in investment, with emerging markets and developing economies (EMDEs) outside China accounting for only about 15% of global clean energy spending. Achieving the COP28 targets will require a doubling of global clean energy investment and a quadrupling of energy investment in EMDEs other than China by 2030.

## 2. Win-Win Cooperation: BRI as a New Model for South-South Cooperation

At present, global public issues are intertwined, and the systemic impacts of climate change and environmental degradation are evolving profoundly, highlighting the vulnerability of developing countries' public systems and governance capacities to multidimensional challenges. South-South cooperation has always played a crucial role in addressing global challenges. Through extensive cooperation among countries of the Global South in the political, economic, social, cultural, environmental, and technological fields, developing countries have been able to achieve their development goals by working together to share knowledge, skills, expertise, and resources.

Over the past 10 years since the inception of the BRI, China has signed BRI cooperation agreements with more than 150 countries and 30 international organizations, which has boosted investment of nearly $1 trillion. A total of 420,000 jobs have been created in BRI countries and 40 million people have been lifted out of poverty thanks to BRI-generated growth. China has also carried out extensive cooperation with developing countries in the field of green and sustainable development, setting a good example for South-South cooperation on a global scale.

### 2.1 Win-Win Cooperation Mechanism of the BRI

The world is undergoing momentous changes unseen in a century. It is moving

toward greater multi-polarity, economic globalization, digitalization and cultural diversity. Never before have the destinies of people in different countries been so closely connected. To respond to the call of the times, during his visit to Kazakhstan and Indonesia in the autumn of 2013, Chinese President Xi Jinping put forward the proposal of the Silk Road Economic Belt and the 21st-century Maritime Silk Road, which became known as the Belt and Road Initiative. The BRI covers both land and sea, straddles the East and West, connects the past and present, and is expected to benefit people in the generations to come. In the past 10 years, China has arranged more than 2,000 assistance projects in more than 120 BRI countries, set up over 80 economic and trade cooperation zones, stimulated investment of nearly $1 trillion, trained more than 100,000 talents in various fields, and lifted nearly 40 million people out of poverty.

According to the World Bank data, during the three-year COVID period (2019-2022), China's GDP, ranking second among the top five economies in 2022, grew from $14.28 trillion to $17.96 trillion, with an average annual growth rate of 7.95%. This growth rate surpassed that of the U.S., India, Germany, and Japan, the fastest among the five countries. This clearly showcases China's role as an engine of global economic recovery[8].

The BRI has brought additional resources to the Global South: according to the Global Development Policy Research Center (GDP Center) of Boston University, China's Development Finance Institutions (DFIs) provided approximately $500 billion from 2008 to 2021, with at least $331 billion during the BRI period from 2013 to 2021. More broadly, for Africa, DFIs from China offered $123 billion worth of financing from 2008 to 2021, with $91 billion during the BRI period. Additionally, Chinese businesses and other entities provided $30 billion to African governments from 2008 to 2021, with $23 billion provided during the BRI period.

Research indicates that, compared to traditional DFIs like the World Bank, which focus on systemic capacity building, China's overseas development finance places greater emphasis on industrial and infrastructure loans. Increasing evidence suggests that, unlike the World Bank loans, Chinese financing is more focused on driving economic growth, overcoming infrastructure bottlenecks, and expanding

[8]World Bank GDP data (current US$)
https://data.worldbank.org.cn/indicator/NY.GDP.MKTP.CD?end=2022&locations=1W&start=2019&view=chart

energy access[9].

At the same time, the BRI has boosted trade and investment ties between China and BRI countries and regions, fostering economic growth, industrial development, and job creation. From 2013 to 2022, the value of goods traded between China and BRI countries increased from $1.04 trillion to $2.07 trillion, with an average annual growth rate of 8%. In terms of bilateral investment, total investment between China and BRI countries exceeded $270 billion during the same period.

### 2.2 The Impact of China's Development Financing on the Global Economy

Globally, China's DFIs, namely, China Development Bank (CDB) and the Export-Import Bank of China (CHEXIM), have established partnerships with other DFIs through the BRI to provide development financing for projects around the world. These Chinese DFIs engage strategically with multilateral, regional, national, and local DFIs on a project-by-project basis, employing various cooperation models such as co-financing, sponsorship of regional funds, MoUs, and framework agreements. Broader cooperation mechanisms include the International Development Finance Club (IDFC) and the Multilateral Cooperation Center for Development Finance (MCDF). IDFC, which includes CDB, is a group of national and regional DFIs focused on aligning development financing with sustainable development goals and the Paris Agreement climate targets. MCDF, launched at the 1st Belt and Road Forum for International Cooperation in 2017, is a multilateral platform initiated by the Chinese Ministry of Finance in collaboration with eight multilateral development banks (including CAF, IDB, and the World Bank Group). MCDF has initiated a Southern Capital Fund and set overarching goals to address infrastructure bottlenecks and build development capacity. [10]

The main modalities of China's cooperation with multilateral development banks (MDBs) include the establishment of joint financing funds with large MDBs, a diversified portfolio of relationships with smaller MDBs, and the establishment of two new South-oriented global MDBs. [11]

First, China has focused on promoting co-financing arrangements between its DFIs and certain MDBs through the establishment of specific funds that operate on a

[9]Kevin P. Gallagher, William N. Kring, Rebecca Ray, Oyintarelado Moses, Cecilia Springer, Linzhu, Yan Wang. Maximizing Benefits and Minimizing Risks in the Tenth Year of the BRI [R].2023. https://www.bu.edu/gdp-cn/files/2023/10/GCI-Report-BRI-10-CH-FIN.pdf

[10] https://odi.org/en/insights/broadening-the-belt-and-road-chinas-new-fund-for-multilateral-cooperation/

[11] https://cdn.odi.org/media/documents/ODI_Report_-_China_MDB_Octoberupdate.pdf

market-oriented model. For example, the International Finance Corporation's (IFC) China-Mexico Fund, started in 2014 with $1.2 billion in capital, has so far successfully participated in a telecommunications project and an energy sector deal. In 2017, China Co-Financing Fund for Latin America and the Caribbean administered by the Inter-American Development Bank's (IDB) offered a syndicated loan for the Solem solar plant in Mexico. [12] While not DFIs, Chinese commercial banks have also collaborated with the IDB. This fund-based co-financing allows China to partner with MDBs and leverage its vast foreign exchange reserves to drive broader global development.

Second, China has actively engaged in collaborative projects with smaller regional MDBs in Africa, the Americas, and West Asia. For example, with the People's Bank of China (PBOC) participating as a non-borrowing shareholder, Chinese policy banks have extended credit lines to these smaller regional MDBs. Chinese DFIs also focus on partnering with traditional development organizations, particularly those from the global North. For instance, the China-Latin America and Caribbean Co-Financing Fund allocated $20 million as part of a co-loan with the German KFW Development Bank for the Eco-Business Fund, working with financial institutions in Latin America and the Caribbean to finance sustainable agriculture and other commercial projects. CDB has also signed a MoU with the French Development Agency (The Agence Française de Développement, AFD) to co-finance a water and sanitation project in Senegal, enhancing cooperation between the two development institutions. [13]Furthermore, China has actively promoted triangular financing arrangements, where two or more donor countries work in a third host country, potentially involving both global North and South partners. For example, the South-South cooperation component of the China-Zambia and China-Ghana renewable energy technology transfer (RETT) projects were funded by the Danish International Development Agency (DANIDA) and the UNDP. [14] This represents a new model of North-South-South tripartite cooperation built upon the previous North-South framework.

In addition, China's DFIs have pioneered South-South cooperation. With China

[12] 6https://www.bu.edu/gdp/files/2022/03/IAD-BU-CLAF-PB-2022.pdf

[13]https://www.afd.fr/en/actualites/communique-de-presse/cdb-and-afd-strengthen-their-strategic-and-operational-cooperation

[14] https://sustainabledevelopment.un.org/content/documents/29087Session_92_Zhang_Xian.pdf

https://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/tn_meetings/18e2ee898379443c85397bd1b3d210a4/ee99ac7846a44132b3bd6c3dca058c5a.pdf

as a major shareholder, the New Development Bank (NDB) and the Asian Infrastructure Investment Bank (AIIB) have increased the amount of globally available development finance managed by middle-income and BRICS countries.[15] In addition to spearheading Southern-led MDBs (including the smaller regional MDBs mentioned above), China has established two South-South funds. The aid-based South-South Cooperation Fund, managed by the China International Development Cooperation Agency (CIDCA), provided resources up to $3 billion to developing countries to achieve SDGs. China's South-South Cooperation Fund supports climate change mitigation and adaptation actions and green transformation in developing countries with a total of $3.1 billion. At the regional level, the Development Bank of Latin America (or Corporacion Andina de Fomento, CAF) held its annual high-level investment and cooperation forum with the Ministry of Finance of China before the COVID. [16] In Africa, China became a member of the African Development Fund (ADF) and the African Development Bank (AFDB) in 1985, and since then the AFDB has signed the MoU with Chinese policy banks. [17]

## 3. Sharing Opportunities: The Green Silk Road Supports Sustainable Development in the Global South

### 3.1 The Essence of Building the Green Silk Road

The Green Silk Road is based on the concept of ecological civilization and green development, adhering to the principles of resource conservation and environmental friendliness, and integrating green development and ecological environmental protection into all aspects and processes of the BRI construction. This includes: enhancing policy communication with the BRI countries as a starting point; upgrading the level of ecological and environmental governance to ensure the connectivity of facilities with the BRI countries; enhancing the greenness of production capacity cooperation to facilitate the smooth flow of trade with the BRI countries; improving the investment and financing mechanism to facilitate the financing flow with the BRI countries; strengthening international cooperation and exchanges on ecological and environmental protection to enhance mutual understanding with the BRI countries. These five aspects are expected to directly contribute to achieving green, low-carbon,

[15] https://www.bu.edu/gdp/files/2019/05/GEGI-WP-R-Ray-2019-Power-Weights-UPDATED.pdf

[16] https://www.caf.com/en/currently/news/2019/10/china-and-latin-america-and-the-caribbean-seek-to-deepen-their-economic-and-commercial-cooperation-amid-global-uncertainty/

[17] https://www.afdb.org/en/countries/non-regional-member-countries/china

and sustainable development in BRI countries.

This report defines the Green Silk Road as a scientific and ecological system that is supported by the concept of green development, based on the principles of joint consultation, joint construction, and shared benefits, and guided by the UN SDGs. It encompasses environmental governance, resource utilization, economic structure optimization, sustainable infrastructure development, the pursuit of equality and public health and social welfare. The Green Silk Road emphasizes achieving a sound balance between economic development, environmental protection, and social equity and welfare, aiming for coordinated development of the economy, society, and ecological environment in BRI countries.

The BRI, as a major initiative to promote the alignment of development strategies of the BRI countries through connectivity, has been recognized by the international community as one of the solutions to promoting the implementation of the sustainable development agenda. Leonid Lajčák, President of the 72nd Session of the UN General Assembly , observed that China is sharing its wealth and best practices through the BRI, thereby contributing to the implementation of the SDGs. UN Secretary-General António Guterres noted that the sustainable development agenda and the BRI share the same macro objectives of creating opportunities, bringing public goods that benefit the world, and facilitating global connectivity in many ways, including infrastructure development, trade, finance, policy, and cultural exchanges, leading to new markets and opportunities, and that the BRI is a tremendous catalyst for the implementation of the agenda.

### 3.2 China's Contribution to Global Environmental Governance

Over the past decade, China has acted on the idea that lucid waters and lush mountains are invaluable assets and has persisted with a holistic and systematic approach to conserving and improving mountain, water, forest, farmland, grassland, and desert ecosystems. This has led to historic, transformative, and comprehensive changes in the construction of ecological civilization and ecological and environmental protection. Significant progress has been made in building a Beautiful China. **In terms of environmental pollution control**, the average concentration of $PM_{2.5}$ in China's key cities has dropped by 57%, making China the country with the fastest rate of improvement in air quality in the world. The proportion of surface water sections with Grade I–III quality has reached 87.9%, approaching the levels

seen in developed countries. **In terms of ecological protection and restoration**, various types of nature reserves now cover about 18% of the nation's land area, and the 1st batch of five national parks, including the Three-River-Source National Park and the Giant Panda National Park, have been established. China has achieved a "dual growth" in forest coverage and stock volume for 30 consecutive years. About a quarter of the world's new green area has come from China since 2000, making it the country with the highest growth in global forest resources during the same period, and the newly-added forest stock volume has completed the 2030 target ahead of schedule. China has also taken the lead in efforts to achieve "zero growth" in land degradation and a "double reduction" in the area of desertification and sandy lands. **In terms of low-carbon transformation,** China has exceeded the 2020 climate action target ahead of schedule, with energy consumption and carbon emission intensity per unit of Gross Domestic Product (GDP) in 2023 declining by more than 26% and 35% respectively compared with that in 2012, making China one of the countries with the fastest decline in energy consumption intensity in the world. China has built the world's largest clean power generation system, with the installed capacity of hydropower, wind power, and solar power ranking first in the world. From 2013 to 2023, China achieved an average annual economic growth of 6.1% with an average annual energy consumption growth rate of 3.3%. The total installed capacity for renewable energy generation has surpassed 1.3 billion kilowatts, exceeding that of coal power. China leads the world in installed capacity for hydropower, wind power, solar power, and nuclear power under construction. These experiences can provide valuable insights for other countries in their green and low-carbon transitions and green economic development.

China's achievements in ecological and environmental protection have been widely recognized by the international community, and China has become an important participant, contributor, and leader in the construction of a global ecological civilization. China has firmly practiced multilateralism and striven to promote the building of a fair, sound, and win-win global environmental governance system in a bid to contributing to the sustainable development of mankind. China has also supplied 50% of wind power equipment and 80% of photovoltaic module equipment to the world, greatly reducing the global cost of renewable energy utilization and contributing greatly to global emission reduction. In leading the global biodiversity

governance process, China, as the host country, successfully organized the 15th meeting of the Conference of the Parties (COP15) to the Convention on Biological Diversity (CBD), which resulted in the historic, ambitious and balanced Kunming-Montreal Global biodiversity framework. This framework marks a new chapter in global biodiversity governance and has received broad international recognition. As one of the earliest signatories and ratifiers of the CBD, China's progress in biodiversity conservation exceeds the global average. The area designated as ecological protection redlines covers more than 30% of China's land area, and the populations of over 300 rare and endangered wild species are showing stable or increasing trends. China has taken the lead to invest 1.5 billion yuan for the founding of the Kunming Biodiversity Fund to support biodiversity conservation across developing countries.

### 3.3 Broad Demand for Green and Low-Carbon Development in BRI Countries

Research indicates that, based on the current NDCs under the Paris Agreement, BRI countries are expected to reduce $CO_2$ emissions by 3.2 billion tons annually by 2030, revealing significant potential. The Green Silk Road is committed to providing financial, technical, and capacity support to these countries, offering solutions for regional green climate action and sustainable development goals. To meet climate targets, BRI countries will need to further reduce emissions by approximately 8 billion tons beyond current efforts and achieve deep decarbonization across their economies, especially in the energy sector, under a 2°C global warming scenario.

As of July 2022, a total of 100 BRI countries have set net-zero emission targets, accounting for 73% of the 137 countries and regions globally with such goals, and 66.7% of the 150 BRI countries. Developing countries in Southeast Asia, Africa, and Latin America face dual challenges of development and climate change while experiencing economic transitions and post-COVID green recovery, creating immense demand for infrastructure and industrial development. For instance, ASEAN countries have set an overall emissions reduction target of 32% by 2025 relative to 2005 levels and aim for renewable energy to constitute 23% of total primary energy supply and 35% of total installed power capacity. Over 60% of electricity projects in Southeast Asia involve foreign participation. Historically, overseas investment has focused on fossil fuels, but recent years have seen increased investment in renewable

electricity, particularly hydropower. China's renewable energy investments in Southeast Asia are primarily in hydropower and PV, with hydropower concentrated in Cambodia, Laos, Vietnam, and Myanmar, and PV investments mainly in Vietnam, the Philippines, and Malaysia. By the end of 2020, Vietnam ranked third globally for new PV installations, becoming a major PV market in Southeast Asia. In Africa, over 90% of countries have submitted NDCs under the United Nations Framework Convention on Climate Change (UNFCCC), with 70% setting specific renewable energy targets and over 25% committing to net-zero emissions. South-South cooperation can support these regions in addressing dual challenges. For example, in 2021, China's investments in Southeast Asia, Africa, and Latin America totaled $50.88 billion, representing 33.1% of China's overseas investment that year.

China has made significant strides in green, low-carbon, and sustainable infrastructure projects, including the China-Pakistan Economic Corridor, the China-Laos Railway, the Mombasa-Nairobi Railway, and overseas wind and solar power projects. China leads the world in sustainable energy use and is the largest market and equipment manufacturer for renewable energy. The Chinese PV industry supplies over 70% of global components. In the field of new energy vehicles, each vehicle is estimated to reduce carbon by about 1.66 tons annually, with China exporting 1.203 million new energy vehicles in 2023, potentially cutting emissions by around 2 million tons per year. A 2022 paper in Nature estimated that from 2008 to 2020, the global PV module supply chain in which China is the biggest player helped save $24 billion for the U.S. and $7 billion for Germany in PV installations respectively.

China's clean energy industry and technology are thriving across BRI countries, becoming a major driver of global energy transition. In 2020, renewable energy investments in BRI countries surpassed those in fossil fuels for the first time, with cooperation in solar, wind, hydro, and thermal energy spanning over 100 countries. Investment in coal projects (including coal power and coal mines) has been declining since peaking in 2015, reaching zero in the first half of 2021.

## 4. Synergistic Effect: Green Silk Road and the UN 2030 Agenda for Sustainable Development

The Sustainable Development Goals (SDGs) adopted by the United Nations in

2015 have led the international community into a new stage of sustainable development. As a shared vision for global development, approximately 52.9% of the overall goals and 14.2% of the sub-goals in the SDGs are related to environmental protection. The Sustainable Development Goals Report 2023: Special Edition, released in 2023, is the official United Nations report monitoring progress on the UN 2030 Agenda for Sustainable Development. The report shows that the combined impacts of climate change, global economic downturn, and other factors have seriously hindered the course of achieving the SDGs. In face of the new situation, the international community needs to build a consensus on global cooperation for development and bring the implementation of the SDGs back on track.

The launch of the UN 2030 Agenda for Sustainable Development ushered in a new era of sustainable development for the international community. The BRI cooperation in green development aligns well with China's eco-environmental conservation and the overall global trend of sustainable development. The BRI supports and complements the 2030 Agenda in terms of concepts, principles, and goals. By synergistically advancing the BRI cooperation in green development and the 2030 Agenda for Sustainable Development, an important path has been carved for regional sustainable development, helping prevent the developing countries from following the development path of "pollute first, clean up later" and making the BRI a crucial initiative for global eco-civilization as well as for a green community with a shared future for mankind.

The Progress Report on the Belt and Road Initiative (BRI) in Support of the UN 2030 Agenda, released by the UN Department of Economic and Social Affairs (UNDESA) in September 2022, highlights the key role of BRI in accelerating the implementation of the 2030 Agenda for Sustainable Development. In supporting the implementation of the 2030 Agenda, the BRI provides momentous opportunities, and makes practical efforts and progress to contribute to the achievement of the SDGs. The UN Secretary-General has repeatedly emphasized that sustainable development is the shared and primary goal of both the 2030 Agenda and the BRI. The 2030 Agenda and the BRI strive to create opportunities, provide global goods, and enhance cooperation, aiming to deepen the interconnection and integration among countries

and regions in infrastructure, trade, finance, policy, and people-to-people ties.

Green Silk Road is closely related to SDG 7 (clean energy), SDG 9 (sustainable infrastructure), and SDG 17 (revitalize the global partnership for sustainable development), impactfully supporting the fulfillment of the UN 2030 Agenda for Sustainable Development in BRI countries. Green Silk Road, through integrating green development and ecological protection into all aspects and the entire process of the BRI, greatly helps BRI countries realize the environmental targets set by the 2030 Agenda, and brings important opportunities for the sustainable development of those countries. The UNSDG Index and Dashboards Report shows that from 2016 to 2022, the SDG index of BRI countries such as Pakistan, Cambodia, Laos, Myanmar, Bangladesh, Nepal, and Ethiopia all significantly improved.

The UN Secretary-General points out three major opportunities in synergizing the BRI and the SDGs: firstly, the world will benefit from the BRI which accelerates the SDGs implementation. The UN Country Teams stand ready to support member states in capacity and governance building, and to harmoniously and sustainably incorporate BRI projects into their national economies and societies based on their national development plans aligned with the 2030 Agenda. Secondly, the world needs to harness the BRI to help bridge the considerable financing gap in accomplishing the SDGs, particularly in developing countries, whose infrastructure investment need totals about $1 trillion. Thirdly, the BRI provides an essential space where green principles can be realized through green actions.

In recent years, the financing gap for infrastructure and climate-related developments in the Global South has been widening. In order to achieve the SDGs by 2030, an additional $1.4 trillion per year or 2% of global GDP is needed for key infrastructure investments, and approximately $700 billion per year in climate financing is needed to realize net-zero emissions by 2050. [18][19]

China is pitching in all the necessary efforts to fill these gaps. Through the BRI, various Chinese financial and economic institutions, including Chinese Development and Financing Institutions (DFI), commercial banks, government entities as well as

[18] https://www.foundations-20.org/wp-content/uploads/2019/06/F20-report-to-the-G20-2019_Infrastrucutre-Investment.pdf

[19] https://www.bu.edu/gdp/2022/03/17/testimony-before-the-us-china-economic-and-security-review-commission-chinas-energy-plans-and-practices/

companies, have been working together to offer goods, services, and financing for infrastructure projects around the world. Furthermore, China has also pledged to provide more green finance and shift overseas investments away from fossil-fueled heavy industry. [20] Despite China's tremendous efforts, the BRI alone cannot fill the infrastructure and climate financing gap to achieve the SDGs. This gap necessitates mobilizing considerable capital from domestic, international, public, and private sources.

Over the past decade, the global ecosystem of economic cooperation aimed at realizing the SDGs in the Global South has continued to grow and expand. Through the BRI, China's financial and economic institutions are now participating in the global economic ecosystem through multilateral and bilateral North-South cooperation as well as bilateral South-South cooperation mechanisms, upon which the reach and impact of the BRI are expected to be further expanded and strengthened.

Western countries have recently proposed their new initiatives to repackage and strengthen its bilateral approach to addressing the problem of infrastructure and climate financing gap. The Build Back Better World (B3W) initiative spearheaded by the United States and the Global Gateway (GG) initiative led by the European Union include a set of financial and economic institutions that can complement BRI activities and enhance participation. The BRI, B3W, and GG should cooperate, coordinate, and complement each other, jointly promoting the fulfillment of SDGs.

## 5. Research Innovation

This report systemically and scientifically presents and evaluates the current state of green development in BRI countries from a global and forward-looking perspective while envisioning the prospects for the Green Silk Road. It outlines the direction and blueprint for BRI cooperation in green development. The main contents of this research include: 1. A systematic review of the progress made in building the Green Silk Road since the inception of the BRI; 2. An account of the Green Development Index and evaluation methodology for BRI cooperation in green development to evaluate the current status and potential for green development in BRI countries; 3. Challenges, opportunities, and key areas of focus for the green development of the

[20] https://www.sciencedirect.com/science/article/pii/S2452292922000054

BRI based on the evaluation results,; 4. Assessment of the support of Green Silk Road to the green development of BRI countries in the key countries and sectors selected by leveraging thematic partnerships within the BRIGC and using case studies and scenario analysis; 5. The prospects and directions for cooperation in building the Green Silk Road, and policy recommendations as well as priority actions to enhance the green development of the BRI.

Built upon the evaluation methodologies of the UN Sustainable Development Report and the Yale Environmental Performance Index, the BRI Green Development Assessment System established in the report emphasizes the role of green and low-carbon transformation in driving economic and social development while balancing economic development with social development, exploring a new sustainable development model in which green and low-carbon transitions drive economic and social advancement..

The research results and policy recommendations highlighted in the report can serve as decision-making references and directional guidance for governments, financial institutions, and businesses alike in their efforts to understand and meet BRI countries' needs for green development and to promote the global cooperation in ecosystem and climate. Simultaneously, they will serve as a reference for BRI countries in promoting green development in key sectors of their own.

The research framework of the report is as follows.

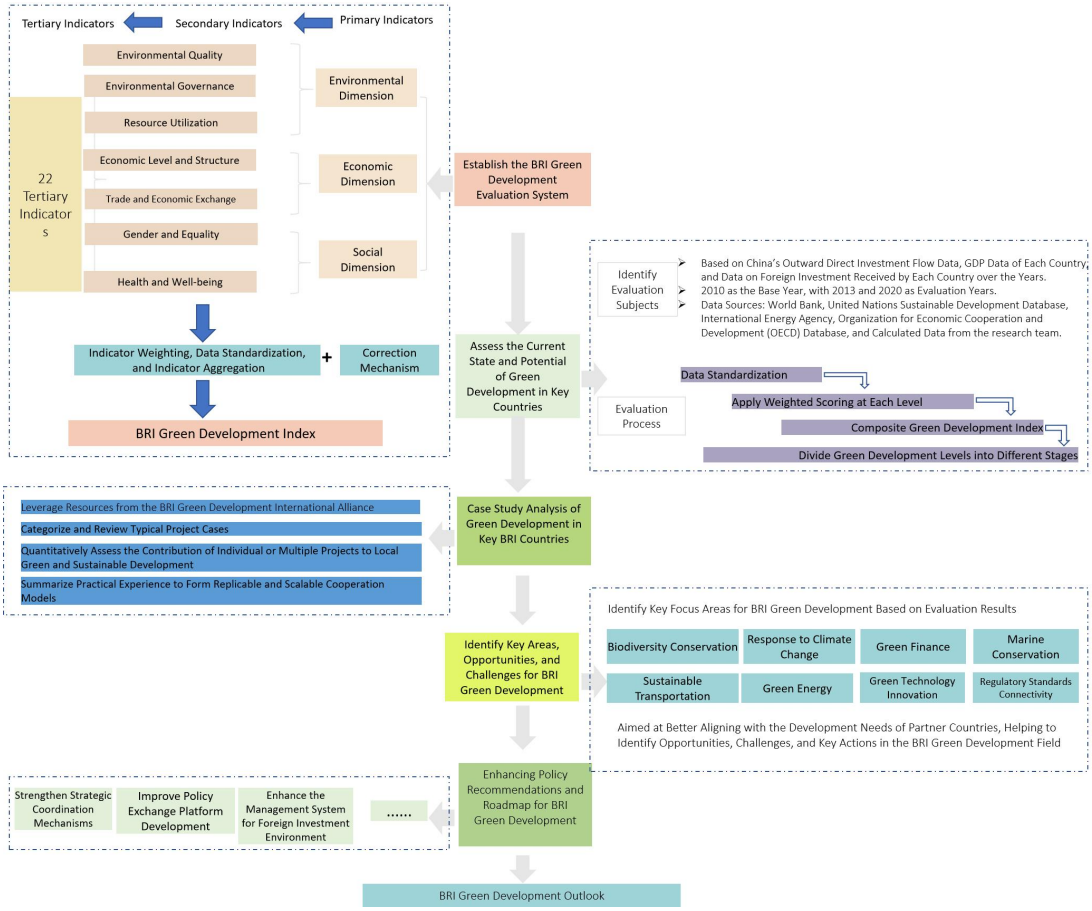


**Figure 1.1 Research Framework**

# Chapter 2 Progress in the construction of the Green Silk Road

Over the past decade, the Belt and Road Initiative has developed into an open and inclusive platform for international cooperation and a well-received global public good. The initiative has shown great vitality and broad prospects for development, providing a strong impetus for developing countries to participate in and improve the global governance system. From 2013 to 2022, China's trade in goods with countries along the Belt and Road has increased from $1.04 trillion to $2.07 trillion, an average annual growth of 8 percent, and the total trade volume has exceeded $13 trillion.[21,22] Two-way investment between China and countries along the Belt and Road has exceeded $270 billion, and Chinese companies have invested $57.13 billion in overseas economic and trade cooperation zones in these countries, creating 421,000 local jobs. Moreover, in the field of investment in green industries, especially the renewable energy industry, China has about 70 percent of the production capacity of the global photovoltaic industry chain, such as silicon, silicon wafers, cells and modules, and 40 percent of the global supply capacity of the wind power industry chain, which means China has comprehensive advantages in the wind power and photovoltaic industry chain. In 2020, the proportion of China's investment in renewable energy (hydropower, photovoltaic, wind and biomass) in the total energy investment of BRI partner countries will exceed that of fossil energy for the first time. The Belt and Road Initiative has been recognized by the United Nations as one of the solutions to promote the implementation of the Sustainable Development Agenda.

At the same time, positive progress has been made in the construction of the Green Silk Road. China has strengthened the cooperation on ecological and environmental protection along the Belt and Road and built international consensus on green developmen by issueing a series of policy documents, has strengthened the ecological and environmental protection services and decision-making support for BRI relevant parties by establishing environmental knowledge and information platforms, has strengthened the cooperation on eco-environmental protection projects along the Belt and Road, by building platforms for technology exchange and transfer, has jointly built national capacity for environmental protection, by fulfilling its

[21] https://www.xinhuanet.com/politics/2023-03/02/c_1129409370.htm
[22] https://www.gov.cn/xinwen/2022-09/14/content_5709753.htm

international responsibility to address climate change, and has promoted its green development in overseas investment by promoting ecological and environmental management.

## 1. Institutional framework design

Since 2013, the Chinese government has issued a series of policy documents to continuously strengthen the Belt and Road ecological and environmental protection work. For example, in 2013, it issued the Guidelines on Environmental Protection in Overseas Investment Cooperation, requiring enterprises to conduct pollution prevention and control work in accordance with the environmental protection laws, regulations and standards of host countries, and discharge pollutants in accordance with the emission standards of host countries and reduce the adverse impact on local biodiversity. In 2015, China issued the Vision and Actions for Promoting the Silk Road Economic Belt and the 21st Century Maritime Silk Road, which clearly calls for highlighting the concept of ecological civilization in investment and trade, strengthening cooperation on ecological environment, biodiversity and climate change, and jointly building a Green Silk Road. In 2017, China issued the Belt and Road Cooperation Plan on Ecological and Environmental Protection and the Guiding Opinions on Promoting Green Belt and Road Construction, which set out the major tasks and roadmap of green Belt and Road construction in detail. In 2018, the Guidelines on Compliance Management of Overseas Operations of Chinese Enterprises were issued, which further clarified that Chinese enterprises should ensure full process and all-round compliance in foreign trade, contract projects and daily operations, and put forward specific requirements for enterprises to do a good job in environmental protection. From 2021 to 2022, China has issued the Guidelines on Green Development in Overseas Investment Cooperation, the Guidelines on Ecological and Environmental Protection of Overseas Investment Cooperation Projects and the Opinions on Strengthening Environmental Management of Overseas Projects under the Belt and Road Initiative, providing guidelines for overseas investment cooperation and environmental management of overseas projects under the Belt and Road Initiative. In addition, in 2021, China will issue top-level documents such as the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of the 2035 Vision Goals, Opinions on Fully, Accurately and Comprehensively Implementing the new

Development Concepts to Achieve carbon Peaking and carbon Neutrality, Action Plan for Carbon Peaking before 2030, and Opinions on Further Strengthening Biodiversity Conservation. Promoting green Belt and Road construction will be an important part of the document. The Opinions on Jointly Promoting Green Development of the Belt and Road has been issued in 2022, setting out the overall requirements for promoting green development under the Belt and Road Initiative in the next stage.

**Box 2.1 Opinions on Jointly Promoting Green Development of the Belt and Road**

On March 28, 2022, the National Development and Reform Commission, the Ministry of Foreign Affairs, the Ministry of Ecology and Environment and the Ministry of Commerce of China jointly issued the Opinions on Jointly Promoting Green Development of the Belt and Road (hereinafter referred to as the Opinions). The Opinions put forward 15 specific tasks in three areas: promoting cooperation in key areas of green development, promoting green development of overseas projects, and improving the support and guarantee system for green development, covering key areas such as green infrastructure connectivity, green energy, green transportation, green industry, green trade, green finance, green science and technology, green standards, and addressing climate change.

The Opinions call for deepening cooperation on green and clean energy and promoting the green and low-carbon transformation of international energy cooperation. China will encourage solar power and wind power companies to "go global" and promote the establishment of a number of green energy best practice projects. China will strengthen international cooperation in green transport and help BRI partner countries develop green transport. China will actively promote the low-carbon development of international shipping and aviation. China will promote energy-efficient and low-carbon means of transport such as new and clean energy vehicles and ships, and promote the Chinese plan for intelligent transportation. China will encourage enterprises to invest and cooperate in new energy industries and new-energy vehicle manufacturing, and promote green and low-carbon development of enterprises that "go global". China encourage enterprises to set up equity investment funds focusing on green and low-carbon fields overseas, and flexibly carry out investment cooperation in green industries through various means.

The "Opinions" stressed that the overseas environmental behavior of enterprises should be regulated. Promoting green and low-carbon development of coal power and other projects. China will stop all new overseas coal power projects, and prudently promote overseas coal power projects under construction. China will promote the green and low-carbon development of overseas coal power projects, encourage relevant enterprises to strengthen the clean and efficient use of coal, adopt advanced technologies such as efficient desulfurization, denitrification, dust removal and carbon dioxide capture, utilization and storage, and upgrade energy conservation and environmental protection facilities. And China will study and promote the green and low-carbon development of international cooperation in the steel and other industries.

## 2. Building dialogue platforms

With the gradual progress of the Belt and Road Initiative, the construction of a Green Silk Road has been echoed by more and more international partners. Over the past decade, communication platforms and cooperation mechanisms for green development have been continuously improved. During the Second Belt and Road Forum for International Cooperation, Chinese and foreign partners jointly launched the BRI International Green Development Coalition, which now has 152 partners from 43 countries. In April 2019, China and relevant countries jointly launched the Belt and Road Energy Cooperation Partnership, which has become the first China-initiated international cooperation platform in the energy sector and now has 33 member countries. The National Development and Reform Commission of China, the United Nations Habitat Programme, the World Health Organization and the Energy Foundation jointly launched the Belt and Road Sustainable Cities Alliance, and held four successive international High-Level forums on Sustainable Urban Development.

China has also made full use of existing international and regional cooperation mechanisms and actively participated in activities such as the United Nations Environment Assembly and the China-CEEC Ministerial Meeting on Environmental Protection Cooperation to share China's ideas, practices and achievements on ecological civilization and green development. China has held more than 70 exchange events on the theme of green Belt and Road under the aegis of World Environment Day, the UN Climate Action Summit and the China-Asean Forum on Environmental

Cooperation, and held more than 20 seminars each year on biodiversity conservation, climate change response and eco-friendly cities, attracting more than 800 participants from BRI partner countries and regions. In addition, China has actively promoted the Green Silk Road Envoys Program and the Belt and Road South-South Cooperation Program on Climate Change to train more than 3,000 officials and technicians in the field of environment and climate for more than 120 developing countries, strengthened communication and cooperation with Belt and Road participating countries, and promoted international consensus on jointly building a green Belt and Road. China has also actively promoted multilateral and bilateral green exchanges and cooperation with BRI partner countries under the frameworks of the United Nations and the G20, and built important platforms for the participation of relevant government departments, international organizations, research institutes and enterprises.

**Box 2.2 the BRI International Green Development Coalition**

The Belt and Road Initiative Green Development Coalition (Green Coalition) was initiated by President Xi Jinping at the first Belt and Road Forum for International Cooperation and co-founded by Chinese and foreign cooperation partners at the second Belt and Road Forum.

As of August 2023, the Green Coalition has 152 partners from 43 countries, including the environmental authorities of 26 BRI partner countries, and has become the first international social group under the framework of the Green Silk Road. The Green Coalition aims to build a multilateral international cooperation platform to promote policy dialogue and communication, knowledge and information sharing, and green technology exchange and dissemination under the Belt and Road framework, and promote international consensus, cooperation and sharing, and joint actions for green development along the Belt and Road.

So far, the Green Coalition has held more than 70 symposiums such as the Belt and Road Green Innovation Conference, released more than 20 policy research reports such as the Belt and Road Green Development Guide, and jointly launched the international communication project of the Green Silk Road with the Belt and Road Media Communication Alliance.

## 3. Knowledge and information support

In the field of ecological and environmental protection, China has promoted the construction of the Belt and Road ecological and environmental protection Big Data service Platform (Big Data Platform). Up to now, it has collected basic environmental information, management systems, laws, regulations and standards of more than 60 BRI partner countries, as well as more than 200 indicators published by more than 30 authoritative international platforms. It has completed the integration of global indicators on atmospheric environment, biodiversity, water resources and water environment, providing decision-making support for governments and enterprises in their overseas investment and cooperation. The big data platform brings together cases of green development under the Belt and Road Initiative to systematically showcase the practice and experience of Chinese enterprises in implementing the concept of ecological civilization overseas. In the field of corporate practice, the Mombasa-Nairobi railway built by Chinese companies has left a green mark of the Belt and Road Initiative in Africa, the Karot Hydropower Station in Pakistan has become a green example of high environmental standards, and the new container terminal project in Ghana has set a green benchmark for biodiversity conservation. In the field of energy, the Belt and Road Energy Cooperation Partnership has released a number of outcomes, including best practices for international energy cooperation. In the field of urban sustainable development, the Belt and Road Sustainable Cities Alliance has released the Consensus on Green Urbanization, formed a series of research reports, and shared China's experience and cases of urban sustainable development with 190 participants from 27 BRI partner countries.

**Box 2.3 Big Data service platform for Eco-environmental protection under the Belt and Road Initiative**

On April 25, 2019, at the Green Road Sub-Forum of the Second Belt and Road Forum for International Cooperation, the portal of the Belt and Road Ecological and Environmental Protection Big Data Service Platform (referred to as the Big Data Platform) was officially launched and included in the list of outcomes of the Second Forum for International Cooperation.

In accordance with the principle of extensive consultation, joint contribution and

shared benefits in the Belt and Road Initiative, the Big Data platform focuses on the requirements of international ecological and environmental protection cooperation such as green economy, digital economy, carbon peaking, carbon neutrality and green transformation under the dual-cycle pattern in China and overseas. It aims to provide public goods forBRI partner countries, provide industry authorities with decision-making support information related to the Belt and Road, and provide environmental risk assessment and consulting services for investment enterprises and financial service institutions along the Belt and Road.

At present, the big data platform has formed a business structure including portal website in Chinese and English, mobile application (APP), Belt and Road comprehensive information database, "One map" comprehensive decision support system, green industry and technology database, etc. With the help of the big data platform expert committee mechanism of government-industry-university-research linkage, It carries out annual reports and quarterly reports research as public information products and comparative analysis on specific topics, as well as consulting services on overseas investment.

In the future, the big data platform will make full use of its own resources and those of all parties in the cooperation network to serve the needs of Green Belt and Road construction and "going global", develop more digital tools and information consulting services, and deepen research and technology development in thematic fields. It will provide more digital empowerment forBRI partner countries and relevant cooperation institutions to promote climate change and green infrastructure construction, strengthen international cooperation on green and low-carbon technologies related to the green Belt and Road, and play a better technical support role in promoting global environmental governance and climate change.

## 4. Technology exchange and transfer

Scientific and technological innovation is an important breakthrough for achieving green and low-carbon development. In the context of addressing the two major challenges of global energy security and climate change, it has become a broad consensus of the international community to vigorously develop clean energy. As the world's largest clean energy market and equipment manufacturer, China has put in

place a relatively sound industrial and supply chain system for clean energy equipment. In particular, the clean energy equipment industry represented by wind power and nuclear power has achieved leap-forward development, providing strong driving force for high-quality Belt and Road cooperation. As a key area of Belt and Road cooperation, over the past decade, China has vigorously promoted green energy equipment, technologies and services to "go global" by strengthening overseas investment in green energy, environmental technical assistance and cooperation, and contributed to the green energy transformation of countries and regions. In 2022, China's exports of wind power and photovoltaic products will reduce carbon dioxide emissions in other countries by about 570 million tons, or 2.83 billion tons in total, accounting for about 41 percent of the world's converted carbon emissions reduction from renewable energy in the same period.[23] At the same time, China has cooperated with more than 100 countries in the fields of solar power, wind power, hydropower and thermal energy, injecting strong impetus into the accelerated transformation of China's energy supply to an efficient, clean and diversified direction.

China has continued to promote the construction of environmental technology exchange and transfer bases, innovated cooperation models, promoted environmental technology exchange and transfer, encouraged Chinese technologies and services to take root in BRI partner countries, and built the Belt and Road environmental technology exchange and transfer Center to open up the whole chain of incubation, investment, cooperation and transformation, with business covering more than 60 BRI partner countries. To be specific, first, a platform for centralized technology exchange and sharing has been built. China has held four Belt and Road Green Innovation conferences at a high level to promote policy, technology and knowledge sharing among BRI partner countries and regions, and invited more than 600 officials, experts and business representatives from more than 20 countries or regions to the conference. China has held two Short video competitions on Belt and Road Green Development Stories, collecting more than 400 works from more than 20 countries, which have been transmitted more than 200 million times. Green transportation, clean energy, water resources protection and other "small but beautiful" stories that benefit people's lives have been widely disseminated and attracted attention. Second, a centralized technology transfer service system has been established. China has organized three

[23] http://www.creei.cn/web/content.html?id=5707

Green Industry Innovation and Entrepreneurship Competitions, collected 800 green technologies in China and overseas, and assisted more than 30 technologies in financing and promotion. It has set up eight overseas liaison offices in Laos, Indonesia and Russia, and held more than 50 technical matchmaking meetings on special topics. It has carried out studies on 22 national policy systems of BRI partner countries, and set up the "Guangdong-Hong Kong-Macao Greater Bay Area International Zero Carbon Service Center" to provide zero-carbon solutions for export-oriented enterprises. Third, to build a matrix of technology transfer demonstration projects. China is carring out technology transfer work in clean energy, green transportation, pollution prevention and control, and environmental monitoring, and realize the implementation of such projects. In terms of education and training, China has built the "Vientiane Sesserta Environmental Vocational Education Base" to provide a platform for China's ecological civilization concept to go global. In the field of green transportation, it has helped Tailing Technology Group and Thailand's National Energy Technology Center to cooperate in the demonstration project of "replacing oil with electricity" for motorcycles. In the field of pollution prevention and control, together with Shenzhen Energy and Environmental Protection Co., LTD., Tailing provided sewage treatment and sludge incineration system operation and maintenance services for the 500,000-ton Dasher Gandhi Sewage treatment Plant in Bangladesh (the first modern large-scale sewage treatment plant in Bangladesh), effectively solving the domestic sewage treatment problem of 5 million residents in Dhaka. In the field of clean energy, China support Shenzhen Xiangyang New Energy Technology Company in implementing the educational pilot project of solar media in Kenya and building a factory in Ethiopia, helping clean energy "light up" Africa. In the field of environmental monitoring, China assisted Shenzhen Chimelong Company to carry out the pilot application of water quality monitoring technology and equipment in Dhaka City Water Supply and Sewage Management Bureau in Bangladesh, which was highly praised by Bangladesh side and reached follow-up business cooperation.

**Box 2.4 Cases of green and low-carbon technology cooperation between China and other BRI partner countries**

Renewable energy cooperation projects between China and other BRI partner

countries have not only boosted local economic and social development, but also brought advanced green and low-carbon technologies. Take Pakistan as an example. Punjab is a large province with the most developed industry and agriculture, with a population of over 100 million. However, electricity supply has always been very tight, which has seriously affected people's lives and hindered economic development. To this end, China's ZTE Energy invested in the construction of 900 MW photovoltaic ground power plant project in Bahawalpur Photovoltaic Park in Punjab Province. The project was officially launched in May 2015, and the first phase of 300MW was officially connected to the grid in June 2016. The completion of the project directly met the electricity demand of about 280,000 local households. Compared with traditional thermal power generation, the photovoltaic power station can reduce coal consumption by nearly 170,000 tons, equivalent to nearly 400,000 tons of greenhouse gas emissions.[24]

At the same time, Chinese enterprises have also provided technical support to jointly build the country's traditional industries for green transformation. Take the Serbian Steel plant project of HBIS, formerly known as Smederevo Steel Plant, as an example. In April 2016, China HBIS Group Co. LTD signed a contract with the Serbian government to buy the Smederevo steel mill for 46 million euros and changed its name to "HBIS Group Serbia Iron & Steel Company". After the acquisition, HBIS Group conducted in-depth diagnosis and analysis of the original equipment of the steel mill, formulated solutions one by one, and invested 190 million US dollars in technical transformation, covering every link and every piece of equipment in ironmaking, steelmaking and steel rolling. Among them, in order to support Serbia's efforts to join the EU, the project started the comprehensive transformation project of energy and environmental protection while upgrading the equipment of the original steel mill, so that the transformed company has reached the leading level in Europe in energy conservation and environmental protection and green manufacturing. In only half a year, the steel mill has reversed the situation of continuous losses for more than ten years. In 2017, it achieved sales revenue of 740 million US dollars; In 2018, it achieved sales revenue of $1.06 billion, the best level in history, and became the largest exporter in Serbia, contributing 1.8 percent to Serbia's GDP.[25]

[24] https://baijiahao.baidu.com/s?id=1748828201281738600&wfr=spider&for=pc
[25] https://www.sohu.com/a/623770977_121447948

## 5. Response to climate change

In 2015, President Xi Jinping announced at the Paris Conference that 10 low-carbon demonstration zones, 100 climate change mitigation and adaptation projects, and 1,000 climate change training places would be launched for developing countries. In 2019, President Xi Jinping announced the implementation of the Belt and Road South-South Cooperation Plan on Climate Change at the second Belt and Road Forum for International Cooperation. By August 2023, China had signed 46 cooperation documents on climate change with 39 BRI partner countries, and carried out more than 70 climate change mitigation and adaptation projects with more than 30 BRI partner countries, including Ethiopia, Pakistan, Samoa, Chile, Cuba and Egypt. Up to now, China has jointly built low-carbon demonstration zones with Laos and Cambodia. By providing materials such as solar street lights, new energy vehicles and portable environmental monitoring equipment, China has jointly formulated plans for the low-carbon demonstration zones, and promoted local green, low-carbon and sustainable development through the combination of materials and intelligence, and helped BRI partner countries improve their capacity to cope with climate change. The implementation of the low-carbon demonstration zone project has strengthened the consensus between China and BRI partner countries on tackling climate change and green and low-carbon transition, and also provided important reference for BRI partner countries to explore low-carbon development paths.

In addition, China has actively implemented assistance projects to address climate change. China attaches great importance to joint efforts to address national realities and major concerns on climate change, adheres to assistance programs tailored to local conditions, and provides material support within its capacity to recipient countries in the fields of clean energy, low-carbon transportation, disaster early warning and environmental monitoring. The household photovoltaic power generation system provided to Pakistan has greatly improved the access to electricity for local residents. The Pakistani Prime Minister said that "China's assistance has brought real benefits to local people". The photovoltaic projects provided to Cuba not only help Cuba solve the problems of basic electricity and lighting for rural residents in some remote areas, but also provide new momentum for Cuba to achieve its greenhouse gas emission reduction targets. In addition to material donations, China has also assisted the construction of a number of climate change projects, including

the National Emergency Command Center and Supporting Emergency Simulation Experience Center in Peru and the automatic weather station demonstration project in Uzbekistan, which have also made important contributions to mitigating the impact of local climate change. The Tiny satellite project in Ethiopia is the country's first artificial satellite. The data collected by the satellite and the resulting data analysis map will help Ethiopia respond quickly to relevant disaster risks and better mitigate the impact of climate change on agriculture, forestry, water resources and other related fields. China also helped build two dams in Tantawi, Tunisia, which effectively reduced the adverse effects of extreme weather such as heavy rainfall. In Benin, China helped repair the Nemarangville flood control dam, improving the local capacity to withstand floods.

In terms of capacity building training, China has held more than 50 training sessions on South-South cooperation on climate change, and trained about 2,300 officials and technicians in the field of climate change for over 120 BRI partner countries, helping relevant countries enhance their capacity to cope with climate change. The training courses were mainly for government officials, experts, scholars and technicians of BRI partner countries to address climate change, and covered such topics as green, low-carbon and sustainable development, greenhouse gas emission reduction and energy transition, addressing climate change through space technology, Belt and Road climate financing, low-carbon technology and industrial development, and ecological adaptation in arid areas. At the same time, regional training courses were held for Pacific island countries and African countries to make the training more targeted. The relevant measures have been highly praised by many developing countries. Many countries, such as the Dominican Republic and Nigeria, have highly recognized that China has trained a large number of local professionals on climate change, demonstrating China's role as a responsible major country.

**Box 2.5 Helping countries build low-carbon demonstration zones**

1. The Saitha Low-carbon Demonstration Zone in Vientiane, Laos

As the first low-carbon industrial park jointly built by China and the rest of the BRI partner countries, the Vientiane Sayserta Low-carbon Demonstration Zone is highly in line with the renewable and green energy development plan proposed by the Lao government, and will help Laos achieve its goal of net zero greenhouse gas

emissions by 2050. It also provides a template for overseas industrial parks and comprehensive development zones to explore green and low-carbon transformation and sustainable development. The first batch of aid for the low-carbon demonstration zone in Laos includes 2,000 sets of solar street lights, 28 new energy vehicles and 5 sets of environmental monitoring equipment. Officially inaugurated in April 2022, the demonstration zone is expected to reduce local carbon emissions by about 1,243 tons per year, equivalent to planting more than 100,000 trees. The concept of green and sustainable development brought by China has promoted the development of Vientiane New City into a model of low-carbon and environmentally friendly cities in Laos and even ASEAN countries. At present, China and Laos have signed a cooperation document on carrying out the second batch of material assistance projects for the low-carbon demonstration zone, which will further help the low-carbon construction of the demonstration zone.

2. Jointly build a low-carbon demonstration zone in Sihanoukville Province, Cambodia

China and Cambodia are jointly building a low-carbon demonstration zone in Sihanoukville Province, and the first batch of assistance includes 2,800 sets of solar street lights, 200 sets of photovoltaic systems for school, 200 electric motorcycles, 10 sets of automatic air quality monitoring stations, and 10 sets of portable industrial smoke monitoring, noise monitoring and vibration monitoring equipment and materials related to climate change. Green light sources have illuminated Sihanoukville port, helping Cambodia take an important step in tackling climate change. At present, the environmental departments of China and Cambodia have signed a memorandum of understanding on cooperation in the second batch of material assistance projects for the low-carbon demonstration zone. China will provide 1,500 sets of solar street lights, 2,000 household photovoltaic power generation systems and two mobile air quality monitoring vehicles to Cambodia to address climate change, and continue to support the development of the low-carbon demonstration zone in Sihanoukville province.

## 6. Ecological and environmental management

At present, many countries in the world regard green as an important direction of

scientific and technological revolution and industrial transformation, and the evolution of green rules in international trade and investment is accelerating. Only by practicing the concept of green development can overseas investment and cooperation become an important support for improving the quality of the domestic and international dual circulation, play a key role in opening up and development, and win the initiative in international cooperation and competition. In 2016, with the support of the Ministry of Ecology and Environment (formerly the Ministry of Environmental Protection), the National Development and Reform Commission and the Ministry of Commerce, in order to effectively promote the construction of the Green Belt and Road, The former China-ASEAN (Shanghai Cooperation Organization) Environmental Protection Cooperation Center, the China Business Council for Sustainable Development and China Environment Service Industry Association jointly launched the Enterprise Initiative of "Fulfilling Corporate Environmental Responsibility and Building a Green Belt and Road", calling on enterprises to participate in the construction of a green Belt and Road and demonstrate the green image of Chinese enterprises. At the same time, the Belt and Road eco-environmental risk prevention training course and the Belt and Road eco-environmental standard training series have been carried out in an orderly manner, and have been highly praised by Chinese enterprises participating in the training.

**Box 2.6 Chinese companies have helped BRI partner countries strengthen green and low-carbon development and transformation**

With the initiative and promotion of the Chinese government, Chinese enterprises have strengthened ecological and environmental management and green and low-carbon development of overseas projects. For example, the 22nd World Cup held in Qatar in 2022 is the first World Cup held in a Middle Eastern country and the second in Asia in history. It will also be the first World Cup held in the winter of the Northern Hemisphere and the first held by a country that has never participated in the World Cup. It will have great significance and far-reaching impact on both Qatar and the Middle East region. In order to host the World Cup, Qatar has specially built a new "green city", Lusaire New City, about 15 kilometers north of the capital city of Doha. Among them, the main stadium of the World Cup, Lusair Stadium, is built by China Railway Construction International Group Co., LTD. (referred to as Railway

Construction International) and Qatar HBK company in a joint venture mode This is the first time for a Chinese company to participate in the construction of FIFA's highest standard professional football stadium as a general contractor for design and construction. It is also the first time for a Chinese company to design and build a World Cup main stadium. It is the largest and most populous professional stadium built by Chinese enterprises overseas as well. In 2016, FIFA adopted the Global Sustainability Evaluation System (GSAS) as the green building evaluation system for the 2022 Qatar World Cup stadiums. The evaluation system carries out sustainability assessment for the three stages of design, construction management and operation during the life cycle of a construction project, and sets eight evaluation indicators, including urban connectivity, site, energy, water, materials, indoor/outdoor environment, cultural and economic value, and management and operation. It focuses on addressing the challenges of air pollution, land abuse and pollution, fossil fuel depletion, water resource consumption and pollution, material depletion, human health and comfort, and climate change in the project. Different levels of GSAS certification are set for different stages of the project. There are a total of 6 stars in the design phase (GSAS-DB), 5 stars in the construction phase (GSAS-CM) and 5 stars in the operation phase (GSAS-OP). The Lussel Stadium project started in November 2016, the main project has been completed in September 2021, and the project has been fully completed in September 2022. Both the design and construction stages have been awarded five-star evaluation, setting up a model of green building.

# Section II Evaluation and Case Studies

# Chapter 3 The BRI Green Development Assessment System

Recent years have seen a surge of research on the BRI, with the primary focus on the impact of BRI on resources and environment at the macro level. However, few studies attempt to quantify the impact of the BRI from the perspective of green development. Even fewer produced any results to comprehensively reflect the overall level of green development of BRI countries. Therefore, it is necessary to evaluate the green development status of BRI countries to fill the research gap on the impact of the BRI, to identify key areas of focus, opportunities, and challenges for green development along the BRI based on the assessment results, and to envision the prospects of high-quality BRI cooperation. For a more rigorous and reliable analysis, this report establishes an assessment index system based on green development indicator data from BRI countries between 2010 and 2020, in an attempt to analyze the green development trend in these countries and assess the role of the Green Silk Road in bolstering green development across these countries.

## 1. Evaluation Objects

The BRI has obtained the global attention since its launch and the number of BRI countries (regions) continues to increase. By June 2023, China has signed over 200 BRI cooperation documents with 152 countries and 32 international organizations. To accurately evaluate the situation and trends of the green development of the BRI, 44 countries were selected for green development evaluation in the report based on the three criteria, namely the comprehensive coverage of indicator data, the time continuity of indicator data, as well as the correlation between the level of BRI participation and bilateral economic and trade activities of the BRI countries with China.

The research team collected data on China's outward FDI flows to 145 countries from 2013 to 2020 [Source: Ministry of Commerce of the People's Republic of China, National Bureau of Statistics of China, State Administration of Foreign Exchange. 2020 Statistical Bulletin of China's Outward Foreign Direct Investment.], each

recipient country's GDP for 2013-2020 [26] and the FDI data received by these countries from 2013 to 2020 [Source: International Monetary Fund.]. Based on the data, two proportions were calculated: 1.the proportion of China's outward FDI to the respective country's GDP in the same year; 2. the proportion of China's outward FDI to the total FDI received by the respective country in the same year. It is a common practice internationally to use these two indicators to characterize the situation of bilateral economic and trade cooperation.

Additionally, in order to ensure comprehensiveness in identifying key countries, the research team combined the information and data from Ministry of Commerce's China's Outward Investment and Economic Cooperation Report, Annual Report on China International Project Contracting, and the Guide for Countries and Regions on Overseas Investment and Cooperation, the China Export and Credit Insurance Corporation's Handbook of Country Risk, the information and trade data from the Economic and Commercial Offices of the People's Republic of China in various countries, as well as data from the International Monetary Fund,. Key countries were selected based on meeting at least three of the following criteria: 1. From 2013 to 2020, China's FDI to the country exceeded 0.1% of the country's GDP on average; 2. From 2013 to 2019, China's FDI to the country exceeded 5% of the country's total FDI inflows; 3. The number and scale of projects undertaken by China should have had a big impact locally. And the country risk and sovereign credit risk should be below medium level without major political or economic risks [Source: Handbook of Country Risk by China Export and Credit Insurance Corporation]. 4. Bilateral trade tie with China is close, and China is a significant economic and trade partner.

**Table 3.1 Key BRI Countries Selected in the Assessment**

| **Region** | **Key BRI Countries Selected in the Assessment** |
|---|---|
| Africa | South Africa, Zambia, Zimbabwe, Kenya, Nigeria, Egypt, Tanzania, Ethiopia, Angola, Mauritania, Democratic Republic of the Congo, Ghana, Uganda, Cameroon, Niger, Gabon, Botswana |
| Asia | Singapore, Thailand, Malaysia, Indonesia, Myanmar, Cambodia, Vietnam, Laos, Nepal, Mongolia, Tajikistan, Kazakhstan, Pakistan, Kyrgyzstan, Bangladesh, Sri Lanka, United Arab Emirates, Georgia, |

[26] Source: The World Bank

| | |
|---|---|
| | Saudi Arabia |
| Europe | Greece, Serbia, Montenegro |
| The Americas | Chile, Ecuador, Jamaica, Panama, Costa Rica |

## 2. Evaluation Methodology

In recent years, new research results have kept emerging on the Green Development Index, mainly focusing on three paths: the green gross domestic product (GGDP) accounting, the multi-index measurement framework of green development, and the evaluation index system of green development. Internationally, GGDP includes the UN System of Environmental-Economic Accounting (SEEA); the multi-index measurement system includes the OECD Green Growth Strategy Framework and the Green Economy Progress (GEP) Measurement Framework by the UN Environment Programme; and the evaluation index system incorporates factors such as the Environmental Performance Index (EPI) proposed by Yale University. In China, there are frameworks such as the Chinese Green GDP Accounting System, the Green Development Multi-Index Measurement System, and the Green Development Comprehensive Evaluation System which include the Resource and Environmental Performance Index (REPI) proposed by the Institute of Sustainable Development Strategy of Chinese Academy of Sciences, and the China Green Development Index Report from Beijing Normal University.

To fully incorporate the various factors related to green development, green development is placed within the broader framework of sustainable development and assessed from three dimensions-- economy, society, and environment across different spatial-temporal scales in order to analyze BRI's contribution to the green development of BRI countries.

The existing research on BRI evaluation index varies in terms of the evaluation system, perspectives and objects. **In terms of the evaluation system**, the existing studies have not been able to effectively reflect the overall level of regional green development in the BRI countries. Currently, the main sustainable development assessment systems (index frameworks) in China and other countries can be divided

into three categories: those based on a single dimension, those based on the Pressure-State-Response model, and those based on systems/themes/goals.

Evaluation systems based on a single dimension refer to an index system from one single dimension related to sustainable development, such as economy, society, and ecological environment. They can be mainly divided into three categories: index frameworks based on economic accounting such as benefit-cost, those based on ecological dimension or biophysical measurement, and those based on the dimension of political sociology. In such systems, some are constructed from one single dimension only to measure the sustainability of the region in that dimension, while others, even based on a single dimension such as economy, are deemed by researchers to be able to comprehensively reflect the sustainable development level of the region on the ground that this dimension is the core of sustainable development. For some researchers, the index systems based on one single dimension can be applied to measure the overall sustainable development level of the region, while others maintain that this type of index systems lean toward a certain dimension and lack comprehensiveness.

A representative model of green development evaluation is "Pressure-State-Response Model" (PSR), which was proposed by OECD and the United Nations Environment Programme (UNEP) in the late 1980s as a model for assessing resource utilization and sustainable development. In the PSR model, the indicator of "pressure" characterizes the positive or negative impacts of human economic and social activities on environmental sustainability, such as pollutant emissions and resource recovery rates. The indicator of "state" characterizes the status of the environment and natural resources in terms of quantity and quality at a specific time period, such as pollutant concentrations. The indicator of "response" characterizes how society and individuals act to mitigate, stop, remedy, and prevent the negative impacts of human activities on the environment and natural resources, such as pollution charges. Due to its ability to reflect the causal relationships between nature, economy, and society, the PSR model organizes and classifies indicators based on the interactive impact of human economy, society and environment, providing a highly systematic framework for assessment. Moreover, it can be applied to different spatial scales and domains. Therefore, this model is widely used in various fields. However, this model fails to present the logical linkage between the indicators of "pressure" and "state" between the social and economic dimensions, therefore, it

cannot support policy making due to its lack of overall understanding of sustainable development. What's more, this model cannot be applied to multi-dimensional problems or to large-scale comprehensive assessment with considerable spatial variance complicated by the interplay of many factors; so it is more suitable for smaller spatial scales, or problems that are large in scale but not across spatial locations.

Evaluation index frameworks based on system classification usually starts from the principle of comprehensive evaluation, divides sustainable development into several systems such as the economy, society, and environment, as previously mentioned. Then, each system is further subdivided into a wide array of subsystems, such as atmosphere, land, ocean, and other subsystems under the environment system. Each subsystem contains multiple different indicators to form a complete hierarchy structure. Theme- or goal-based assessment index frameworks take a different approach by dividing the index system by the core themes of sustainable development or by the SDGs to be achieved, or by the major sustainable development policies in the research area. It then further defines sub-themes or goals, and selects different indicators for each sub-theme or sub-goal. The system/theme/goal index framework should be able to reflect the three key perspectives of sustainable development measurement, namely, coordination, development, and duration. Among them, coordination reflects the coordination level between various systems or elements of sustainable development; development reflects the level of development in the study area; and duration reflects the evolving trend of sustainable development. However, this type of index framework cannot cohesively take all three perspectives into account simultaneously. **In terms of assessment perspective**, existing research primarily focuses on the sustainable development process within the BRI, highlighting its connotations, principles, and the impact it brings about. However, there is a lack of studies that assess the development and construction of the BRI from a green development perspective, which emphasizes greenness as a defining feature. **In terms of the assessment objects**, current researches primarily examine the level of sustainable development of the world on the whole, or individual countries, cities, specific enterprises or products, with a predominant emphasis on that at the national or regional levels instead of at the global level. For global initiatives such as the BRI which are committed to mega-scale international cooperation and exchange, research on index frameworks at or above the national level is of paramount importance.

Traditionally, international research on index frameworks assessing global-scale sustainability has been conducted primarily by international organizations and scholars from developed countries, while developing countries tend to focus more on index frameworks at or below the national level.

Therefore, from a holistic perspective, the existing research on the evaluation of development in BRI countries/regions is inadequate in the following three aspects: Firstly, there is a lack of evaluation of BRI countries from the perspective of green development. Secondly, the research on assessment index systems has mainly focused on national and regional level, while research at the global level is still relatively scarce, which is just the key part for promoting large-scale cooperation and communication between countries, such as the BRI. Finally, studies on global sustainability index systems have conventionally been led by international organizations and scholars from developed countries. In contrast, developing countries have often concentrated on national and subnational index systems at or below the national level. .

In selecting evaluation system models, a variety of index systems are available globally. However, there is no universally recognized standard system and evaluation method. Given the large scope and multiple dimensions of the assessment in this report, neither a single-dimension model nor a PSR evaluation system is suitable. Therefore, this report opts for a type of evaluation system based on an array of systems/targets/themes as the framework to assess the performance of green development in 44 BRI countries over a period of time. Specifically, it includes: First, establish an evaluation index framework and database in the three dimensions of economy, society and environment. Second, standardize the indicator data. Third, assign weights to the indicators. Fourth, calculate the scores of the three dimensions and the composite score. Fifth, compare the spatial-temporal variances in the green development level of BRI countries. To fully evaluate the effectiveness of the BRI, this study will select 2010, 2013, and 2020 as key years, analyzing the contribution of the BRI to the green development in BRI countries since its inception.

This report evaluates the green development level of BRI countries by constructing a rating system for green development. The evaluation process fully considers the different stages of development of various countries in which the ratings acknowledge the endeavors of the BRI countries for green development based on a good understanding of the current state of green development level in each country. In

the rating process, more attention is paid to the efforts taken by specific countries towards a common goal of green development, rather than a simple ranking based on a country's green development performance in the past. Therefore, a rating system is more applicable to this research report. Ratings of green development level can further highlight and clarify the actions that should be taken to improve green development and the direction of future cooperation in green development with other BRI countries. For investors, it can also provide reference for foreign investment cooperation on the basis of a good understanding of the opportunities and challenges of the environmental, economic, and social development across the BRI countries.

## 3. BRI Green Development Index

Key areas for building the Green Silk Road are identified to include green production, green construction, green transportation, green energy, and ecological environment protection. Consequently, based on the principles of rigor, comprehensiveness, regional relevance, and practical applicability, and in line with the basic national conditions of BRI countries, BRI's goal of "five connectivity" as well as other factors, this report is aimed to design and construct a Green Development Index in accordance with the green development goals of the BRI countries and the three dimensions of sustainable development, drawing reference from the existing research results of the academic communities in China and globally. Sustainable development has three cornerstones: economic growth, social inclusion, and environmental sustainability through good governance. Based on these three cornerstones, this report classifies various indicators according to the green development situation. They are mainly divided into three dimensions: economy, society, and environment.

In the environmental dimension, ecological environment protection is a vital requirement for regional and national green development. Taking internationally representative green development index as references, and focusing on priorities of ecological conservation in BRI countries, this report selects indicators from the three aspects of environmental quality, environmental governance and resource utilization. For example, in terms of environmental quality, indicators such as $PM_{2.5}$ and per capita $CO_2$ emissions are used. In terms of environmental governance, indicators such as the Red List Index (RLI) and forest coverage rate are used.

In the economic dimension, green development is closely related to economic

growth. The sustainability of resources and environment is directly affected by human activities. The level and structure of economy also have a direct impact on resource and environmental sustainability. This report mainly selects indicators from two aspects: level and structure of economy, and the degree of international connectivity of economy. In terms of economic development, the size of the economy of BRI countries determines their consumption of resources and environment status. Different stages of economic development lead to varying levels of pollution and environmental governance. In terms of the level of economic development, the report selects per capita GDP as the main indicator to measure the level of economic development, which is a common practice of all relevant studies. In addition, given that BRI countries are mostly developing countries undergoing industrialization, this report also selects indicators such as the proportion of industrial-added value to measure the economic structure. Furthermore, the key focus of the BRI is to achieve the "five connectivity", namely policy, infrastructure, trade, financial and people-to-people connectivity. Considering data availability, this report selects indicators such as foreign trade dependence, railway density, and the proportion of international tourists to measure international connectivity of economy.

In the social development dimension, given that green growth requires not only the concerted efforts of governments worldwide but also the active participation of the general public, it is thus imperative to prioritize the delivery of social welfare. Consequently, the focus has been placed on themes and indicators that underscore the close relationship between green growth and the general public. This research has drawn on internationally representative green development index, taking into account factors such as data availability in BRI countries to assess social development from the aspects of gender and equality as well as health and well-being. In the area of gender and equality, indicators such as the ratio of male to female students in primary and secondary education are selected. In the area of health and well-being, indicators such as life expectancy are chosen.

### 3.1 Evaluation Index

Green development emphasizes the coordination of the economic system, social system, and natural environment system, as well as the diversification of development goals within the system. Therefore, in line with the two main themes of green and development, indicators closely related to them are chosen to construct a scientific evaluation system. The main steps are as follows: First, a comprehensive index

framework is built based on the three dimensions of economy, society, and environment. Second, based on the connotation of green development, sub-dimensions and specific sub-indicator system is formed. Third, in line with the experiences of China and other countries, the index framework is further refined by re-examining available indicators suitable for the overall index framework. Fourth, all relevant indicator data is gathered, and indicators are further modified, deleted, and replaced based on data quality and other factors.

In selecting indicators, the report uses internationally recognized indicators such as the United Nations Sustainable Development Goals (SDG) Index and the Yale Environmental Performance Index (EPI) as far as possible, and incorporates other indicators, both official and unofficial, when there is a shortage of data. The report takes into account the principles of data availability, universalizability, timeliness and conciseness, and the indicator data cover at least 80 per cent of the countries assessed. Evaluation indicators are selected from three primary dimensions (first-level indicators): economic, social, and environmental. Specifically, it includes seven second-level indicators and 22 third-level indicators.

**(2) Evaluation Method**

**1) Data Standardization**

Given the large differences between various indicators, the measurement units should be unified before comparison. After each indicator is standardized, the values of each indicator in various countries fall mostly between 0 and 1, where 0 suggests this country performs the worst in this indicator, and the larger the value, the better the performance of this country in this indicator. However, the maximum and minimum values in 2020 were consistent with those in 2010, which can better display the differences in development. This method requires first judging the attribute (positive, negative, or median) of each indicator, and then performing different standardizations according to different indicator attributes. Among them, a positive indicator means that the larger the data value of the indicator, the better the green development; a negative indicator means that the smaller the data value of the indicator, the better the green development; and a median indicator means that the closer the data value of the indicator is to a certain median value, the better the green development.

$$y_{ijk}=\begin{cases}\dfrac{x_{ijk}-x_i^{min}}{x_i^{max}-x_i^{min}}, & \text{Positive Index}\\ \dfrac{x_i^{min}-x_{ijk}}{x_i^{max}-x_i^{min}}, & \text{Reverse Index}\\ 1-\dfrac{x_q-x_{ijk}}{\max(x_q-x_i^{min},x_i^{max}-x_q)}, & x_{ijk}<x_q\\ 1-\dfrac{x_{ijk}-x_q}{\max(x_q-x_i^{min},x_i^{max}-x_q)}, & x_{ijk}>x_q \text{ Moderate Index}\\ 1, & x_{ij}=x_q\end{cases}$$

In the formula, $y_{ijk}$ is the standardized value of the original data for the i-th indicator of the j-th region in the k-th year; $x_{ijk}$ represents the actual value of the i-th indicator of the j-th region in the k-th year; $x_i^{min}$ and $x_i^{max}$ respectively represent the minimum and maximum values of the i-th indicator among all countries/regions in 2010, and $x_q$ represents the median value of the median indicator.

**2) Indicator Weighting**

At present, there are various assessment methods based on the index system, including the traditional methods such as data envelopment analysis, principal component analysis, and additive average weighted method. In recent years, some new methods have also emerged, such as the matter-element extension method as well as the neural network method. However, traditional evaluation methods are relatively more mature in the assessment of the BRI. This study adopts the average weighted method, a rather conventional and mainstream approach, the core of which is to determine indicator weights. When the number of tertiary indicators is already adequate to reflect the status of green development from different aspects and also given the lack of consensus on weighting method in various sustainability evaluations, the average weighted method is employed as a commonly used method. Therefore, this report adopts average/equal weighted method for indicators. First, all primary indicators are assigned the same weight, which means that every indicator is assigned a weight of 1/3. Secondly, for each secondary indicator under a primary indicator, the same weight is also assigned, such as the three secondary indicators under the environment development: environment quality, environment governance, and resource utilization, which are assigned the same weight, that is, 1/3×1/3. In the same way, the same weight is assigned to each tertiary indicator under a secondary indicator. This method has the advantage that when a new indicator is added to a specific green development theme, its relative weight under the secondary indicator will not be

affected. Given that some tertiary indicators are not available, this report adopts the dynamic equal weight method, that is, assigning the weight of the secondary indicators equally among the tertiary indicators available.

**3) Indicator Synthesis**

Once the scores of various dimensions are calculated, the Composite Green Development Index is obtained by weighted summing. The scores of Green Development Index range from 0 to 1, with higher values indicating better performance in green development. According to the scores, the Composite Green Development Index is classified into four grades based on the level of performance in green development, including A$^{+}$[0.8－1], A[0.6 - 0.8）, A$^{-}$[0.4 - 0.6), and B[0 - 0.4).

# Chapter 4. Evaluation of Green Development in BRI Countries

## 1. The Overall Green Development Status in BRI Countries

Among BRI countries, except for a few countries like Singapore, most are developing countries whose economic development is at a relatively lower level with extensive economic development model. In addition, most BRI countries and regions are located in areas prone to climate and geological changes, with complex natural environments and diverse yet fragile ecosystems. Some BRI countries have fragile ecosystems and intense human activities. Environmental issues in some BRI countries are particularly complex and diverse, with apparent differences in ecological characteristics among countries.

The green development evaluation results show (Figure 4.1) that from 2010 to 2020, the green development index scores of BRI countries have been continuously increasing, making green a defining feature of high-quality BRI. In 2010, there were 0 countries with an $A^+$ performance in the green development evaluation, 3 countries with an A performance, 40 countries with an $A^-$ performance, and 1 country with a B performance. In 2013, there were 0 countries with an $A^+$ performance, 5 countries with an A performance, 37 countries with an $A^-$ performance, and 2 countries with a B performance. In 2020, there was 1 country with an $A^+$ performance, 4 countries with an A performance, 38 countries with an $A^-$ performance, and 1 country with a B performance.

Compared with 2013, the average green development index scores of BRI countries in 2020 increased from 0.515 to 0.531, signaling an overall upward trend in green development. In particular, in environmental and social development dimensions, the average green development index scores for the environmental dimension of BRI countries in 2020 was 0.183, an increase of 1.32% from that of 2013, which increased by a merely 0.23% from that of 2010. In 2020, the average value of the green development index for the social dimension was 0.213, an increase of 3.97% from that of 2013, while the increase was only 0.23% from 2013 to 2010. Among them, 32 countries saw an increase of score in the green development index, indicating that the BRI had indeed facilitated the level of green development in BRI countries. Countries such as Singapore, the United Arab Emirates, Saudi Arabia, and

Georgia had made notable progress, with their green development index scores increasing by more than 10%.

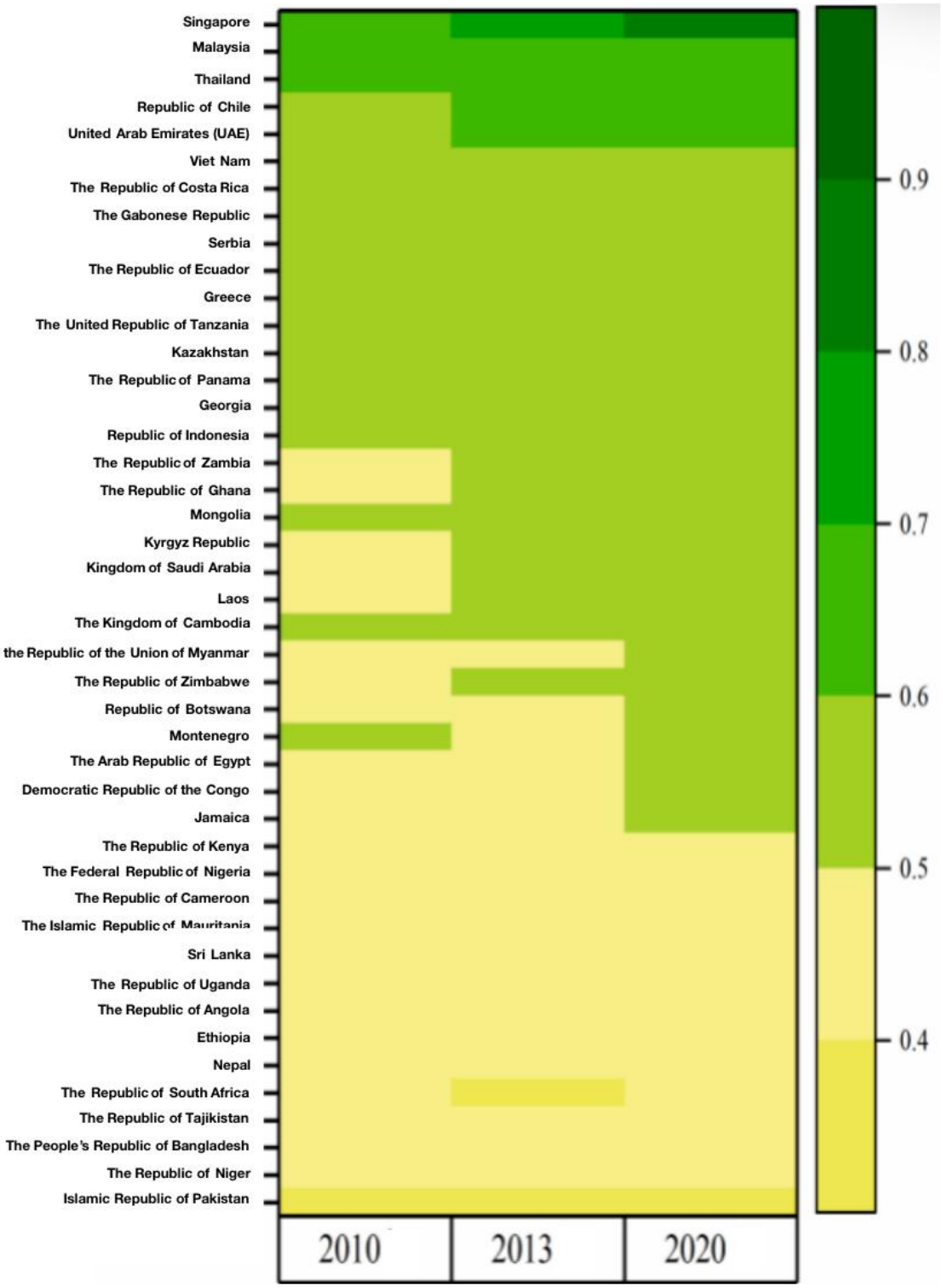


**Figure 4.1 Composite Green Development Index and Ratings of BRI**

Compared with 2010, the composite green development index score slightly increased in 2013, but the overall distributional concentration decreased slightly; and the green development composite index score in 2020 showed an evident

improvement, with an increase in overall distributional concentration as well (Figure 4.2). However, it is worth noting that the curve in 2020 was a left-skewed distribution, indicating an increase in data dispersion. This suggests that there still existed clear uneven development among BRI countries, with a large number of countries lagging behind in development. Green development of the BRI should prioritize these countries.

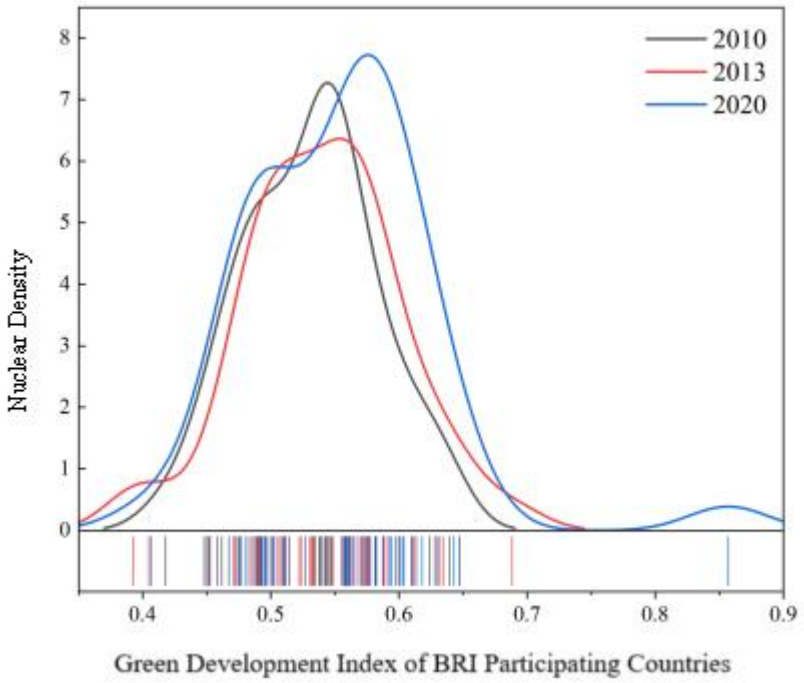


**Figure 4.2 Kernel Density Distribution of Composite Green Development Index Scores of the BRI Countries**

From 2010 to 2020, the average green development index scores of BRI countries in Asia and Europe demonstrated an increasing trend year by year; that of BRI countries in the Americas showed a stable trend, and that of BRI countries in Africa first increased and then decreased (Figure 4.3). In terms of the absolute value, the BRI countries in Europe and the Americas scored relatively higher in the green development index, followed by that of BRI countries in Asia, and the lowest in Africa. In addition, the variances in the green development index scores of BRI countries in Europe and the Americas were moderately small, while those of BRI countries in Asia and Africa were relatively large.

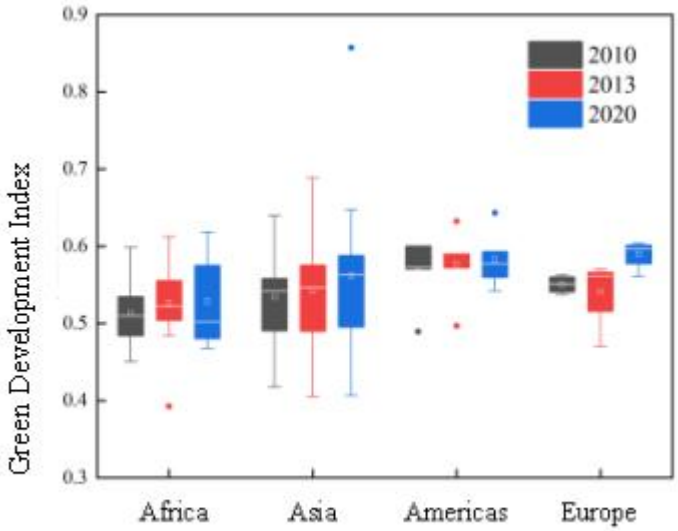


**Figure 4.3 Green Development Performance in Four Continents, 2010, 2013 and 2020**

## 2. Green Development Level of BRI Countries in Different Dimensions

### 2.1 Green Development Level of the Economic Dimension in BRI countries

From 2010 to 2020, the overall economic development level of BRI countries showed a rising trend. However, except for five countries such as Singapore, the United Arab Emirates, and Malaysia, the remaining 39 countries grew at a moderately low level (with a secondary economic development indicator lower than 0.2) (Figure 4.4). In addition, compared with the social and environmental dimensions, the economic development level of BRI countries was comparatively lower, which significantly constrained the green development of these countries. Compared with 2010, the economic development index scores of BRI countries displayed slight progress in 2013 and 2020, but the distributional concentration has decreased, and the density distribution was more skewed to the right, suggesting that a few BRI countries experienced faster economic development than others (Figure 4.5).

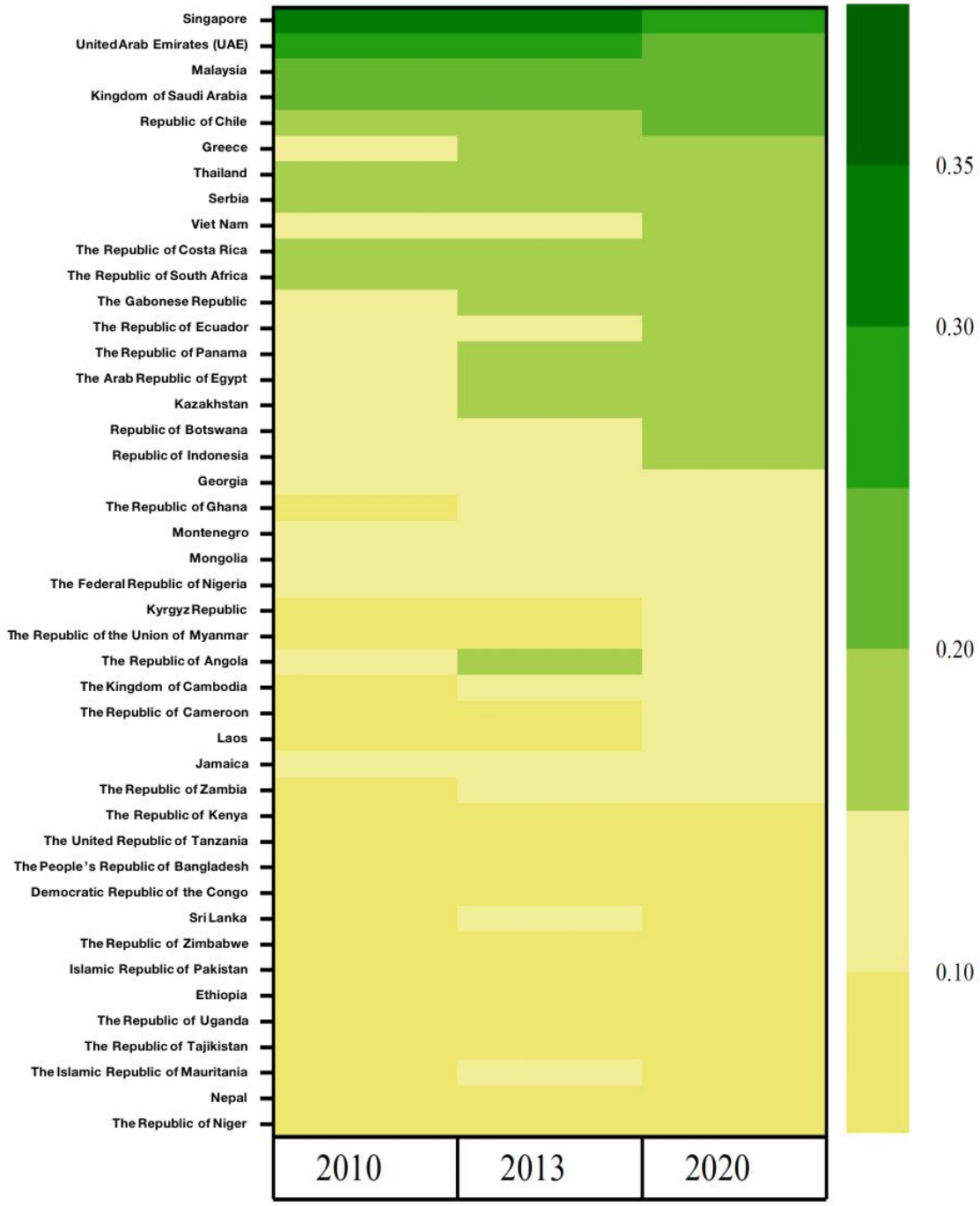


**Figure 4.4 Development Level of Economic Dimension in the BRI Countries**

Note: Countries are listed in descending order of their 2020 Economic Development Index scores.

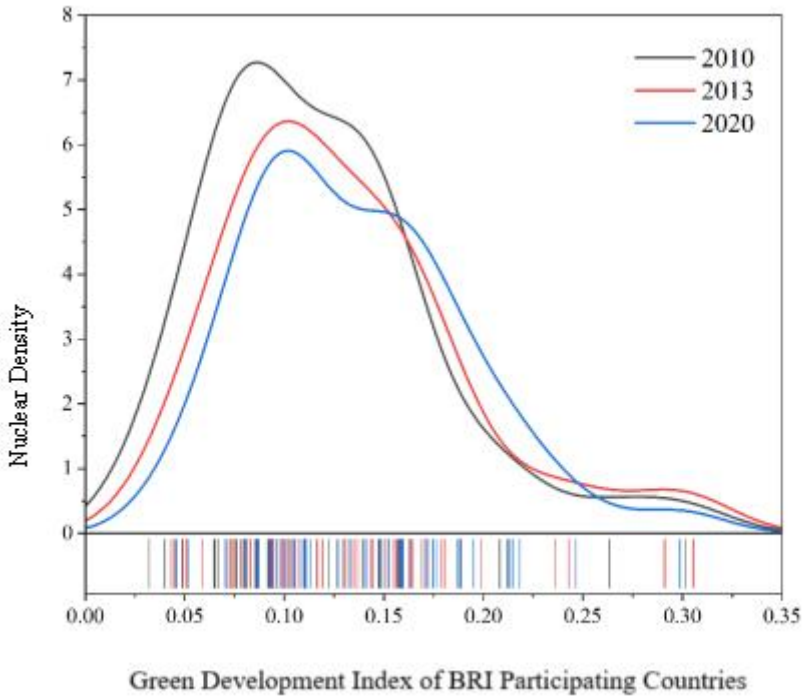


**Figure 4.5 Kernel Density Distribution of Scores on the Development Level of the Economic Dimension in the BRI Countries**

From 2010 to 2020, the composite economic development index of the BRI countries in Asia, the Americas, and Europe showed a clear growing trend, while that of the BRI countries in Africa gradually stagnated after an initial rise (Figure 4.6). Generally, the economic development index of the BRI countries in Europe and the Americas was higher than that of countries in Africa and Asia. Moreover, the economic development index scores of European BRI countries were rather balanced, while there was a noticeable variance in the economic development index among the BRI countries in Asia and Africa, especially in Asia.

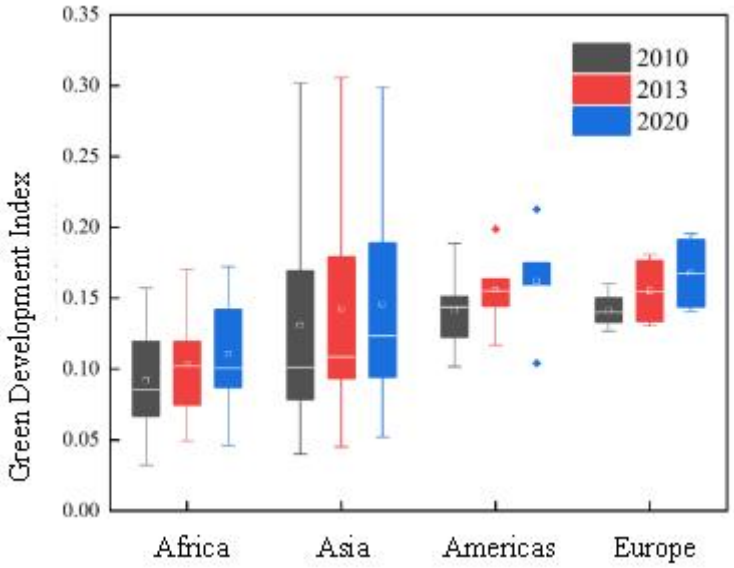


**Figure 4.6 Economic Development Performance of Four Continents, 2010, 2013 and 2020**

**2.2 Development Level of the Social Dimension in BRI Countries**

From 2010 to 2020, the social development level of BRI countries demonstrated an improving trend, but with certain fluctuations and imbalances. In 2020, except for 11 countries such as Saudi Arabia and Cambodia, the social development index scores of the other 33 countries were greater than 0.2, showing a relatively good level (Figure 4.7). Compared to the economic and environmental dimensions, the social development level of BRI countries was comparatively higher, an essential supporting factor for the composite green development index. From 2010 to 2020, the average social development index scores of BRI countries did not change significantly, but the concentration has increased (Figure 4.).

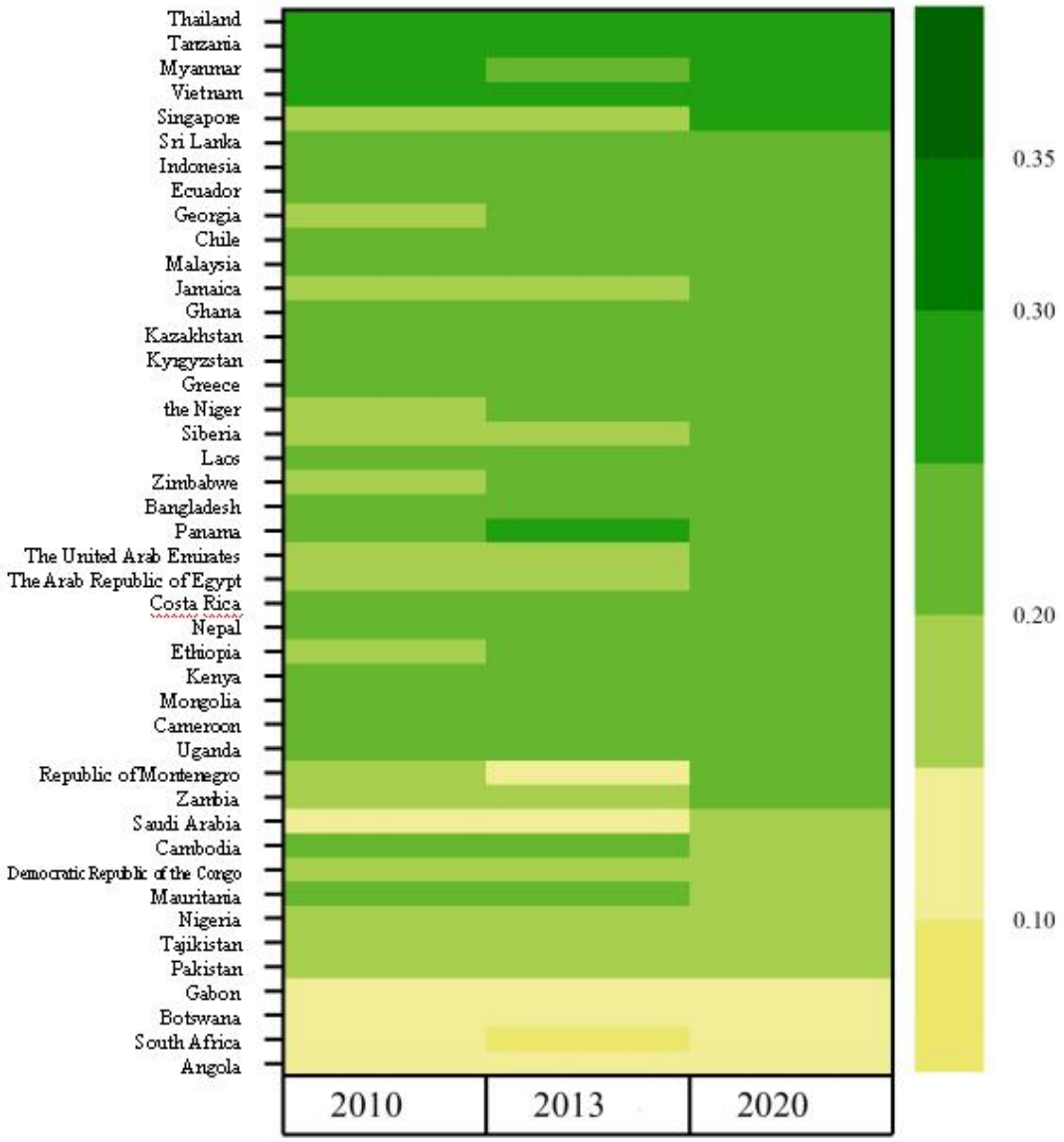


**Figure 4.7 Development Level of Social Dimension in the BRI Countries**

Note: Countries are listed in descending order of their 2020 Social Development Index scores.

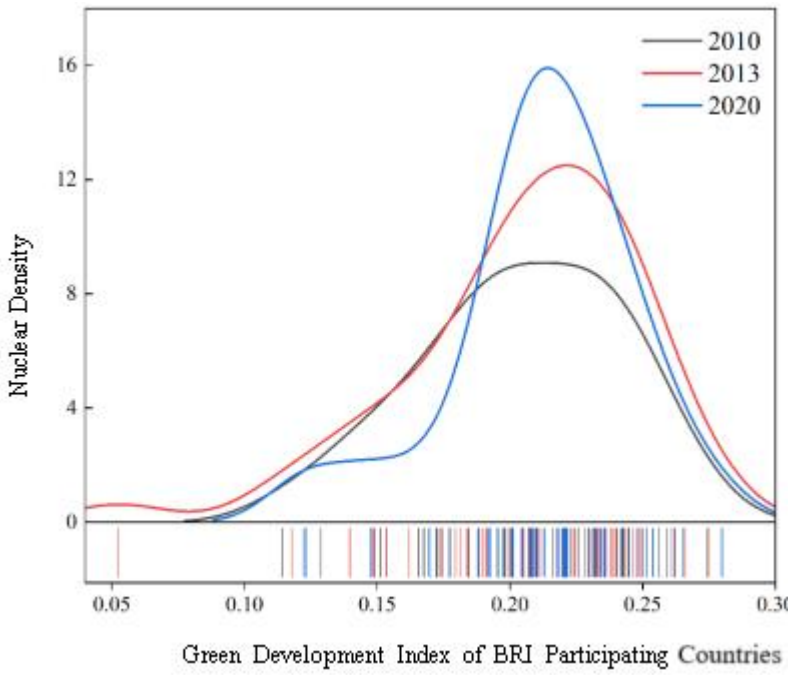


**Figure 4.8 Kernel Density Distribution of Scores on the Development Level of the Social Dimension in the BRI countries.**

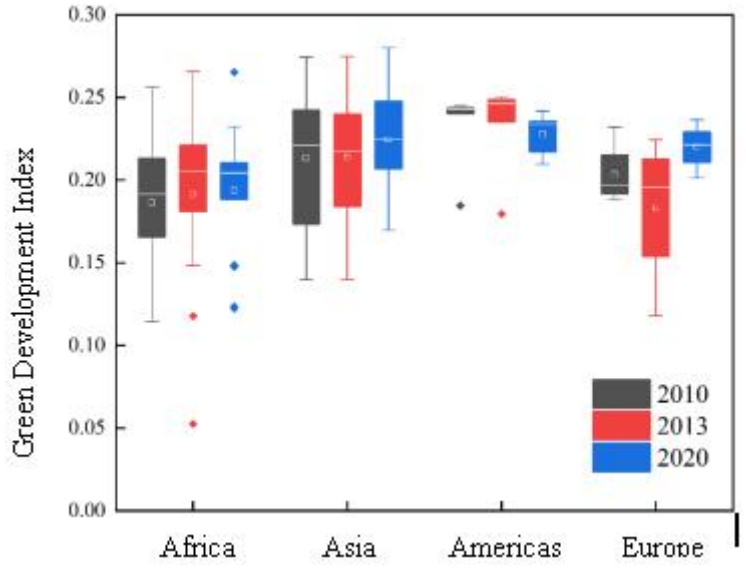


**Figure 4.9 Social Development Performance in Four Continents, 2010, 2013 and 2020**

From 2010 to 2020, the average social development index scores of BRI countries in the four continents exhibited little variance but with some fluctuations (Figure 4.9). The main reasons are, on one hand, attributed to the fluctuating and long-term nature of the indicators related to social development; on the other hand, there is a serious lack of data for the tertiary indicators of social development in

different countries, and the data is outdated.

### 2.3 Development Level of the Environmental Dimension in the BRI Countries

From 2010 to 2020, the environmental development level of BRI countries were the most stable one among the three dimensions, lower than that of the social dimension but higher than that of the economic dimension (Figure 4.10). Ten countries including Singapore and Gabon, scored higher in environmental development index (greater than 0.2), with Singapore and Gabon being particularly notable. Due to factors such as harsh natural environment, the environmental development index of six countries including Egypt and Pakistan scored below 0.1. In general, compared with 2010, the average environmental development index of the BRI countries in 2013 and 2020 experienced little change, but the concentration increased marginally, indicating overall stability (Figure 4.11).

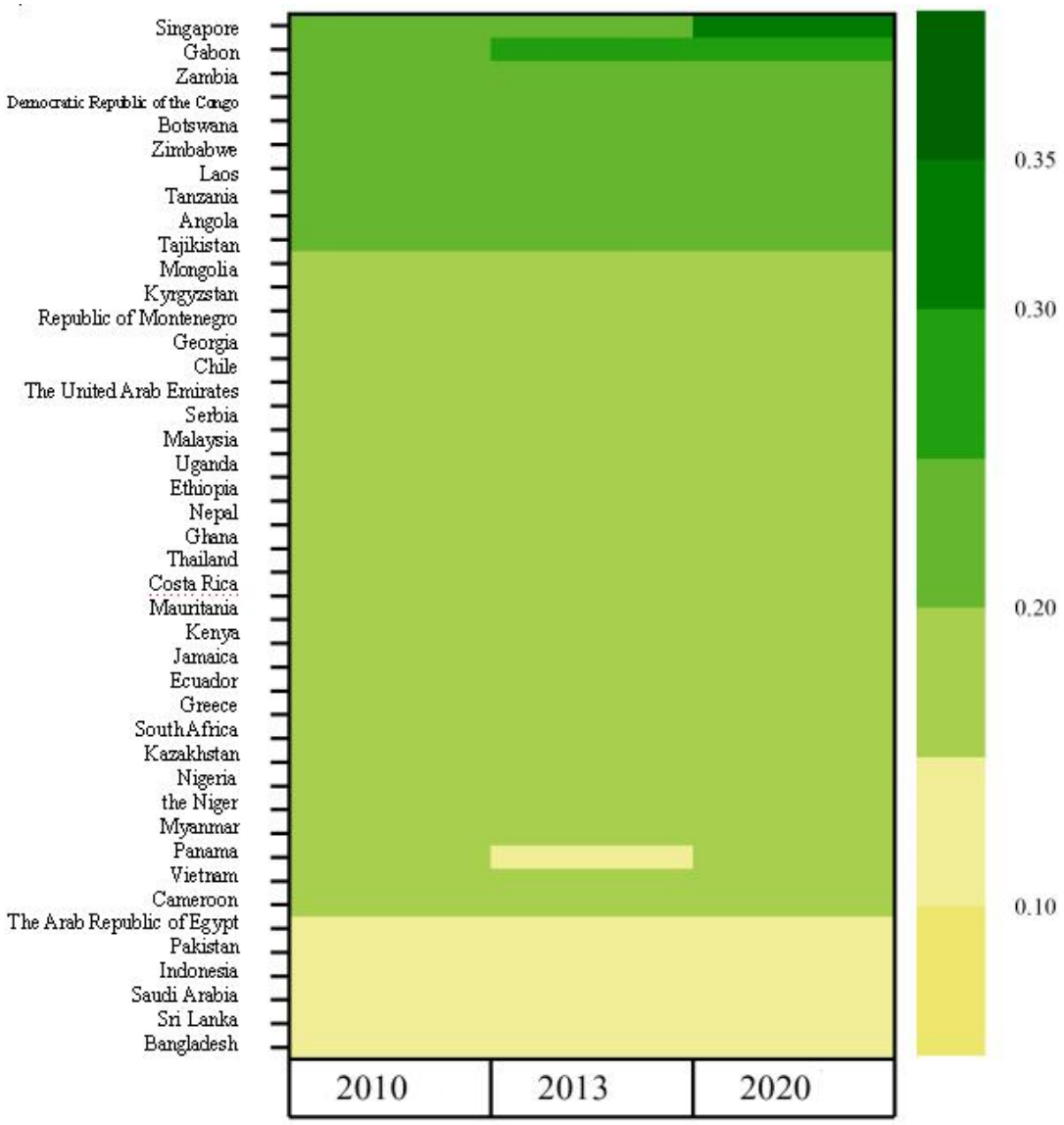


**Figure 4.10 Development Level of Environmental Dimension in the BRI Countries**

Note: Countries are listed in descending order of their 2020 Environmental Development Index scores.

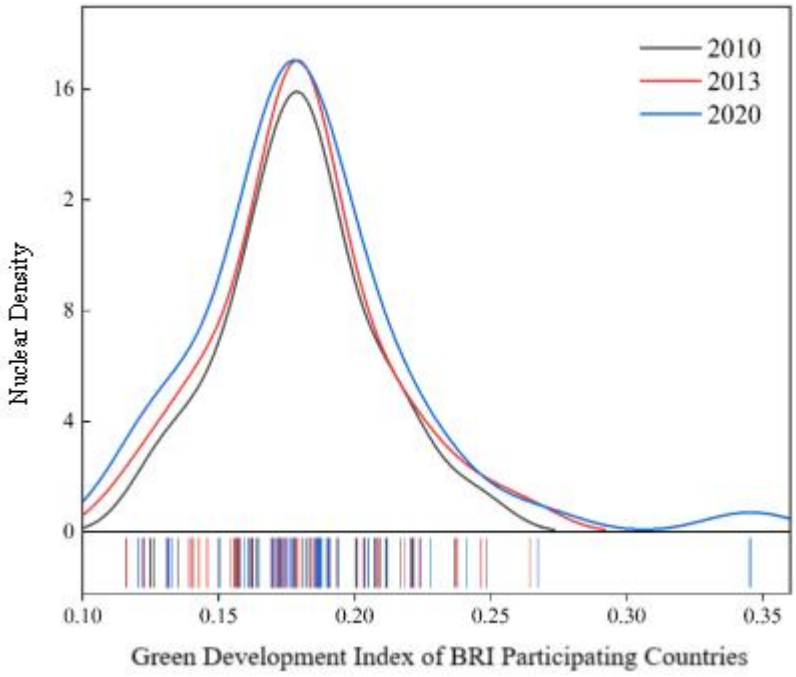


**Figure 4.11 Kernel Density Distribution of Scores on the Development Level of the Environmental Dimension in the BRI Countries**

In terms of the regional distribution, the environmental development levels of the BRI countries in Africa and Europe were higher, while those of countries in Asia and the Americas were slightly lower, but without great variance between them (Figure 4.12). Consistent with the economic and social dimensions, the environmental development levels of African and Asian countries varied considerably within. On the one hand, some countries enjoy superior natural ecological environments in Africa and Asia such as Gabon and Cambodia, but some had poorer natural ecological environments such as Egypt and Saudi Arabia. On the other hand, due to the industrialization process, some countries such as Indonesia scored poorly in indicators such environmental quality and resource utilization, affecting its level of environmental development.

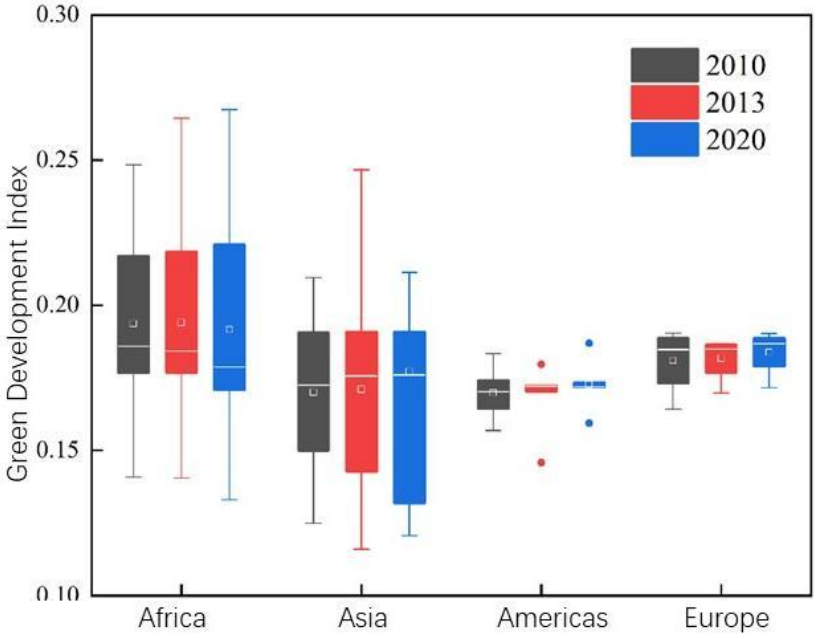


**Figure 4.12 Environmental Development Performance in Four Continents, 2010, 2013 and 2020**

# Chapter 5 Country Study and Case Study on BRI Green Development

The construction of the Green Silk Road has promoted the economic, social and environmental development of BRI partner countries and achieved positive results. This chapter aims to illustrate the contribution and role of the Green Silk Road to the key areas of green and sustainable development of BRI partner countries through exemplary BRI green development cases.

## 1. Environment governance

### 1.1 Supporting countries to tackle desertification challenges

The Saharan is faced with serious desertification, which poses a severe threat to food, ecology, energy and national security in Africa. China has mature experiences in desertification control and has formed a complete set of technical system and control models. As China's ecological construction technologies go global, it has improved the capacity of African countries to combat desertification, which not only allows China to fulfill its obligations as a member to the United Nations Convention to Combat Desertification but also practices Green Silk Road[27,28].

As early as 2012, an expert team specialized in sand prevention and control from the Xinjiang Institute of Ecology and Geography of the Chinese Academy of Sciences brought advanced technologies and solutions to Mauritania to promote the concept of sand control to local people. In 2016, the former State Forestry Administration of China and the Secretariat of the United Nations Convention to Combat Desertification jointly issued the Joint Action of Belt and Road Initiative to Combat Desertification. In 2017, the Xinjiang Institute signed an agreement with the Green Great Wall initiative of Africa to participate in the construction of the Green Great Wall in Africa. The Chinese side aims to provide technical support in areas such as soil remediation and improvement, development and enhancement of agriculture, forestry and animal husbandry systems, development of geographic information and early warning and monitoring systems, sustainable land management and green economy, in order to promote social and economic development of Africa and local management of the

27 Xinhuanet. Our scientific researchers will participate in the construction of the Great Green Wall in Africa.http://www.xinhuanet.com/2017-09/24/c_1121715600.htm

28 Chinese Journal of Science. China's experience in sand control opens a new window for science and technology diplomacy in the South-South cooperation of climate change.
http://news.sciencenet.cn/sbhtmlnews/2019/6/346874.shtm

Great Green Wall initiative. In addition, China is also helping to improve Africa's water and soil quality through environmental-friendly agricultural projects. According to data provided by the Xinjiang Institute, after long-term systematic monitoring, experimental research and application, Chinese and African experts have built a pilot demonstration zone for quicksand fixation and water-saving irrigation in Nouakchott, capital of Mauritania. In Kano State, Nigeria, a pilot demonstration zone for economic forest conservation has been set up. In response to the ecological restoration and reconstruction of scrub grassland in low-altitude areas of Ethiopia, a model of ecological restoration and sustainable livelihood development of scrub grassland featuring "clear irrigation and grass cultivation, enclosure and rotation grazing, and herding" has been established, including a 200 hectare fenced-off demonstration area and a 2 hectare water-harvesting forest and grass restoration demonstration area. According to a study by Chinese and African experts, the total area of desertification in the Sahel has decreased from 72.31 percent to 69.23 percent between 2000 and 2020.

### 1.2 Improving the ecology and environment through green transformation

The Shymkent Oil Refinery, one of the three largest oil refineries in Kazakhstan, was built in the 1970s and is managed by China National Petroleum Corporation and Kazakhstan National Petroleum Corporation. Restricted by the backward production process and the aging equipment, crude oil processing of the refinery was insufficient with high energy consumption before the modern transformation, and the product followed low-quality standards, while treatment on oil, sewage, sulfur emissions, and other environmental protection facilities are less strengthened. After upgrading in September 2018, the Shymkent Oil Refinery relieved the domestic supply shortage of refined oil products in Kazakhstan, ending the country's dependence on imported refined oil products. It has played a vital role in ensuring the supply of refined oil products, improving ecology and environment and promoting economic and social development in Kazakhstan. Environmental protection was highly focused on the upgraded refinery and has been prioritized in the renovation process. After upgrading, oil products that follow Euro IV and Euro V standards can greatly reduce the air pollution of gas emissions. Meanwhile, the upgraded wastewater and gas treatment facilities have reduced pollutant emissions by 90%, and can save 1.5 million cubic meters of water each year. The outstanding performance in environmental protection of the refinery has won the “Outstanding Contribution of Ecological Protection

Award" set up by the President of Kazakhstan.

## 2. Resource utilization

### 2.1 Developing renewable energy

Tackling climate change is an important part of the Belt and Road cooperation. In 2019, during the second Belt and Road Forum for International Cooperation, Chinese President XI Jinping announced to launch the Belt and Road South-South Cooperation Initiative on Climate Change. The Belt and Road Energy Partnership was jointly launched with 29 BRI partner countries, and the Cooperation Principles and Concrete Actions of the Belt and Road Energy Partnership was endorsed. In 2021, at the general debate of the 76th session of the UN General Assembly, President Xi Jinping announced that China would stop building new overseas coal-fired power projects. Since most BRI partner countries are developing countries with a large energy demand, China is competitive in fields such as renewable energy. China's technology, products, experience and solutions will help solve their energy shortage while promoting the transformation and upgrade of traditional industries, greatly promoting cooperation on Green Silk Road.

Located on the Jhelum River in Pakistan's Punjab province, the Karot Hydropower Station[29] has a total capacity of 720 MW. It is a key project of energy cooperation on the CPEC, the first large-scale hydropower investment project and a key BRI project that was written into the Joint Statement of the Chinese and Pakistani governments. With an average annual capacity of 3.2 billion kWh, the project can provide Pakistan with a competitive clean energy that can meet the power demand of some 5 million local people and will effectively alleviate the electricity shortage in Pakistan. The project is expected to save about 1.4 million tons of standard coal and reduce carbon dioxide emissions by about 3.5 million tons per year, improving Pakistan's energy mix and economic and social development, and helping to achieve the global carbon neutrality goal. The project adopts Chinese technology and standards from design to construction, and extends Chinese technology and standards to the world in connecting with global standards. In terms of environmental impact evaluation, the results meet the requirements of local environmental management laws and regulations in Pakistan, and takes IFC performance standards on

29 BRIGC. Case Study Report on BRI Green Development. http://www.brigc.net/zcyj/bgxz/202011/P020201130031910858067.pdf

environmental and social sustainability into account, which has gained acknowledgment from the international community.

The Mozura Wind Power Project[30] is one of the successful examples of energy cooperation between China and Malta and is regarded as a model project for the wind power industry in central and eastern Europe. Located in Montenegro, with a total installed capacity of 46 MW, the project was put into operation by the end of 2019. Based on Montenegro's national electricity production in 2017, the project can provide 5 percent of the country's total electricity production for 100,000 residents. The operation of the Mozura wind farm will provide more than 112 million kWh of clean electricity. It will bring huge economic and environmental benefits to the country, further benefit the well-being of local people, and strongly support Montenegro in achieving the goal of "doubling the installed capacity of new energy ".

### 2.2 Addressing environmental problems accompanied by urbanization process

As most BRI partner countries are developing countries and emerging economies, they are facing the arduous task of promoting industrialization and urbanization. This process leads to environmental pollution, ecological degradation, climate change and other ecological and environmental problems, among which the treatment of domestic waste is a serious one. Taking Viet Nam as example, about 85 % of the waste generated in Viet Nam is left untreated and buried in landfills, 80% of which is unsanitary. A report released by Vietnam's Ministry of Natural Resources and Environment showed that in 2019, the country produced about 64,658 tons of domestic waste each day, an increase of 46% over 2010. Many Asian cities face the challenge of solid waste treatment. in this regard, Can Tho City of Viet Nam develops a waste-to-energy project of waste incineration that provides an efficient and environmentally friendly solution. The clean energy can help countries reduce their dependence on fossil fuels .

The waste incineration power generation project is located in the Thai Lai District of Can Tho, a southern Mekong Delta City. The project is the first modern domestic waste-to-energy project in operation in Viet Nam. The project was put into operation at the end of November 2018 and has a processing capacity of more than 400 tonnes of domestic waste per day, equal to 70% of the total daily domestic waste

30 BRIGC. Case Study Report on BRI Green Development. http://www.brigc.net/zcyj/bgxz/202011/P020201130031910858067.pdf

of the city. The project has effectively improved local garbage removal capacity, and provided impetus for local economic development and environmental protection. At the same time, it has enhanced the technical development of waste incineration power generation in Viet Nam and showed an important demonstration effect. The core technology and equipment of the project are developed by Chinese enterprises, including an incinerator system, gas and leachate treatment system. The daily online monitoring index of flue gas emission is above the EU 2010 standard. The project adopts international leading standards from process design, and equipment selection to plant construction.

## 3. Unimpeded global economic flow

### 3.1 Improving infrastructure development

Most BRI partner countries have weak infrastructure, while China is a major infrastructure country and holds advanced technologies and rich experiences in the construction of roads, railways, airports, ports, bridges, tunnels and other infrastructure, which laid a good basis for international cooperation. Infrastructure connectivity, the cornerstone of international connection, is a priority area for BRI development. It aims to strengthen infrastructure and enhance connectivity in areas such as transport, power and communications, facilitating cross-regional trade and investment. In March 2022, China's National Development and Reform Commission, the Ministry of Foreign Affairs, the Ministry of Ecology and Environment and the Ministry of Commerce issued the Opinions on Promoting Green Development under the Belt and Road Initiative, proposing to strengthen green infrastructure connectivity. It guides enterprises to promote green standards and best practices for environmental protection of infrastructure, rationally select sites and routes during the design phase, reduce the impact on various protected areas and ecologically sensitive and fragile areas, do a good job in environmental impact assessment, and implement practical ecological and environmental protection measures during construction and operation, so as to continuously improve the level of green and low-carbon development in the operation, management and maintenance of infrastructure. To guide enterprises to adopt energy-saving and water-saving standards in the construction of overseas infrastructure, reduce waste of materials, energy and water resources, improve resource utilization rate, reduce waste discharge and strengthen waste treatment.

For instance, The Jakarta-Bandung high-speed railway, which runs 142

kilometers from Indonesia's capital Jakarta in the north to Bandung in West Java in the south, has a designed maximum speed of 350 kilometers per hour. As the first high-speed railway in Indonesia and even the entire Southeast Asian region, the Jakarbandung high-speed Railway involves a large number of people and a high density, and is an important channel connecting Indonesia, which can better meet the needs of people's passenger and freight transport. The project adheres to the concept of ecological and environmental protection, strengthens the investigation, design and construction organization, strengthens safety and quality control, and promotes the construction in a scientific, orderly, high-quality and efficient way. The project selected routes to avoid landslide, volcano and other bad geology to the maximum extent, innovatively designed Bridges with better vibration reduction and isolation performance, ballastless tracks with higher smoothness, and advanced train operation control systems with stronger functions, and built 13 tunnels and 56 Bridges to a high standard. During the construction of these projects, Chinese companies have actively fulfilled their social responsibilities and purchased a large amount of cement and other raw materials produced locally in Indonesia, which has boosted the local economy. A large number of Indonesian employees have been recruited to participate in the construction of the projects, creating a total of 51,000 local jobs and training 45,000 Indonesian employees. After the completion of the project, the fast transportation has narrowed the distance between cities and brought huge development opportunities. It can make the scattered Indonesian industries more intensive, turn the railway line into an economic belt, and stimulate the "new driving force" of Indonesia's economic growth.

### 3.2 Strengthening industrial, commercial and trade cooperation

Unimpeded trade is one of the priority areas of Belt and Road cooperation. It aims to facilitate investment and trade, reduce trade barriers, expand two-way trade, promote regional free trade progress, promote trade exchanges, accelerate investment facilitation and expand mutual investment. Over the past decade, the level of free trade and trade facilitation between China and other BRI partner countries have been steadily improved, while international trade and two-way investment have maintained rapid growth. Between 2013 and 2020, China's direct investment to other BRI partner countries registered a total of USD 139.85 billion. In 2021, China's total import and export volume to BRI partner countries reached 11.6 trillion yuan RMB, an increase of 23.6% over 2020. The non-financial direct investment to BRI partner countries

reached USD 20.3 billion, an increase of 14.1% over 2020. The development of overseas economic and trade demonstration zones is a new form and an important carrier of BRI production cooperation. As of the end of September 2022, nearly 70% of the overseas economic and trade demonstration zones included in MOFCOM's statistics are located in BRI partner countries.

For example, as the first national industrial park set up by China in Malaysia, the Kuantan Industrial Park is also a demonstration zone for cross-border international production capacity cooperation and a major BRI project. The park was officially opened in 2013 and has become a sister park of the China-Malaysia Qinzhou Industrial Park (CMQIP). Thanks to the natural endowments, industrial advantages, and market resources of the two countries, China and Malaysia have accelerated the construction of cross-border industrial chain, supply chain and value chain, and planned special industries based on the two industrial parks. The construction of the industrial park system has been accelerated as the exchanges and cooperation deepens, and become a model of innovation in economic cooperation between the two countries. The Kuantan Industrial Park has become one of the most successful industrial parks in the East Coast Special Economic Region of Malaysia.

### 3.3 Improving digital penetration

At the first and second Belt and Road Forum for International Cooperation, President Xi stressed building a digital Silk Road while promoting the innovation and development of BRI. To date, China has become the second largest digital economy and has even become the world's leading nation in building mobile internet infrastructure and the innovation of digital trade. In turn, some BRI partner countries also have unique advantages in terms of designing new software and building new Internet platforms. Chinese tech-giants including Alibaba and Baidu have made big strides into the commercial and telecoms markets of the Middle East and Northeast Africa. In addition, Huawei[31], the global leader in 5G networks and one of the world's top suppliers of telecom equipment, is also interested in overseas markets. In 2018, Huawei became one of Qatar's first wholly foreign-owned technology enterprises, boosting the development of local 5G technology. In 2019, Huawei signed a MOU with Saudi Arabia's leading telecoms operator, Zain KSA, to help the company build its first 5G LAN project in the Middle East and North Africa. A number of telecom

[31] 【Chinese company in Albania】Huawei: The Shining Business Card of China Smart Makes in Albania. https://news.china.com/news100/11038989/20170815/31098802.html

companies in the United Arab Emirates have also collaborated with Huawei on 5G network services.

## 4. Gender Equality

### 4.1 Improving women's employment

Women's employment has always been a global concern. It can reflect the quality and economic status of the female labor force, and the gender equality and social status between men and women. At the 2015 Global Women's Summit, President Xi put forward China's proposal to fight for women's development in tandem with social and economic progress. He clearly stated that “Women's organizations in different countries should strengthen interactions with each other to enhance friendship, pursue development, and achieve progress together”. China's investment in BRI partner countries has significantly promoted women's overall employment in the host countries and significantly improved the employment structure of women in the three industries.[32] For instance, in 2012, the Huajian International Shoe City[33] invested by China Huajian Group in the Oriental Industrial Park in Ethiopian Addis Ababa, employed nearly 6,000 people, 90% of whom were women, which has greatly boosted local female employment.

### 4.2 Ensuring equal employment[34]

Beyond the economic level, Belt and Road cooperation is an important way to improve the global development mechanism and governance. As an important approach to promote the sound development of economic globalisation, it reflects the aspirations of all countries, especially developing countries, to pursue peace and development. The McKinsey & Company surveyed thousands of Chinese companies in eight African countries and found that 89 percent of their employees are native Africans, indicating that 300,000 jobs were created for Africa. The Loto Taumafai Society National Disability Center is a fine example. Since its establishment in 1981, the center has been working to provide basic education and skills training to Samoan children with disabilities. However, teachers and students can only live in rented premises. At the request of the government of Samoa, the Chinese government decided to build a training center for the disabled. In 2015, the Loto Taumafai Society

[32] Han S. C., Xu S. Has OFDI promoted female employment in BRI partner countries? An empirical study based on country panel samples. Investment Research, 2020, 3, 20-34.
[33] BRI win-win cooperation: Huajian group's win-win investment in Ethiopia. https://world.huanqiu.com/article/9CaKrnK2nyf
[34] Ambassador to Samoa, Wang Xuefeng's speech at the completion ceremony of the Samoa Training center for the disabled. http://switzerlandemb.fmprc.gov.cn/web/dszlsjt_673036/t1313173.shtml

National Disability Center was completed, with increased training capacity from 150 people to over 400 people, providing strong support for the development of Samoa's disabled community.

## 5. Health and Well-being

### 5.1 Improving medical and healthcare[35]

Cooperation in the health sector is an important part of the BRI. On the one hand, China has provided medical and public health assistance to BRI partner countries since the BRI was proposed. For example, technical assistance is in place for schistosomiasis control in Zanzibar, Tanzania, to help design control protocols that reduce the infection of local schistosomiasis. The artemisinin program in Comoros has rapidly eradicated malaria, resulted in a zero fatality rate and reduced malaria infection by 98%. In addition, China has built more than 50 medical and health infrastructure projects in Congo, Rwanda, Zimbabwe, Cambodia, Kyrgyzstan and other BRI partner countries, playing an active role in protecting people's health and training medical talents. China has also provided medical equipment, medicines and medical supplies to the countries concerned, lifting the shortage of medical resources. Assistance is also provided to more than 20 countries to build up specialized medical departments through cooperation with local medical institutions. On the other hand, medical personnel in BRI partner countries can make full use of the BRI as a bridge to continue opening up and carrying out international exchanges and collaboration among medical institutions. It’s important to exchange medical knowledge and experience, draw on each other’s strengths and focus on mutual learning, so as to enhance the expertise of medical care in BRI partner countries and benefit the local people.

### 5.2 Ensuring safe drinking water

Safe and hygienic water is one of the basic conditions for human survival. The developing countries, especially BRI partner countries, are weak in water environment protection and faces serious water pollution. Ensuring safe drinking water has become a major challenge for all countries. China has made great progress in water environment protection, such as personnel training, basic research,

[35] China's International Development Cooperation in the New Era. The State Council Information Office of the People's Republic of China. 2021.01

technological research and equipment production, which can be shared with fellow developing countries. The Cabinda Water Supply Project[36], completed in 2020, is the most important project for Cabinda, Angola. China Railway Construction Corporation undertook the design, construction, and pre-operational maintenance of the project. Upon completion, the water supply can cover 95% of Cabinda's population and directly benefit more than 600,000 residents. The project will effectively address Cabinda's overall poor urban water supply and urban roads infrastructure, the low coverage and penetration of water supply systems, the uneven distribution of water supplies, and the instability of water quality and availability. It could also reduce the incidence of malaria, diarrhea and cholera in the city. The project has not only provided safe and hygienic drinking water to the Angolan people through the construction of a high-quality and comprehensive water supply system, effectively improving people's livelihoods. It also promotes the quality of the local environment and the well-being of the community through the construction and operation of various types of sustainable infrastructure and social service measures. These endeavors have helped Angola to accelerate its progress towards achieving Sustainable Development Goal 6 (SDG 6), namely access to safe water and sanitation and sound management of freshwater for all. The assessment from the Sustainable Development Report 2021(SDSR 2021) of the United Nations Sustainable Development Solutions Network (SDSN) shows that the progress on SDG6 is on the rise in Angola, partly contributed by the Cabinda Water Supply Project.

### 5.3 Supporting poverty reduction of the poor[37]

Poverty is an internationally recognized “silent crisis”,and its elimination is the common goal and aspiration of human development. In his speech at the opening ceremony of the Boao Forum for Asia Annual Conference 2021, President Xi pointed out that China will act in the spirit of openness and inclusiveness and work with all willing participants to build the BRI into a pathway to poverty alleviation and growth, which will contribute positively to the common prosperity of humankind. In terms of the current distribution of extremely poverty population globally, Sub-saharan African countries account for nearly 60% of the world’s extreme poor population, while South Asian countries account for about 30%, which are mostly BRI partner countries.

[36] Case Study Report on BRI Green Development. [R]. BRIGC. 2020-12. http://www.brigc.net/zcyj/bgxz/202011/P020201130031910858067.pdf

[37] China Daily website: Promote Poverty Reduction Cooperation in East Asia and Building a Community of Shared Future. https://baijiahao.baidu.com/s?id=1689396828508292846&wfr=spider&for=pc

Building the BRI as an important platform for cooperation and focusing on infrastructure, trade and investment, and livelihood projects will contribute to global poverty reduction. In 2019, a report from the World Bank indicated that, full implementation of the BRI could lift 7.6 million people out of extreme poverty and 32 million out of moderate poverty. It will enhance the trade between China and BRI partner countries by 2.8-9.7%, global trade by 1.7-6.2% and global income by 0.7-2.9%. By 2021, China will have set up 25 economic and trade cooperation zones and hundreds of industrial parks in Africa, making a positive contribution to Africa's industrialization, employment and increasing exports. According to incomplete statistics, 25 economic and trade cooperation zones alone have created around 40,000 jobs and nearly 11 billion dollars of tax revenue for the host country. In addition to major projects, China also initiated “Small yet smart” projects to promote infrastructure and agricultural development in remote areas that have long been neglected, supporting poverty alleviation in BRI remote areas. For instance, since 2017, China has launched a three-year “Village-wide promotion” and “Targeted poverty alleviation” trial in six villages of three BRI countries, namely Laos, Cambodia and Myanmar. Starting from the same year, by invitation of the provincial government of East Highland of Papua New Guinea, a Chinese expert group set up a Juncao technology (breeding fungi with herbaceous plants) demonstration site in Lufa District. Today, the fungus cultivation has been extended to 16 districts in 8 provinces of Papua New Guinea, lifting tens of thousands of people out of poverty.

# Section III Key Areas of Green Silk Road

**The third section** (Chapters 6-13), based on the analysis of the first two sections and considering the development strategies, opportunities, and challenges faced by BRI countries, identifies eight key areas: biodiversity conservation, climate change response, green finance, sustainable ocean development, sustainable transportation, green energy transition, green technology innovation, and regulatory standards connectivity. It provides current situation analysis, future outlook, and cooperation recommendations for each of these areas. The report points out that the ecological environment in the BRI regions is sensitive and fragile, with rich biodiversity and species diversity, complex landforms, and geographical conditions. The infrastructure construction under the BRI is closely related to ecological and environmental protection, making biodiversity conservation, climate change response, and ocean protection key areas of regional sustainable development and directly linked to the SDGs. At the same time, green finance, as an important tool to unlock the potential of green development, sustainable transportation, and green energy as key industries of the BRI, and green technology innovation and harmonized rules and standards as important guarantees, all provide great potential and solutions for promoting the green and low-carbon transition of the BRI.

# Chapter 6 Biodiversity Conservation

Biodiversity loss is a major crisis and challenge that human beings are facing. The *Global Risks Report 2020* published by World Economic Forum [40] pointed out that $44 trillion of economic value generation - over half the world's total GDP – is moderately or highly dependent on nature and its services. Although the world's 7.6 billion people represent just 0.01% of all living creatures, humanity has already caused the loss of 83% of all wild animals and half of plants. Biodiversity loss and ecosystem collapse will remain among the Top5 global risks regarding likelihood and impact. Biodiversity loss is among the Top4 global risks in the long term in the *Global Risks Report 2021*[41] *Global Risks Report 2022*[42], *Global Risks Report 2023*[43], and *Global Risks Report 2024*[44].

In May 2019, the *Global Assessment Report on Biodiversity and Ecosystem*

[40] https://www.marsh.com/cn/en/insights/research/global-risks-report-2020.html Global Risks Report 2020.
[41] https://cn.weforum.org/reports/the-global-risks-report-2021 Global Risks Report 2021.
[42] https://cn.weforum.org/reports/global-risks-report-2022 Global Risks Report 2022.
[43] https://www.weforum.org/reports/global-risks-report-2023/ Global Risks Report 2023.
[44] https://www.weforum.org/publications/global-risks-report-2024/ Global Risks Report 2024.

*Services* was published by the seventh session of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Plenary[45]. According to the report, since 1970, 75% of the land surfaces and 40% of the ocean area are significantly altered; 100 million hectares of tropical forests and 87% of wetlands have been lost; around 25% of species in assessed animal and plant groups are threatened and one third of ocean fish stocks are under the threat of overfishing. These will finally threaten the sustainable development of human society. The Report concluded that it is likely that most of the Aichi Biodiversity Targets for 2020 will be missed and that the world needs urgent and concerted efforts to foster transformative changes.

The Convention on Biological Diversity (CBD) was opened for signature in 1992 and entered into force on 29 December 1993. It has three main objectives: the conservation of biological diversity, the sustainable use of the components of biological diversity, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. The Sixth Session of the Conference of the Parties to the Convention on Biological Diversity (COP 6) and the Tenth Session of the Conference of the Parties to the Convention on Biological Diversity (COP 10) identified 2010 global biodiversity goals and 2020 global biodiversity goals respectively. Despite positive actions taken by the international community, the progress was unsatisfying. The loss of ecosystem, species, and generic diversity continues, making biodiversity conservation all the more pressing. COP 15 Part 2 was held on 7-19 December 2022 in Montreal, Canada. The landmark "Kunming-Montreal Global Biodiversity Framework" (hereafter referred to as "Kunming-Montreal Framework") adopted at COP 15 proposed a new blueprint for global biodiversity conservation by 2030 and beyond, unveiling a new round of biodiversity conservation actions around the world. The Kunming-Montreal Framework often referred to as the "Paris Agreement" in biodiversity conservation, establishes a global framework for transitioning towards a sustainable and nature-smart economy.

Biodiversity conservation is critical for implementing the United Nations 2030 Agenda for Sustainable Development and stabilizing the economy. According to the World Bank, by 2030, biodiversity loss will reduce global GDP by an average of

[45] https://ipbes.net/global-assessment IPBES Global Assessment Report on Biodiversity and Ecosystem Services

2.3%, with low-income countries facing declines of up to 10% [1]. In this context, it is crucial to analyze the status and developments of biodiversity along the Belt and Road. It is also imperative to identify and manage the impacts of BRI project construction and operation on biodiversity, as well as integrate and optimize ecological, economic, and social benefits in line with the Kunming-Montreal Framework. Such efforts will provide valuable insights for future Belt and Road cooperation on biodiversity conservation and China's participation and leadership in global biodiversity governance process.

# 1. Status Quo of Biodiversity Conservation along the BRI

## 1.1 Biodiversity Challenges in Regions along the Belt and Road

Regions along the Belt and Road encompass several globally recognized key areas of biodiversity conservation, while also being among the most severely threatened regions for biodiversity. However, amid economic globalization and prioritization of economic development, biodiversity conservation efforts in many BRI participating countries have not received adequate attention. *Sustainable Development Report 2023* shows that only 3.2% of the 154 BRI participating countries[46] realized SDG 15 (Life on Land) targets. Conserving biodiversity in the regions along the Belt and Road presents significant challenges.

The industries most dependent on nature, such as agriculture, infrastructure, and extractive industries, have the most severe impacts on biodiversity. If more sustainable production methods are not adopted to protect nature, industries, employment, and national economies may face risks. It is noteworthy that there is a significant demand for strengthening infrastructure in regions along the Belt and Road. For instance, railway development in Central Asia is slow and the lines are severely outdated while South Asia and Central Asia lack highways and have poor road quality, which naturally poses greater challenges for biodiversity conservation in the region. It is estimated by the World Bank that BRI participating countries will need US$ 650 billion of infrastructure investment by 2030[2]. According to the *Asia-Pacic Countries with Special Needs Development Report 2017* published by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), countries with special needs (CSN) will need to invest, on average, an amount equivalent to 10.5% of their GDP every year to close the infrastructure deficit, taking urban population

[46] Data retrieved on 27 April, 2024.

growth and increasing impact of climate change into account. This far exceeds current levels of infrastructure funding in these economies, which ranges between 3% and 4% of GDP. *From Development to Differentiation: Just How Much Has the World Changed*, a research report published by the United Nations Conference on Trade and Development (UNCTAD) in 2019, argues that economic and social gaps between developed and developing countries remain significant over the last quarter century with growing infrastructure divide, employment divide, and digital divide. With 40 years of successful experience in promoting economic development, China can enhance the connectivity among economies through the BRI, help to narrow the funding gap for realizing SDGs, boost trade and improve people's wellbeing, and promote economic development and social progress in countries along the Belt and Road. In fact, in recent years, China has actively promoted road and railway construction projects in collaboration with countries participating in the Belt and Road Initiative, making significant contributions to the economic development of these countries.

However, infrastructure construction means interruptions to nature and ecosystems. Linear infrastructure projects, including highways, railways, bridges, power transmission facilities, and power plants, while bringing convenience and economic benefits to local communities, inevitably pose risks to natural landscapes and ecosystems because of their vast area and complex engineering features., including habitat degradation and segmentation, environmental pollution, habitat isolation, the invasion of alien species and change of microclimate. At the same time, the regions along the Belt and Road regions have complex and diverse climates and terrains, with some areas rich in biodiversity and species resources, which require high ecological environmental quality. To balance the relationship between ecological protection and economic development and to successfully carry out infrastructure construction projects, it is essential to better measure, assess, and mitigate the negative impacts of these projects on local biodiversity.

In addition to the impacts of infrastructure development, the funding gap is a significant challenge. Biodiversity financing helps guide capital to utilize natural resources more sustainably. The World Economic Forum's 2020 report, *The Future of Nature and Business*, suggests that a "nature-positive" strategy could generate $10 trillion in economic opportunities and create 395 million jobs by 2030. However,

according to the latest estimates from the Paulson Institute[47], the annual biodiversity funding gap is projected to be between $720 billion and $970 billion by 2030. Furthermore, the current financing process lacks a comprehensive standard system for biodiversity conservation. A study evaluated biodiversity standards among 35 Chinese financial institutions and 30 international ones involved in Belt and Road financing, finding that only 17 of these institutions have developed biodiversity conservation standards for their financing activities, with just one Chinese investment institution represented [5]. This highlights the importance of improving the standards for biodiversity financing.

### 1.2 Status Quo of Biodiversity Conservation in BRI Participating Countries: Progress Towards the Aichi Biodiversity Targets

In October 2020, BRI International Green Development Coalition (BRIGC) and related partners jointly published *Key Biodiversity Areas and Impact Assessment in BRI-covered Areas* [48]based on WWF-SIGHT and other visualization tools. The identification results showed that BRI important biodiversity areas are mainly concentrated in Southeast Asia, the India-Myanmar border, Europe, and South Africa, where their warm and humid climates predominantly characterized by plains, hills, and mountains, create favorable conditions for biodiversity. Meanwhile, these areas, especially Southeast Asia and the China-India-Myanmar border, are also home to most of the IUCN Red List of Threatened Species.

In 2010, the Tenth Session of the Conference of the Parties to the Convention on Biological Diversity (COP 10) proposed 20 action targets for global biodiversity conservation, or the "Aichi Biodiversity Targets" (Table 6.1), which are composed of 60 elements. In 2016, Resolution No.27 (XIII/27) adopted by the Thirteenth Session of the Conference of the Parties (COP 13) required Parties to prepare the sixth national report, conducting a self-assessment of their domestic biodiversity conservation. This includes national conservation targets, actions taken for biodiversity conservation and their effectiveness, progress in implementing national targets, and contributions to the Aichi Biodiversity Targets. By 27 April 2024, 103 Parties have submitted their national reports[49], including 85 BRI participating countries. In reference to the 44 key BRI participating countries studied by the report,

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47 https://www.paulsoninstitute.org/wp-content/uploads/2020/09/FINANCING-NATURE_Full-Report_Final-Version_091520.pdf

48 http://www.brigc.net/zcyj/bgxz/2020/202011/P020201130030492040093.pdf.

49 CBD Secretariat. National Reports [EB/OL].https://www.cbd.int/reports,2023-01-03.

22 countries are identified as the object of study in this chapter based on various factors, including biodiversity richness, importance, and data availability. They are 8 Asian countries: Thailand, Malaysia, Indonesia, Myanmar, Kyrgyzstan, Sri Lanka, Saudi Arabia and the UAE; 9 African countries: South Africa, Zambia, Kenya, Egypt, Tanzania, Ethiopia, Cameroon, Niger, and Botswana; 2 European countries: Greece and Serbia; and 3 American countries: Chile, Panama and Costa Rica. The following analysis is based on the 22 countries.

**Table 6.1 Archi Biodiversity Targets**

| No. | Target | No. | Target |
|---|---|---|---|
| 1 | Awareness of the values of biodiversity | 11 | Protected areas |
| 2 | Biodiversity values integrated | 12 | Extinction of threatened species prevented |
| 3 | Positive incentives for the conservation and sustainable use of biodiversity developed and applied | 13 | Safeguarding genetic diversity |
| 4 | Sustainable production and consumption | 14 | Ecosystem services restored and safeguarded |
| 5 | Habitat loss halved or reduced | 15 | Ecosystem resilience and the contribution to carbon stocks enhanced |
| 6 | Sustainable management of aquatic living resources | 16 | The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational |
| 7 | Sustainable agriculture, aquaculture and forestry | 17 | Implementation of effective, participatory and updated national biodiversity strategy and action plans (NBSAPs) |
| 8 | Pollution reduced | 18 | Traditional knowledge fully integrated and reflected |
| 9 | Invasive alien species prevented and controlled | 19 | Knowledge, science base and technologies are improved, widely shared and transferred, and applied |
| 10 | The integrity and functioning of coral reefs and other vulnerable ecosystems maintained | 20 | Mobilization of financial resources |

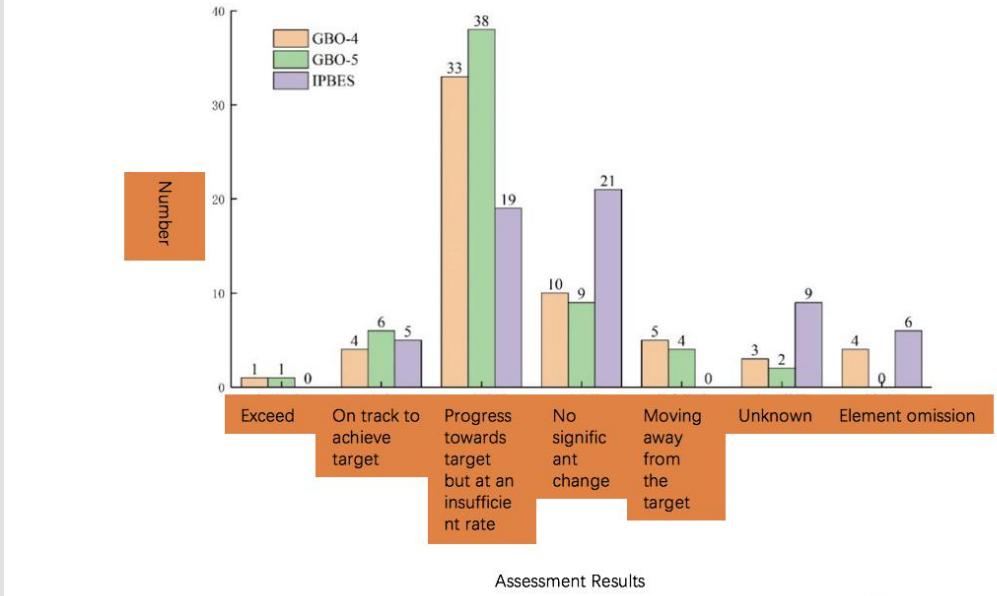
In reference to the fifth edition of the *Global Biodiversity Outlook* (GBO-5), the chapter indicates the level of progress towards the Aichi Biodiversity Targets using

one of the six categories: (a) on track to exceed target, (b) on track to achieve target, (c) progress towards target but at an insufficient rate, (d) no significant change, (e) moving away from the target, (f) unknown. Results show that **BRI participating countries have made significant progress in Target 1, 11, 13, 14, 16, and 19**. Compared with the results globally provided by GBO-5 (**Box-6.1**), BRI participating countries outperformed the global level in Target 1, 13 and 14; kept in line with the global level in Target 11, 16, and 19; and performed worse than the global level in Target 9, 17 and 20. **In summary, in the achievement of 20 Aichi Biodiversity Targets, compared with the global level, BRI participating countries studied in this report performed better in 3 targets, up to par in 3 targets, and performed worse in 3 targets.**

**BOX-6.1 Global Summary of Progress Towards the Aichi Biodiversity Targets**

The Secretariat of the Convention on Biological Diversity published the fifth edition of the Global Biodiversity Outlook (GBO-5) online on 18 September 2020. Based on the 163 national reports received by July 2020 and the information provided in the 170 National Biodiversity Strategies and Action Plans (NBSAPs), GBO-5 made a global summary of progress towards the Aichi Biodiversity Targets. According to the results, at the global level, only six targets have been partially achieved (Targets 9, 11, 16, 17, 19 and 20). Examining the 60 specific elements of the Aichi Biodiversity Targets, 7 have been achieved and 38 showed progress. 13 elements showed no progress or indicated a move away from the target, and for 2 elements the level of progress was unknown.

Examining the 60 specific elements, the results of the IPBES Global Assessment on Biodiversity and Ecosystem Services were the most pessimistic. Only 24 have been exceeded, achieved, or shown progress (40%). In comparison, the results of GBO-4 and GBO-5 showed "overall progress with worsening trends in certain elements". More specifically, 45 have exceeded, achieved, or showed progress (75%) in GBO-5, higher than that of GBO-4, which was 38 (63%).




From the perspective of the 20 action targets, only Targets 1 and 17 are consistent across GBO-4, GBO-5, and the IPBES assessments. Compared to GBO-4, most target evaluations in GBO-5 remain consistent, showing progress in areas such as Target 9 (reduce invasive species), Target 11 (protected areas), Target 12 (prevent extinctions), and Target 20 (mobilize resources). However, there is a decline in Target 16 (implement Nagoya Prot.). In comparison to IPBES, most targets and indicators in GBO-5 are either stable or more positive, with only Aichi Target 13 (conserve gene pool) exhibiting a downward trend.

| Archi Biodiversity Targets | Element Assessment | | |
|---|---|---|---|
| | GBO-4 | GBO-5 | IPBES |
| Target 1 | | | |
| Target 2 | | | |
| Target 3 | | | |
| Target 4 | | | |
| Target 5 | | | |
| Target 6 | | | |
| Target 7 | | | |
| Target 8 | | | |
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| Target 15 | | | |
| Target 16 | | | |
| Target 17 | | | |
| Target 18 | | | |
| Target 19 | | | |
| Target 20 | | | |


Among the five direct drivers of biodiversity loss, except for invasive alien species (Target 9), which has shown improvement, habitat degradation (Target 5), environmental pollution (Target 8), overexploitation (Target 10), and climate change (Target 12) have all made poor progress, with some even deviating from their targets.

Under a “business as usual” scenario, it is anticipated that over the next decade, positive progress may be achieved in four elements: ecosystem connectivity, conservation and restoration actions, ecosystem services (water, air, natural disasters), and biodiversity responses to climate change and disasters. In contrast, 11 elements, including harmful subsidies, habitat area, sustainable use, pollution, fragile

ecosystems, and wild relatives, are expected to show little to no progress, or only slow progress.

Specifically, the realization rates of Target 1, Target 11, and Target 19 among the countries studied are the highest (i.e., the ratio of “on track to achieve target” to “on track to exceed target”, the same applies below), at 64%, 59%, and 55%, respectively. Target 2, 5 9 and 10 are the least achieved with over 70% of countries failing to achieve the target. Countries “on track to achieve” Target 2 are all Asian countries (Indonesia, Myanmar, Thailand and UAE) and African countries (Botswana, South Africa and Zambia). Target 9 has the highest proportion of countries (18%) showing “no change”, including Ethiopia, Zambia, Costa Rico and Myanmar. Target 10 has the highest proportion of countries (18%) categorized as “unknown”, including Cameroon, Ethiopia, Serbia and Saudi Arabia (**Figure 6.1**).

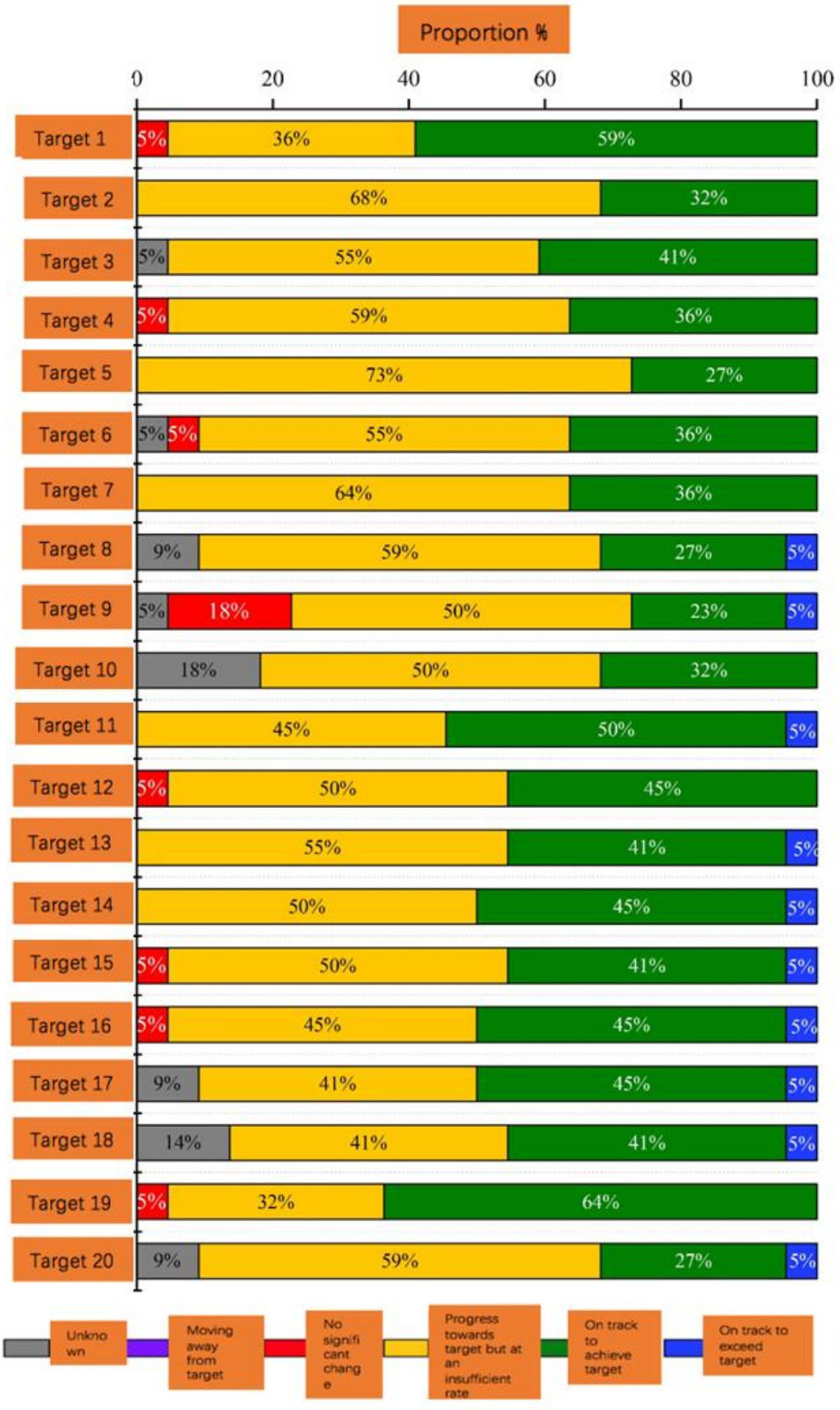
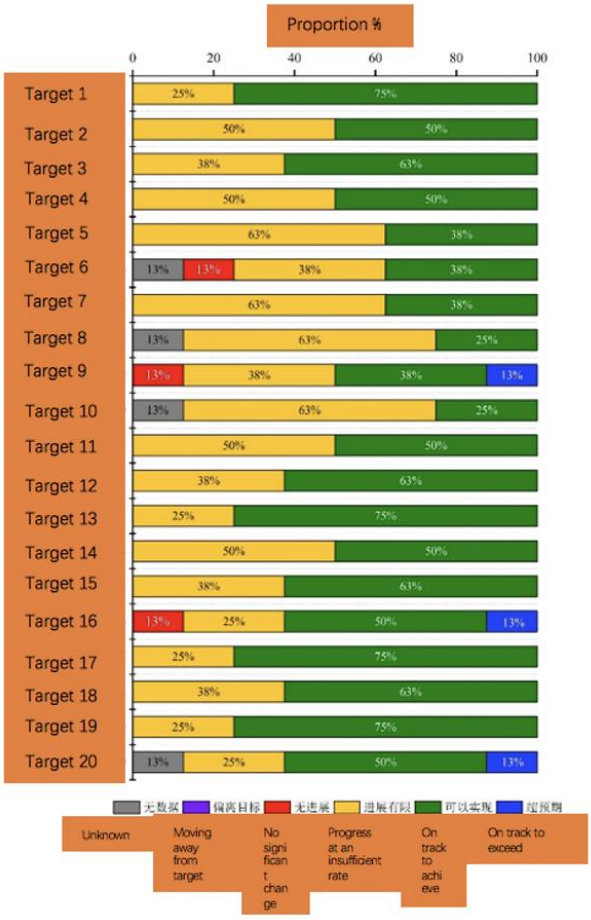


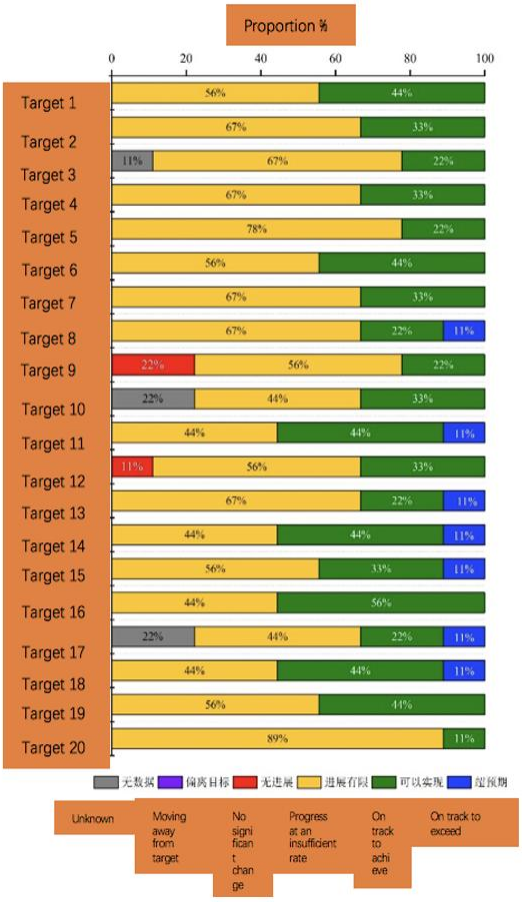

**Figure 6.1 Progress Towards the Aichi Biodiversity Targets**

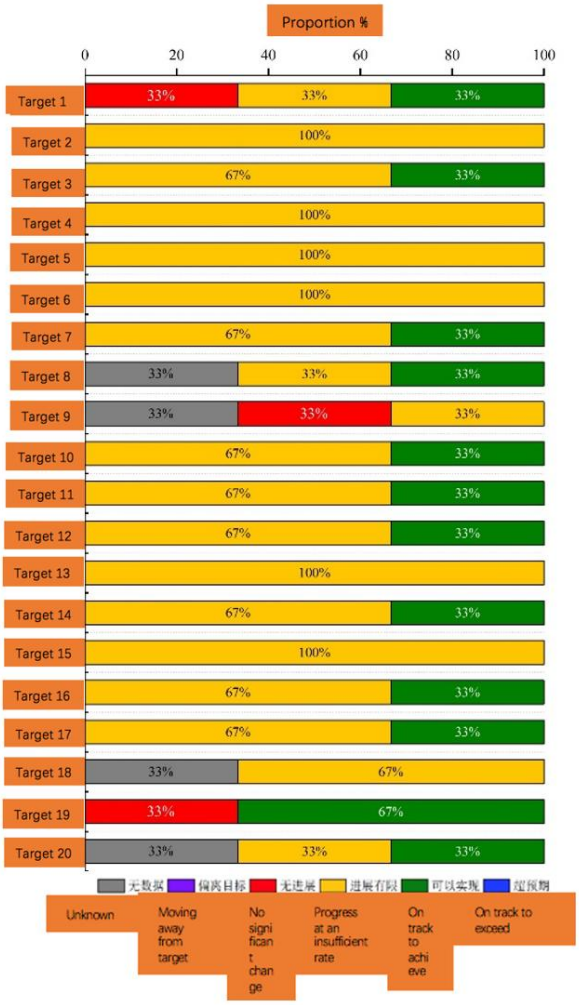
Regionally, Asia and Europe have made progress, while Africa and America showed no significant change. 15 targets are “exceeded” or “on track to be met” by over 50% of Asian countries. Target 1, 13, 17 and 19, in particular, have been achieved by 75% of Asian countries. Meanwhile, Target 8 and 10 have been achieved by only 25% of Asian countries, which indicates that greater efforts are needed. As for Europe, 15 targets are “exceeded” or “on track to be met” by over 50% of European countries. Target 1, 11 and 19, in particular, have been achieved by 100% of European countries. Meanwhile, Europe showed the least progress in Target 4 with 50% of all countries on track to achieve target and another 50% having made no significant change. Progress towards Target 18 is unknown, which indicates that “traditional knowledge” is still a bottleneck for Europe.

Only Target 16 is achieved by 50% of African countries. Africa showed the least progress in Target 20 with only 11% of all countries on track to achieve target, indicating that “mobilizing resources from all sources” is the greatest challenge for Africa. Target 9 and 12 are the bottleneck for Africa with “no significant change” in 22% and 11% of all countries respectively. American countries have only made progress towards Target 19, with 67% of all countries having achieved target while the rest 33% made no significant change. None of the American countries studied in

this report have made significant change towards Target 2, 4, 5, 6, 13 and 15.

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Unknown
Moving away from target
No significant change
Progress at an insufficient rate
On track to achieve
On track to exceed


Proportion %
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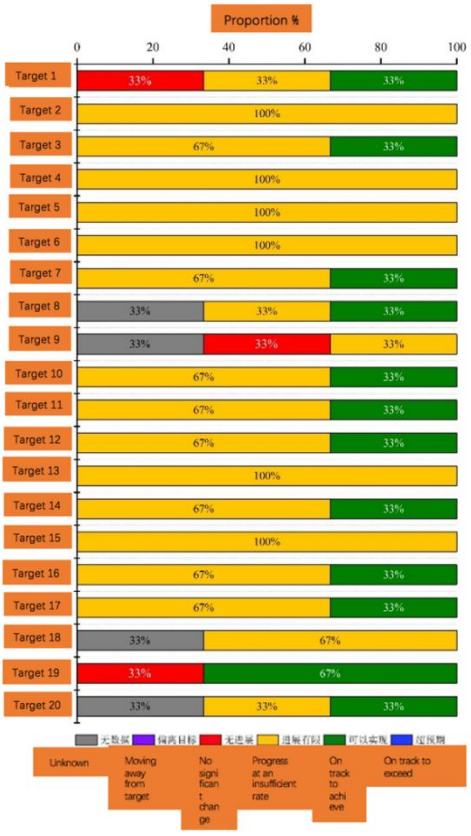
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可以实现
提前期
Unknown
Moving away from target
No significant change
Progress at an insufficient rate
On track to achieve
On track to exceed

**Figure 6.2 Regional Progress Towards the Aichi Biodiversity Targets**

Note: Upper-left: Asia; upper-right: Africa; lower-left: Europe; lower-right: the Americas

**(1)Asia**

Asia is the largest continent in the world, covering 8.7% of the earth's total surface area and having the highest plant diversity among all continents. However, biodiversity in Asia is severely threatened by factors such as overexploitation of resources and environmental pollution. Although Southeast Asia only occupies 3% of the earth's surface area, it is home to 20% of the world's animal, plant, and marine species, as well as the world's third-largest tropical rainforest. Yet, this region has the highest deforestation rate in the world. It has lost 14.5% of its forest cover since 2002, with an average annual loss of 1.2% [6]. In addition to deforestation, environmental pollution also poses a serious threat to biodiversity in Southeast Asia. Haze is a common environmental problem in the region, mainly caused by farmers using fire to clear agricultural land. In 2019, months of consecutive forest fires in Indonesia coupled with the fact that cloud seeding couldn't be practiced in the dry season caused an extremely serious haze problem, with the air pollution index in the central Kalimantan province reaching "dangerous levels" [7]. Pollutants can put plants in various agricultural areas at high risk and pose a severe threat to endangered wildlife. Since many pollutants are soluble, aquatic ecosystems are more vulnerable to pollution than terrestrial ecosystems. Pollutants can easily spread to the tissues of aquatic organisms [8]. Organic compounds such as carbon, nitrogen, and phosphorus have been found to be continuously increasing in the river systems in the northern part of Southeast Asia. As a result, fish and other organisms may experience increased mortality rates or physiological impacts [9].

**Thailand**, as one of the 20 countries in the world with a high biodiversity of up to 10%, spans two global biodiversity hotspots (Indo-Burma and Sundaland) and possesses a diverse range of ecosystems. However, in recent years, the economic development of Thailand has led to the overexploitation of natural resources. Additionally, due to a lack of experienced managers, inadequate laws and regulations, and limited implementation capabilities, Thailand's biodiversity faces significant challenges, resulting in an increase in endangered species.

**Indonesia** is the world's largest archipelagic state with 47 ecosystems, including rainforests, coral reefs, and seagrass beds. It is also the country with the largest area of

mangroves in the world. According to a report by the World Resources Institute in 2022 [10], 84% of Indonesia's mangroves, 55% of its seagrass beds, and 57% of its coral reefs are located outside of the marine reserves, which means that only less than 20% of the marine reserves are covering those important ecosystems that serve as critical barriers against marine disasters and for carbon storage. In 2021, Indonesia signed the *Glasgow Leaders' Declaration on Forests and Land Use* at the 26th UN Climate Change Conference of the Parties (COP26), pledging to halt and reverse deforestation and land degradation by 2030. According to the *2022 Forest Declaration Assessment* [11], Indonesia is one of the few countries moving in the right direction, with its forest loss rate decreasing each year during the past five years.

**Malaysia**, as one of the most biodiverse countries in the world, has a high discovery rate of new species. Between 1997 and 2004, over 2,200 new species had been discovered in Malaysia. Data from the World Wildlife Fund shows that Malaysia's forest cover is currently around 54%. Despite fully protected areas and a permanent forest reserve system to enhance forest ecosystem management, deforestation remains a major problem. From 2001 to 2019, Malaysia's tree coverage decreased by approximately 8.12 million hectares. According to a joint report by the World Bank [12], Malaysia may suffer an annual GDP loss of 6% by 2030 if its ecosystems partially collapse, which would be equivalent to the economic impact of the COVID-19 crisis in 2020.

**Myanmar** is a global biodiversity hotspot with a wide variety of unique wildlife species. The forest ecosystems in Myanmar play a crucial role in promoting the country's economy and local welfare, as over 70% of the population resides in rural areas and relies heavily on forest resources for food, fodder, shelter, and fuel. Myanmar has made significant efforts to protect its ecosystems, aiming to have 30% of its land area designated as permanent protected forestland by 2030 [13]. It is noteworthy that since 2015, China and Myanmar have been conducting joint research and cooperation in biodiversity conservation. The Chinese Academy of Sciences has established the Southeast Asia Biodiversity Research Institute based in Myanmar to carry out extensive cooperation in joint scientific expeditions, talent training, and species discovery.

**Kyrgyzstan**, with 95% of its land covered by mountains, boasts unique species and rich ecosystems nurtured by the distinctive geological environment of the Tien Shan Mountains and Pamir Plateau. It has almost all types of plant communities found

in the Eurasian continent. Kyrgyzstan has a highly concentrated biodiversity, with approximately 1% of all known species on Earth found within its territory, which accounts for only 0.13% of the global land area. However, in terms of biodiversity and habitat, Kyrgyzstan ranked 147 out of 180 assessed countries in the *2022 Environmental Performance Index* [14] mainly lagging in indicators such as the protection of terrestrial ecosystems and the species protection index. The country's Special Protected Natural Areas (SPNA) network is expanding actively, covering 1.2 million hectares or 6% of the country's land area, with a plan to increase the coverage to 10% by 2024.

**Sri Lanka**'s rich biodiversity makes it the country with the highest concentration of species in Asia. According to a report by the Ministry of Mahaweli Development and Environment in Sri Lanka [15], the country's biodiversity is facing six major threats, including river diversion that poses a risk to freshwater fish and other species, habitat loss and fragmentation, pollution from organic and inorganic waste, overdevelopment, invasive alien species, and climate change. Furthermore, since one-third of the wild elephant population lives outside elephant protected areas, human-elephant conflict is increasingly intensifying in Sri Lanka. At present, most of Sri Lanka's endemic flora and fauna are found in in wetlands and mountainous areas with the lowest proportion of protected areas.

**The United Arab Emirates (UAE)** has always been actively protecting biodiversity. For example, the "Scimitar-horned Oryx Reintroduction Program in Chad" led by the Environment Agency- Abu Dhabi is the most ambitious large mammal reintroduction plan in the world[50], aiming to release 500 scimitar-horned oryxes into their natural habitat in Chad. In terms of marine conservation, the UAE has maintained a leading position globally. There are 16 marine conservation areas in the country, accounting for 18.4% and 12.01%[51] of the land and marine areas respectively. At present, the UAE is facing biodiversity-related challenges including the lack of arable land, desertification, invasive alien species, climate change, red tide occurrences, overgrazing, overuse of marine resources, oil spills along the coast, water desalination, wastewater discharge, and rapid tourism development.

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[50] Samihah Zaman. May 20, 2022. Abu Dhabi successfully translocates oryxes, antelopes to wildlife reserve in Chad. Gulf News.https://gulfnews.com/uae/abu-dhabi-successfully-translocates-oryxes-antelopes-to-wildlife-reserve-in-chad-1.88006890

[51] UAE Governmental Portal. About the UAE-Life below water. Updated on 02 Feb 2023. https://u.ae/en/about-the-uae/leaving-no-one-behind/14lifebelowwater

**Saudi Arabia** announced the Saudi Green Initiative and the Middle East Green Initiative in March 2021, which set out clear goals to reduce carbon emissions by 278 million tons annually by 2030, to plant 10 billion trees over the coming decades, to restore approximately 40 million hectares of degraded land, and to increase the area of protected areas to 30% of the total land and marine area.

**(2)Africa**

Biodiversity is one of the key factors for achieving sustainable development in Africa and is crucial for ensuring food security, water supply, and mitigating climate change. Africa has 369 wetlands of international significance, 255 important bird and biodiversity areas, and 8 world biodiversity hotspots. Africa is home to a quarter of the world's mammal species and a fifth of bird species, and at least one-sixth of global plant species are endemic to Africa [16]. The Congo Basin, which is home to the world's second-largest tropical rainforest after the Amazon, harbors approximately 10% of the world's biodiversity, including 400 species of mammals, 1000 species of birds, 700 species of fish, and even 900 species of butterflies. Known as the earth's "second green lung", the Congo Basin absorbs 4% of global carbon emissions each year, offsetting the annual emissions of the entire African continent. Over 62% of the rural population in Africa relies on the diverse natural ecosystems of the continent to meet their needs for food, water, energy, health, and livelihood. For example, the coral reef system extending from Egypt to South Africa provides a food resource for millions of Africans.

However, African biodiversity is under multiple pressures from rapid population growth, agricultural expansion, wildlife exploitation, unsustainable fishing practices, deforestation, land degradation, urbanization, and infrastructure development. Nature reserves in Africa are far from adequate. According to a survey conducted in 39 African countries, only an average of 4% of the land surface is officially designated as protected areas [17]. Data shows that the number of African vertebrate species has decreased by 39% since 1970. 20% of Africa's land surface has degraded due to soil erosion, salinization, pollution, and loss of vegetation or soil fertility. According to the United Nations Environment Program - World Conservation Monitoring Centre (UNEP-WCMC) 2016 estimates, by the end of this century, the overdevelopment and degradation of ecosystems will result in Africa losing 50% of its bird and mammal species and 20-30% of its lake productivity. Furthermore, Africa is considered the continent most affected by climate change. If the global temperature increase exceeds

1.5℃, it is estimated that over 90% of Africa's regions will have more than 10% of their plant, vertebrate, and invertebrate species at risk of local extinction.

**South Africa** occupies only 2% of the earth's land area but is home to 10% of global plant species, 7% of reptile, bird, and mammal species, and 15% of marine species with obvious endemism. It has over 95,000 known species, making it the third most biodiverse country in the world. However, South Africa's biodiversity is under significant threat. According to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species assessment, 10% of birds and frogs, 20% of mammals, and 13% of plants in South Africa are under threat. Biodiversity is an important foundation for South Africa's economic development, with 418,000 jobs directly related to biodiversity [18], and related industries contributing about 7% of the country's Gross Domestic Product (GDP) [19]. Creating protected areas such as nature reserves and national parks is a major measure taken by the South African government to conserve biodiversity. As of 2020, 9.2% of South Africa's land area was protected.[52] At the same time, combating poaching is crucial to wildlife conservation in South Africa. Over 80% of the world's rhinos live in South Africa, making it a major target for rhino poaching.

**Zambia** has 8,500 species of plants, of which about 54% are endemic to the country [20]. In Zambia, forests, agricultural ecosystems, and wetlands are the most important ecosystems for the national economy and rural livelihoods [21]. Economic drivers are a significant factor that causes the loss of biodiversity in Zambia, with agricultural expansion alone leading to 90% of forest cover loss [22]. Establishing protected areas is the primary mechanism for conserving biodiversity in Zambia, with over 480 forest reserves, 20 national parks, and 40 game management areas already established. It is estimated that the protected area network covers 37.8% of the country's land area.

**Tanzania** is one of the countries with the richest biodiversity in the world, with over 55,000 confirmed species. Additionally, it is home to one-third of Africa's plant species and 20% of the continent's large mammal species. To preserve its local ecosystem and biodiversity, Tanzania has identified a protected area that includes nature reserves, marine parks, and national parks, taking about 43.7% of its total land area. Among them, animal reserves (including game reserves) account for at least

[52] https://www.statssa.gov.za/?p=14732

28%, and forests for about 15.7%. However, most wild animals are found outside the current protected areas, meaning their survival is in a race against human socio-economic development. Over the past few decades, Tanzania has lost at least one-third of its important ecosystems, and both the number of species and individual populations are declining. In just ten years, the number of threatened species in Tanzania has doubled. There are plentiful wetlands occupying 10% of the total land area in Tanzania. Due to the rapid growth of its social economy, the country has witnessed a switch in wetland utilization, leading to intensified degradation of wetlands. There is a considerable decrease in the density, height, and area coverage of mangroves within the forests. The most immediate cause of mangrove degradation is excessive logging, which is used for fuel, charcoal production, building materials (such as poles), and boat construction, accounting for around 46%.

**Egypt** has made tremendous efforts toward the conservation of biodiversity and natural resources to ensure their sustainable use, but constraints still exist. The main threat to terrestrial, marine, and coastal ecosystems is habitat loss caused by excessive development. Freshwater environments are particularly affected by fragmentation. Land reclamation, urbanization, and industrial activities have destroyed and altered important natural habitats and their flora and fauna. Overgrazing and overfishing lead to biodiversity degradation. In Egypt, as wildlife utilization is largely unregulated, overhunting is endangering some wildlife animals and resident and migratory birds. Habitat loss and land degradation caused by overgrazing imperil desert biodiversity. Biodiversity loss in mountainous areas is largely attributed to human activities such as hunting, logging, trafficking, and urban development.

**Ethiopia** is rich in biodiversity, with approximately 6,000 species of higher plants (of which 10% are endemic) and 2,800 species of animals (of which 4.6% are endemic). Ethiopia is the origin of cultivated crops such as coffee and is also a center of diversity for many crop species, including durum wheat, barley, and sorghum. Forests play a crucial role in ensuring food security and sustainable livelihoods for millions of households in Ethiopia. Between 1990 and 2020, the area of naturally regenerating forests in Ethiopia decreased by 16%. The country's annual rate of forest loss (~~3%)~~ was the highest among African countries in the previous decade [23].

**Cameroon** ranks fifth in animal diversity and fourth in plant diversity in Africa. However, many species have been pushed to the brink of extinction, as the chase of game and international wildlife trade boomed. More than 630 species of animals and

plants have been included in the International Union for Conservation of Nature (IUCN) Red List. Lack of financial support and poorly trained wildlife authorities, who often lack adequate resources and mastery over monitoring, are some of the major challenges faced by Cameroon.

Most of **Botswana**'s territory consists of rainforests and grasslands. Abundant in wildlife resources, one third of its land is wildlife reserves. Four of the country's seven major ecological areas are fragile. According to a study, fences built to protect some specific species can impede and disrupt migratory routes of animals. In Botswana, fences prevented elephants from free movement. As a result, the elephants drank water from ponds in an area where warming had increased cyanotoxin blooms, triggering mass mortality.

**(3)Europe**

Europe is home to a considerable diversity of species. There are 260 species of mammals (of which 40 are marine mammals), 500 species of fish, 500 species of breeding birds, 150 species of reptiles, 84 species of amphibians, and 90,000 species of insects, including 10,000 of butterflies and moths, as well as 30,000 of beetles. In Europe, nearly one sixth (15%) of the terrestrial mammals and 25% of marine mammals are threatened with the risk of extinction due to human activities and climate change. To better conserve biodiversity, the EU proposed and established Natura 2000, a network of protected areas, which mainly consists of two parts, i.e. Special Areas of Conservation (SACs) designated by Member States in the Habitat Directive, and Special Protection Areas (SPAs) classified under the Bird Directive [24]. Natura 2000 stretches over 18% of the EU's land area and more than 8% of its marine territory. Moreover, in May, 2020, the *EU Biodiversity Strategy for 2030* was released, as a key component of the European Green Deal. Its main targets include reversing biodiversity loss as well as building resilience to climate change and the emergence and spread of future diseases. The strategy calls on to reduce the use of chemical pesticides in agriculture, to widen the network of protected areas, and to plant at least 3 billion additional trees.

Among the main pressures and drivers causing biodiversity loss in Europe are habitat fragmentation, degradation, and destruction due to land-use change. Fragmentation due to urban sprawl and infrastructure development – nearly 30% of EU land shows signs of moderately high to very high fragmentation – severely affects the connectivity of ecosystems, and their health and ability to provide services.

Furthermore, 30% of species are threatened by overexploitation of forests, oceans, rivers, and lakes. Additionally, invasive alien species are posing an increasingly severe threat to biodiversity. Of the around 12,000 alien species spotted in the environment, 10-15% are of invasion, and the number is on the rise. Especially in marine and estuarine systems, 22% of species are under threat from invasive aliens.

**Greece** is one of the countries with the richest biodiversity in Europe. Parts of Greece are located in the Mediterranean Basin biodiversity hotspot, the second largest hotspot in the world. Due to its varied topography and landforms, it has a very high proportion of endemic species compared to other countries. World Wildlife Fund (WWF) Greece stated that the Greek government has made limited tangible progress on key issues related to protecting biodiversity. In the past decade, a series of new regulations have caused damage to Natura 2000 sites. In December 2020, Greece was condemned by the European Court of Justice for its improper care of Natura 2000.

**Serbia** is one of the most intact protected areas in Europe. It is home to 39% of European vascular plant species, 51% of fish fauna, 74% of bird fauna, and 67% of mammalian species. Meanwhile, Serbia also boasts 5 national parks defined as Category II by IUCN. In 2021, the terrestrial protected areas in Serbia accounted for 7.6% of the total land area [25]. In May 2021, its government passed the Nature Protection Programme for the period from 2021 until 2023, which outlines the overall goals and specific measures for improving the natural protection system and conserving biodiversity in a definable, measurable, acceptable, practical, and timely manner as defined in its action plan for nature protection. This plan ensures the effective implementation of the goals, measures, and subsequent action plans of the European Union Biodiversity Strategy for 2030.

**(4)Americas**

The forest and grassland area of the Americas accounts for about 30% and 14.5% of the continent's land area respectively, and 18% and 11% of the world's total. According to the United Nations Environment Programme (UNEP), around 60% of global terrestrial life, and diverse freshwater and marine species, can be found within Latin America and the Caribbean. As one of the most diverse ecosystems on Earth, the Amazon tropical forest accounts for half of the world's total rainforest area and 20% of the earth's forest area. With over 100,000 plants found in each square kilometer of land, the Amazon, often referred to as the "lungs of the planet", produces over 30% of oxygen in the Earth's atmosphere. The Amazon region alone houses 10%

of the world's biodiversity. These are just the known species; researchers estimate that there are at least three times more plant species in the Amazon than are currently known [26]. Teeming with a variety of plants, it enjoys a warm and humid environment, making it a paradise for animals. Incomplete figures demonstrate that in the Amazon rainforest, there are more than 2.5 million species of insects alone, more than 3,000 types of fish, and more than 1,300 species of birds (about 20% of the world's total).

On a global scale, Latin America, host of the world's largest tropical forest, suffers from the most significant loss of biodiversity, showing a decrease in average population abundance at 94% over the past four decades. For example, the rate of species extinction in the Amazon region is worrying. The United Nations finds that around one million species are now threatened with extinction. Between August 2018 to July 2019, deforestation reached 9,842 square kilometers, with the rate of deforestation rising to its highest level in a decade. The loss of species in the region was mainly caused by human occupation and expansion of industrial and agricultural land, as well as excessive development of grasslands, rainforests, and wetlands. More than half of the ecosystems in the whole Americas fail to meet the global goals. According to the IUCN Red List of Threatened Species, nearly one-third of ecosystems and one-fifth of vegetation groups in the Americas are rated as vulnerable, endangered, or critically endangered.

**Costa Rica** is home to nearly 6% of the species on Earth, making it one of the most biodiverse countries in the world. It has rich coastal marine ecosystems, including coral reefs, mangroves, beaches, and seagrass meadows. Also, it houses 12 sites designated as Wetlands of International Importance. In the 1970s and 1980s, the forest coverage in Costa Rica plummeted from 75% to 21% due to deforestation. The number of wildlife species in the country has been decreasing. In the 1990s, Costa Rica established the Payments for Environmental Services Program (PES), a financial mechanism, which became the key to reversing the situation. Today, 52% of Costa Rica's area is covered by forests, and over 25% of its territory consists of dozens of national parks, biodiversity reserves, and natural habitats for wildlife. In 2019, ecotourism generated more than 8% of Costa Rica's GDP. Biodiversity conservation brings ecological dividends, allowing the government and individuals to invest more funds into environmental protection; on the other side, further enrichment of biodiversity promotes ecotourism. In this way, a path toward sustainable development is taking shape.

A total of 30,000 species were found in **Chile**, of which 25% are endemic. About 22% of Chile's territories are designated as national wildlife reserves. Data from the Global Forest Watch shows that from 2001 to 2021, Chile lost 2.17 million hectares of tree cover, resulting in an 11% decrease in forest cover, equivalent to a carbon sink loss of 8.81 million tons of CO2. 6.8% of tree cover loss occurred in areas where the dominant drivers of loss resulted in deforestation. In 2022, Chile became the first country in Latin America to enter ecological overshoot for the second consecutive time.

### 1.3 Best Practices for Biodiversity Protection in the Belt and Road Initiative

#### (1)The Most Comprehensive Ecological Space Protection System—China's Ecological Protection Red Line

To mitigate the rates of species extinction and biodiversity loss, building a protected area system is recognized as an effective approach. China has proposed and established the Ecological Protection Red Line system, which offers a novel ecological protection model. This system regulates important ecological spaces to achieve maximum ecological protection benefits with a minimum protected area, thereby maintaining habitat integrity. The Ecological Protection Red Line in China innovatively expands the scope of protection beyond traditional areas such as national parks. It considers ecosystem functions, ecological vulnerabilities, and biodiversity hotspots, emphasizing the integrity and connectivity of ecosystems. This allows for the large-scale and holistic protection of species and habitats, providing an innovative solution for global biodiversity conservation. Since its launch in 2014, the initially defined national ecological protection red line covers no less than 30% of the country's terrestrial land area. This includes areas with strong carbon sequestration capabilities or potential, leveraging nature-based solutions to mitigate climate change.

Additionally, China has established a system of natural protected areas centered on national parks. To date, China has officially designated the first five national parks, with nearly 10,000 natural protected areas in total, accounting for approximately 18% of the terrestrial land area. This achievement precedes the Aichi Biodiversity Target of reaching 17% by 2020. 74% of key nationally protected wild plant and animal species are effectively conserved. Some rare and endangered species are gradually recovering in the wild. For instance, the giant panda population has increased from 1,114 in the 1970s and 1980s to nearly 1,900 today; the critically endangered Hainan gibbon has grown from a low of 7-9 individuals to 37; the population of the crested

ibis has recovered from 7 individuals upon its discovery to nearly 10,000; and the Tibetan antelope population has rebounded from 70,000 to over 300,000 currently.

**(2)Biodiversity Conservation Corridors in the Greater Mekong Subregion: Building Cross-Border Links for Biodiversity Conservation in Rapidly Developing Areas**

As one of the most biodiverse regions in the world, the Greater Mekong Subregion (GMS) is home to numerous endemic species. Given that a significant portion of the world's threatened species resides in this area, many of these species are in critical danger, at risk of extinction, or vulnerable. Rapid and sustained economic development, particularly along the GMS Economic Corridor, poses further threats to the already stressed ecosystems and natural habitats. In this context, the Biodiversity Conservation Corridor Initiative was launched in 2005, funded by the Asian Development Bank and others, defining Biodiversity Conservation Corridors (BCCs) as suitable habitat areas that provide links between protected areas. Most biodiversity conservation corridors run parallel to the GMS Economic Corridor. This requires ensuring that while the economic corridor enhances "physical connectivity," the biodiversity conservation corridors support "ecosystem connectivity" to facilitate species movement between core areas. The initiative's three main implementation phases include: establishing biodiversity corridor sites to implement ecosystem restoration and poverty alleviation measures; taking climate change into account and improving the management of transboundary biodiversity conservation landscapes and local livelihoods; prioritizing sustainable management in areas with high ecosystem service value, economic growth pressures, and potential, based on ecological landscapes livelihood and employment. By the end of the second phase of the project, 8 biodiversity corridor pilot projects had been established, including those in Xishuangbanna, Yunnan and Jingxi, Guangxi, as well as 7 cross-border biodiversity conservation landscapes in the Karst region along the China-Vietnam border and the upper Mekong region (Laos, Myanmar, Thailand, and Yunnan, China), protecting a total of over 2.6 million hectares of biodiversity. The success of this project can be replicated in the Belt and Road Initiative and other cross-border infrastructure development programs in biodiversity-rich areas, such as the China-Indochina Peninsula Economic Corridor.

**(3)China's Responsible Forestry Investment in Gabon: A Fifteen-Year Path to Sustainable Development**

Driven by the "Going Global" strategy, China's forestry investment abroad has

been growing. As a resource-oriented sector, China's overseas forestry investments are of significant importance to global biodiversity conservation while also playing a critical role in promoting local social and economic development, particularly in terms of increasing employment and income. Gabon is one of the most important countries in Central Africa, endowed with abundant natural resources, with 85% of its territory covered by tropical rainforest. This makes it a hotspot for global forestry investment and the largest destination for China's forestry investments in tropical regions. In 2009, *A Guide on Sustainable Overseas Forest Management and Utilization by Chinese Enterprises* was released, marking the first industry guidance issued by China for overseas investments. Such a guideline can help Chinese enterprises conduct development activities in biodiversity-rich regions to comply with local laws and regulations while referencing sustainable management techniques and measures both domestically and internationally. The guideline aims to identify and protect areas of high conservation value, mitigate adverse environmental impacts, and respect the rights of local communities, effectively promoting green and sustainable development in overseas investments.

**(4)Nature-Based Solutions: Restoring the Water Retention and Drainage Functions of Natural Ponds to Enhance Flood Resilience in Sri Lanka**

Seasonal flooding has been a significant issue on Mannar Island, Sri Lanka, negatively impacting the economic and social activities of its residents. There are over 70 ponds on the island that serve natural drainage. Ponds and reservoirs are crucial for water storage and groundwater replenishment, especially in northern Mannar, where surface water is extremely scarce, and residents rely on groundwater for drinking and agricultural purposes. However, over time, many ponds have been filled in to clear land for residential and commercial development. Unplanned urban development has compromised the flood mitigation benefits provided by the pond system. Due to a lack of effective urban planning, some road drainage systems and culverts are also severely limited. Consequently, roads act like dams, causing water levels to rise during monsoon rains. Flooding disrupts public services, displaces residents, causes food shortages, and spreads waterborne diseases. Furthermore, municipal authorities face high costs for restoring and rebuilding infrastructure.

To address the challenges faced by Mannar Island, Sri Lanka, with support from the United Nations and other partners, has made efforts to raise public awareness about the negative impacts of illegal encroachments on ponds and unauthorized

constructions within pond boundaries. Additionally, existing natural ponds have been restored, serving as natural infrastructure for flood management and water retention solutions.

Effective coordination and collaboration with residents are key to the successful intervention and protection of community livelihoods. To enhance public awareness and capacity development, Sri Lanka has conducted training activities to educate people about the importance of ponds for local groundwater replenishment and flood retention, as well as methods for improving the operation and maintenance of natural and hybrid infrastructure. The restoration has increased the water retention capacity of Mannar Island by 8,840 cubic meters, enabling the ponds to collect more runoff (reducing flood risk) and helping to enhance water infiltration (improving groundwater quantity and quality).

**(5)Costa Rica's Path to Biodiversity Conservation Through Ecotourism**

Costa Rica is home to nearly 6% of the world's species, making it one of the most biodiverse countries on the planet. In the 1970s and 1980s, due to rampant deforestation, Costa Rica's forest cover plummeted from 75% to 21%, leading to a gradual decline in biodiversity. In the 1990s, Costa Rica established an ecological compensation mechanism, which became crucial in reversing this trend. This mechanism provides economic compensation to those who protect biodiversity on their land.

Leveraging its rich biodiversity to develop ecotourism has been a key to Costa Rica's success and can serve as a model for other countries. Today, this nation of only 5 million people welcomes about 3 million tourists annually, with over 60% of visitors choosing to come here because of its abundant biodiversity. Biodiversity can indeed be a source of wealth for national development and a legacy for future generations. Protecting biodiversity cannot rely solely on government, laws, and education; it ultimately requires the involvement and benefit of each community, which is why biodiversity conservation has deeply rooted itself in the hearts of Costa Ricans.

Currently, 52% of Costa Rica, often referred to as the "Garden of Central America," is covered by forest. Over 25% of its land consists of dozens of national parks, biodiversity reserves, and natural wildlife habitats. In 2019, tourism generated nearly $4 billion in revenue for Costa Rica, accounting for more than 8% of the country's GDP. Biodiversity conservation brings ecological dividends, allowing the

government and individuals to invest more in protection, further enriching biodiversity and promoting ecotourism, thereby creating a positive cycle of development.

## 2. Outlook of Biodiversity Conservation under the Framework of the BRI

### 2.1 The implementation of the "Kunming-Montreal Global Biodiversity Framework" will be the key to post-2020 biodiversity conservation

During the second part of the meeting held in December 2022, China, as the presidency of the 15th meeting of the Conference of Parties to the UN Convention on Biodiversity Conservation (COP15), promoted the establishment of the "Kunming-Montreal Framework." This Framework is ambitious, practical, and balanced, including 23 action targets. It is of milestone significance and offers a new blueprint for global governance on biodiversity (Figure 6.3). At COP15, Parties agreed on key issues such as the targets of the Framework, resource mobilization, and digital sequence information on genetic resources. The "30 by 30" pledge was made, which contains a series of targets including protecting at least 30% of Earth's land and waters by 2030. Strong measures were put in place to secure financial resources. The agreement made it clear that developing countries must receive the support they need in terms of financial resources, technologies, and capacity building. The "Kunming-Montreal Framework" will guide global efforts on jointly halting and reversing biodiversity loss, promoting biodiversity recovery, and realizing the vision of "living in harmony with nature" by 2050.

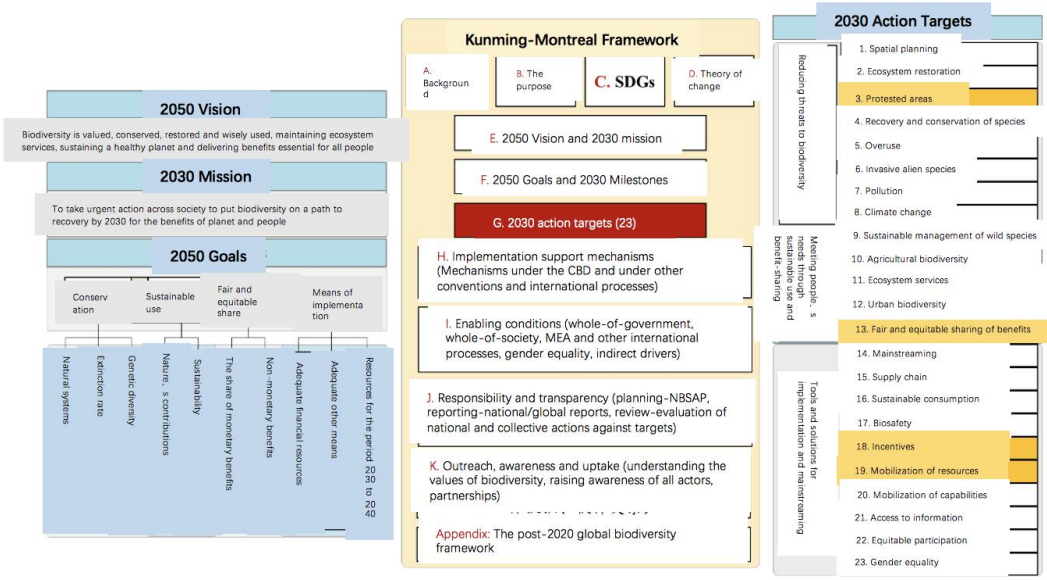


**Figure 6.3 Structure of the "Kunming-Montreal Framework"**

**2.2 Infrastructure development in regions along the Belt and Road is in high demand, with the impacts of BRI projects on biodiversity requiring careful attention**

Regions along the Belt and Road feature complex and diverse climates and terrains, with most areas exhibiting rich biodiversity, which demands high standards for ecological environmental quality. The Greater Lancang-Mekong Region, for instance, is of great significance to global biodiversity conservation as it overlaps with the Indo-Myanmar biodiversity hotspot. Meanwhile, BRI participating countries are in urgent need to improve and build new infrastructure facilities, especially linear infrastructure projects such as railways and highways. To ensure the successful implementation of infrastructure construction projects, we need to carefully assess and minimize their impact on biodiversity and adopt biodiversity assessment tools. For example, transportation infrastructure projects need to follow the *Guidelines for Addressing the Impact of Linear Infrastructure on Large Migratory Mammals* under the Convention on Migratory Species (CMS). To minimize the ecological impact on national parks or protected areas, railway or highway projects should be designed to avoid routing near these areas whenever multiple parks or protected zones are present along the proposed route. In cases where it is impossible to avoid protected areas, for the protection of wild animals, measures must be taken to facilitate safe passage of animals across the intrusion, including overpasses, underpasses, and crosswalks for animals to preserve the integrity of habitats and ecosystems.

### 2.3 BRI participating countries face daunting challenges in biodiversity conservation, creating huge potential for international cooperation

Over the past three decades since the *Convention on Biological Diversity* entered into force, the global community has reached a consensus on the conservation and sustainable use of biological diversity and taken conservation measures. However, the results of these efforts have fallen short. BRI participating countries are still in urgent need of addressing biodiversity risks. Effective conservation actions require international cooperation. For instance, in contrast with Europe and other developed areas where biodiversity conservation is identified as a priority task, African countries, hindered by economic constraints and lack of capacity, find it hard to push ahead with the transition to green development. As an important force in global biodiversity conservation, China upholds the philosophy of harmonious coexistence between humans and nature, continuously strengthening and innovating biodiversity protection measures. The country is committed to improving its biodiversity protection system, establishing a mechanism characterized by government leadership, public participation, multilateral governance, and win-win cooperation, which can provide valuable insights for BRI participating countries.

### 2.4 Biodiversity conservation is strongly relevant to addressing climate change, making it important for the global community to make synergistic efforts

Climate change is one of the major causes of biodiversity loss. It affects the number of species, alters the distribution of species, and accelerates the loss and fragmentation of habitats. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report indicates that from 2011 to 2020, global surface temperatures were 1.1°C higher than those recorded between 1850 and 1900 [28], leading to a 14% loss of biodiversity [29]. Concurrently, the earth is experiencing its sixth mass extinction [30], with approximately one million species at risk of extinction worldwide. However, a range of measures aimed at mitigating and adapting to climate change can enhance biodiversity conservation. Furthermore, reducing activities that harm biodiversity can enhance our resilience to climate change. To address the dual crises of climate change and biodiversity loss, it is essential to view climate action and biodiversity conservation as complementary goals, ensuring their synergistic advancement.

### 2.5 BRI participating countries face a significant funding gap for biodiversity conservation, urgently requiring long-term and robust support

For BRI participating countries, relying solely on national fiscal resources is insufficient to support biodiversity conservation efforts [31]. For example, South Africa faces an annual funding gap of up to $700 billion for biodiversity protection. It is imperative to shape an economic system that values nature, innovate long-term financing mechanisms for conservation, and mobilize private sector capital to provide adequate and sustainable funding for biodiversity protection. Biodiversity finance is regarded as a crucial financial tool for achieving the targets of the Kunming-Montreal Framework and the United Nations Sustainable Development Goals, playing an important role in conserving biodiversity and building a green Belt and Road. During the second phase of the COP15 meeting, the United Nations Development Programme (UNDP), along with major partners such as the Global Environment Facility (GEF) and the Green Climate Fund (GCF), launched $3.2 billion in investment projects in 138 countries aimed at ecosystem management and biodiversity conservation, helping nations promote nature-friendly investments. While global resource mobilization continues to advance, biodiversity-related finance remains insufficient, with most green finance being directed toward climate change response. According to data from the International Development Finance Club (IDFC), of the $134 billion allocated to the green finance sector globally in 2018, only $9 billion was invested in non-climate-specific financial initiatives. A 2019 OECD study found that, compared to the total size of the global bond market of $108 trillion, total investment in biodiversity conservation stands at only about $80 billion.

## 3. Recommendations for BRI Biodiversity Conservation

### 3.1 Enhancing alignment with international rules and standards and strengthening biodiversity protection under BRI projects

When implementing BRI projects, Chinese companies should take ecological factors into full consideration in alignment with international rules and standards to effectively protect local biodiversity. It is recommended that Chinese enterprises involved in Belt and Road Initiative projects actively align with China's national commitments, particularly those related to international conventions signed by China, such as *the Convention on Biological Diversity*, *the United Nations Framework Convention on Climate Change, the International Convention for the Protection of*

*New Varieties of Plants*, *the Convention concerning the Protection of the World Cultural and Natural Heritage*, *the Convention on International Trade in Endangered Species of Wild Fauna and Flora* and *the Convention on Wetlands of International Importance Especially as Waterfowl Habitat.* This alignment will promote the high-quality development of a green Belt and Road Initiative. In addition, projects are encouraged to follow principles, standards, and practices on environmental protection adopted by international organizations and multilateral financial institutions.

**3.2 Strengthening project assessments and nature-related environmental information disclosures to reduce the biodiversity impacts of BRI projects.**

Action Target 15 of the Kunming-Montreal Framework mentions the need to promote large multinational companies and financial institutions to regularly monitor, assess, and disclose their risks, dependencies, and impacts on biodiversity. Currently, various policies and tools for biodiversity impact assessment and management have been established globally. Enterprises involved in the Belt and Road Initiative should be encouraged to conduct biodiversity impact assessments for their projects based on the biodiversity protection status, development trends, and needs of partner countries, utilizing existing policies and tools. This includes conducting nature-related disclosures according to the framework recommended by the Taskforce on Nature-related Financial Disclosures (TNFD). It is advocated to use biodiversity assessment decision-making tools to screen risks before infrastructure investments, enhancing capacity building for risk identification and analysis of infrastructure projects. Biodiversity risks should be integrated into common frameworks, establishing a regular environmental risk supervision mechanism. Environmental factors such as pollution, biodiversity protection, and climate change should be considered important components of assessments, mitigating the negative impacts of projects on ecosystems throughout their entire lifecycle, from preparation and construction to operation. Emphasis should be placed on establishing stakeholder consultation mechanisms to ensure effective participation and consultation of relevant parties in biodiversity assessment and management. Implement a tiered and categorized management approach for Belt and Road projects, focusing on their impacts on environmental pollution, biodiversity protection, and climate change, and clearly defining positive and negative lists to provide green solutions for partner countries and related projects.

### 3.3 Making use of multiple resources to strengthen pragmatic cooperation and effectively meet the challenge of biodiversity loss for BRI participating countries.

We could strengthen cooperation under international frameworks such as the UN Decade on Ecosystem Restoration, and plan and implement projects similar to the World Restoration Flagship in partner countries to effectively meet the challenge of biodiversity loss. We could support and expand existing initiatives of different countries, such as “Bhutan for Life” or Africa’s “Great Green Wall” initiative, and promote the BRI for net benefits in biodiversity protection. At the same time, we could strengthen scientific research cooperation, promote exchanges between talents, jointly carry out biodiversity protection, share China’s experience in biodiversity conservation, and explore solutions to climate change, biodiversity loss, and other global problems with partner countries. We can provide skills training and share development experience for neighboring developing countries on sustainable utilization and management of biodiversity resources, biosafety, and biodiversity valuation assessment, to help partner countries build biodiversity conservation capacity.

### 3.4 Promoting biodiversity finance and deeply integrating biodiversity protection into the Green Silk Road

Financial institutions should play an active role in guiding green investments toward biodiversity protection or projects that benefit biodiversity. This includes incorporating biodiversity risks into financing cost assessments and providing financing support for projects that adopt preventive construction investments. Nature-positive Investment should be aligned with the International Finance Corporation’s Performance Standards on Environmental and Social Sustainability and the European Union’s Sustainable Finance Taxonomy. It is important to clearly define the boundaries of biodiversity-friendly investment and financing activities to better mobilize public and private funds toward nature-positive areas, addressing the current funding shortfall for biodiversity protection. We should fully utilize international platforms and resources, including the Natural Capital Coalition, the Biodiversity and Ecosystem Services Network, the Biodiversity Finance Initiative launched by United Nations Development Programme, the Natural Capital Finance Alliance (NCFA), the OECD and its Biodiversity Finance Tools Database, the International Development Finance Club (IDFC), and the Coalition for Private Investment in Conservation

(CPIC), to accelerate innovation in green financial instruments including joint investment platforms for development finance and sustainable-linked bonds/loans. This will help set out reasonable plans or goals for the sustainable and green development of the Belt and Road Initiative at the financial decision-making level. Engaging the private sector is crucial to bridging the biodiversity funding gap. We should reference the *Biodiversity Finance Reference Guide* published by the International Finance Corporation in 2022 to guide investors in identifying and investing in sectors that can protect and restore biodiversity and ecosystems. Additionally, we should effectively utilize the Kunming Biodiversity Fund[53], focusing on the three main objectives of the Convention on Biological Diversity: biodiversity protection, sustainable use, and benefit-sharing. The emphasis should be on supporting high-quality projects that can deliver significant economic benefits while effectively protecting biodiversity, thereby promoting the implementation of initial projects and providing support for developing countries to protect and restore biodiversity.

### 3.5 Promoting nature-based solutions and synergy between biodiversity protection and climate change response

Climate change and biodiversity loss are two highly intertwined hot topics and environmental challenges that all of us around the globe must face together. The necessity and importance of making coordinated progress for both are also based on extensive global consensus. Nature-based solutions (NbS) represent the most effective path for their coordination. During the implementation of the Belt and Road Initiative, it is essential to enhance investments in green, environmentally friendly, low-carbon, and renewable energy projects. Nature-based solutions should be fully integrated into the investment in large infrastructure projects, with a focus on the sustainable use of resources to ensure biodiversity integrity. Additionally, green development philosophy should be incorporated into the selection and management of infrastructure projects, to develop more environmentally sustainable, low-carbon projects. At the same time, we can promote the standards, experiences, and practices of China's ecological protection red line delineation, assisting BRI participating countries in formulating spatial management policies based on ecological protection

[53] On October 12, 2021, Chinese President Xi Jinping delivered a keynote speech at the Leaders' Summit of the 15th Meeting of the Conference of the Parties to the Convention on Biological Diversity, announcing China's initiative to establish a Kunming Biodiversity Fund and take the lead by investing 1.5 billion RMB yuan to support biodiversity protection in developing countries. On May 28, 2024, the Kunming Biodiversity Fund was officially launched.

red lines. This approach helps to safeguard critical ecological function areas before any potential harm or degradation occurs.

**References**


[1]. Johnson, Justin Andrew, et al. The economic case for nature: a global earth-economy model to assess development policy pathways. World Bank, 2021.

[2]. Ju Chuanxiao. Challenges and Suggestions for Financing Connectivity in the Belt and Road Initiative [J] China Investment, 2021, 20-21.

[3]. Alice C. Hughes. Understanding and minimizing environmental impacts of the Belt and Road Initiative [J]. Conservation Biology, 2019, 33(4), 883–894.

[4]. Xuan Liu, et al. Risks of biological invasion on the Belt and Road [J]. Current Biology, 2019, 29(3), 499-505.

[5]. Narain, Divya, Martine Maron, Hoong Chen Teo, Karen Hussey, and Alex Mark Lechner. Best-practice biodiversity safeguards for Belt and Road Initiative's financiers [J]. Nature Sustainability, 2020, 3, 650-657. https://doi.org/10.1038/s41893-020-0528-3.

[6]. Miettinen, J., C. Shi, and S. C. Liew. Deforestation rates in insular Southeast Asia between 2000 and 2010 [J]. Global Change Biology, 2011, 17, 2261–2270.

[7]. Borneo Nature Foundation. Indonesian fires and toxic smoke devastate wildlife as well as people [eb/ol]. 2019. https://www.borneonaturefoundation.org/news/indonesian-fires-and-toxic-smoke-devastate-wildlife-as-well-as-people/

[8]. Wu, Y., J. Shi, G. J. Zheng, P. Li, B. Liang, T. Chen, and W. Liu. Evaluation of organochlorine contamination in Indo-Pacific humpback dolphins (Sousa chinensis) from the Pearl River estuary, China [J]. Science of the Total Environment, 2013, 444, 423–429.

[9]. Glibert, Patricia M. Harmful Algal Blooms in Asia: an insidious and escalating water pollution phenomenon with effects on ecological and human health. ASIANetwork Exchange A Journal for Asian Studies in the Liberal Arts, 2014, 21.1.

[10]. Napitupulu, L., S. Tanaya, I. Ayostina, I.Andesta, R. Fitriana, D. Ayunda, A. Tussadiah, K. Ervita, K. Makhas, R. Firmansyah, and R. Haryanto. 'Trends in marine resources and fisheries management in indonesia.' report. Jakarta: world resources institute Indonesia. 2022. https://wri-indonesia.org/en/publications/trends-marine-resources-and-fisheries-management-indonesia-review

[11]. Forest declaration assessment partners. 2022. Forest declaration assessment: are we on track for 2030? https://forestdeclaration.org/wp-content/uploads/2022/10/2022 forest declaration assessment.pdf

[12]. World Bank Group, Bank Negara Malaysia. An Exploration of Nature-Related Financial Risks in Malaysia. 2022. https://documents1.worldbank.org/curated/en/09931 5003142232466/pdf/P175462094e4c80c30add50b4ef0fa7301e.pdf

[13]. Asian Forest Cooperation Organization (AFOCO). 2021. Forests and forestry in Myanmar: an overview of forestry laws, policies, and strategies. https://afocosec.org/newsroom/news/forestry-news/forests-and-forestry-in-myanmar-an-overview-of-forestry-laws-policies-and-strategies/

[14]. Wolf, M. J, Emerson, J. W., Esty, D. C., De Sherbinin, A., Wendling, Z. A., et al. 2022 environmental performance index. new haven, ct: yale center for

environmental law & policy. 2022.
[15]. Sevvandi Jayakody, Eric Wikramanayake Suranjan, Fernando, Kithsiri Ranawana. Biodiversity profile of Sri Lanka - sixth national report to the convention on biological diversity. 2019.
[16]. Africa center for strategic studies. 2022. African biodiversity loss raises risk to human security. https://africacenter.org/spotlight/african-biodiversity-loss-risk-human-security/
[17]. Paul V. Desanker. Impact of climate change on life in Africa. WWF climate change program. https://wwflac.awsassets.panda.org/downloads/wwfbinaryitem4926.pdf
[18]. South African National Biodiversity Institute (SANBI) and University of Cape Town. 2018. National biodiversity assessment. https://ba.sanbi.org.za/contentmanagement/ index? guid=96f2b64e-da8f-48ec-8f1a-0d1ab770bf21
[19]. Department of Forestry, Fisheries and the Environment. Republic of South Africa. Business and biodiversity in South Africa, 2018. https://www.dffe.gov.za/ projectsprogrammes/businessandbiodiversityinsouthafrica
[20]. Secretariat of the convention on biological diversity. Zambia biodiversity. https://zm.chm-cbd.net/
[21]. Convention on biological diversity. Zambia - sixth national report. 2018. https://chm.cbd.int/database/record?documentid=241363
[22]. The Biodiversity Finance Initiative (BIOFIN). Key drivers of biodiversity loss in Zambia. 2018. https://www.biofin.org/knowledge-product/key-drivers-biodiversity-loss-zambia
[23]. FAO, global forest resources assessment 2020: main report (food and agriculture organization of the United Nations, Rome, 2020).
[24]. Zhang Fengchun, Zhu Liucai, Peng Ning. EU Natura 2000: A Model of Nature Reserves. Environmental Protection, 2011(6), 73-74. doi:10.14026/j.cnki.0253-9705.2011.06.020.
[25]. The World Bank data. Terrestrial protected areas (% of total land area) - Serbia. https://data.worldbank.org/indicator/er.lnd.ptld.zs?locations=rs
[26]. Madeleine audsley. Latin America's biodiversity is critical for global goals. Natural Resources Defense Council (NRDC). 2020. https://www.nrdc.org/bio/jessica-carey-webb/latin-americas-biodiversity-critical-global-goals
[27]. Patrick J. Comer. Jon C. Hak, Carmen Josse, Regan Smyth. Long-term loss in extent and current protection of terrestrial ecosystem diversity in the temperate and tropical Americas. 2020. https://doi.org/10.1371/journal.pone.0234960
[28]. IPCC. Climate change 2021: the physical science basis [M]. Cambridge: Cambridge University Press, 2021
[29]. The Intergovernmental Science-Policy Platform on Biodiversity And Ecosystem Services (IPBES)-IPCC. Co-sponsored workshop report on biodiversity and climate [R]. Bonn: Ipbes Secretariat & Ipcc secretariat, 2021
[30]. IPBES. Global assessment report on biodiversity and ecosystem services of the intergovernmental science-policy platform on biodiversity and ecosystem services [R]. Bonn: IPBES Secretariat, 2019.
[31]. Hou Y L, Xing F Y, Ma L, et al. Addressing climate change and biodiversity conservation synergy: global practices and implications [J]. Climate Change Research,2023,19 (1):91-101.

# Chapter 7 Climate Change Response

Climate change is exerting widespread, complex, and far-reaching impacts on our planet and humanity, a reality that makes climate change response increasingly urgent. The synthesis report for its 6th Assessment Report released by the United Nations Intergovernmental Panel on Climate Change (IPCC) in March 2023 indicates that global GHG emissions in 2030 make it likely that warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C. To limit warming to 2°C, global net zero CO2 emissions need to be reached in the early 2070s; and to limit warming to 1.5°C, global net zero CO2 emissions need to be reached in the early 2050s. The *WMO State of the Global Climate 2023* report confirmed that 2023 was the warmest year on record, with the global average near-surface temperature at 1.45° Celsius above the pre-industrial baseline and ocean heat reaching its highest level in 65 years.

At present, the global trend of green and low-carbon transformation underpinned by the *Paris Agreement* is irreversible. The 28th Conference of the Parties to the UN Framework Convention on Climate Change (COP 28) delivered the milestone UAE Consensus, which include multiple decisions and actions on the first Global Stocktake (GST), mitigation, adaptation, fund, loss and damage, and just transition. By September 2023, A total of 151 countries have committed to carbon neutral goals, accounting for 88% of the world's carbon emissions, 92% of the global GDP, and 89% of the world's population. 90% of these countries are committed to realize carbon neutrality by 2050 or later, while only 12 of them promised to achieve carbon neutrality before 2050.

Against the backdrop, addressing climate change has become the greatest challenge for BRI countries to achieve the goals of the Paris Agreement and the SDGs. On one hand, these nations are mostly located in ecologically fragile areas and are highly vulnerable to the impacts of climate change. On the other hand, many of them adopt a rather extensive mode of growth, resulting in higher energy and carbon emission intensities.

Green is a defining feature of Belt and Road cooperation. China upholds its commitment to green, low-carbon and sustainable development, and has led the global climate governance process with practical actions and excellent results. It has provided support and assistance within its capacity to BRI countries in their endeavors

to address climate change. China is actively promoting the Belt and Road South-South Cooperation Initiative on Climate Change. It has signed 50 South-South MoUs on climate change with 41 developing countries, build 4 low-carbon demonstration zones, carried out more than 70 climate change mitigation and adaptation projects, and organized capacity training sessions to help BRI partner countries to more effectively cope with climate change. Moreover, China implemented the "Africa Solar Belt" program to advance cooperation with African countries in developing solar photovoltaic resources and clean energy. The program, adopting the model of "assistance in kind + exchange and dialogues + joint research + capacity building", aims to establish a China-Africa photovoltaic resources development and cooperation demonstration zone to boost green and low-carbon development in Africa.

This chapter aims to provide a comprehensive overview of the current status and challenges related to climate change in the BRI countries, identify crucial areas where low-carbon cooperation can make a significant impact and address outstanding needs. Furthermore, the chapter endeavors to propose directions and pinpoint key focal points for Belt and Road cooperation in climate change response in order to realize a shared green and low-carbon future .

## 1. Status Quo of Climate Change Response under the Framework of the BRI

### 1.1 Challenges of climate change response in BRI countries

**(1)Environmental vulnerability leads to susceptibility to the impacts of climate change**

On the whole, countries along the Belt and Road are ecologically vulnerable and susceptible to climate change impacts with high levels of climate risk. Firstly, in terms of extreme weather, most BRI participating countries have witnessed severe climate extremes over the past few decades [1－4]. For example, in the past 30 years, South Asia, Southeast Asia, and Central Europe have experienced a notable increase in extreme precipitation intensity and frequency of rainstorms, while regions like southern Europe, North Africa, Central Asia, and West Asia face the most frequent extreme droughts in the past century. In parts of South Asia and Southeast Asia, there is a rising trend of both drought-flood coexistence and extreme droughts and flood. Secondly, in terms of ecology, as many of the BRI participating countries are located

in ecologically fragile regions with arid-semiarid or arid-subhumid climate, they are confronting urgent environmental issues due to the intensifying impact of global climate change and human activities [5]. Recent studies reveal alarming trends, including the reduction in tropical rainforest areas, serious desertification of grasslands, degradation of desert vegetation, and the widespread deterioration of wetlands in the Belt and Road region in the past few decades [6]. Thirdly, in terms of warming, the BRI region witnessed an average temperature rise of 1.38℃ in the past hundred years, which is higher than the global temperature rise (0.98℃) during the same period [6]. Under the high greenhouse gas emission scenario, the average temperature will generally rise by more than 5℃ by the end of the 21st century [8]. Fourthly, in terms of precipitation, the average precipitation in the BRI regions has increased at a pace slightly higher than the global average [6]. However, there are also significant changes in the distribution of precipitation. Observation results show that global warming leads to spatial variation of aridity index [5]. The spatial variation of aridity index will become more obvious as well at the 2.0℃ warming level. There are abundant agricultural resources and many large agricultural countries along the BRI, climate change has increased the spatial and temporal differences in precipitation, resulting in an uneven distribution of water resources, leading to frequent floods and droughts.

**(2)A high proportion of carbon-intensive industries coupled with a heavy industrial structure**

Countries along the Belt and Road cover more than 60% of the world's population and 30% of global GDP [14]. However, it is worth noting that the majority of BRI countries are developing countries whose economies are predominantly dependent on high-emission industries, such as coal power, cement, iron and steel, etc. Limitations in terms of their own level of economic development, financial strength, and technological capabilities make it exceedingly difficult for these countries to achieve net-zero emissions on their own. For example, China's major industries include manufacturing, construction, finance, information technology, and agriculture, with a high proportion of carbon emission intensive sectors like coal, iron and steel, cement, and chemicals. Egypt's major industries include agriculture, oil and gas, mining, manufacturing, and tourism, of which the oil and gas sector being a prominent contributor to carbon emissions. Indonesia relies on coal as primary source of electricity generation, leading to high carbon emissions.

**(3)A heavy energy structure results in the predominance of fossil energy in energy consumption**

The heavy national energy consumption, the high-carbon energy consumption structure, the predominance of fossil energy in the BRI participating countries pose a serious challenge to their emission reduction actions. According to the *BP Statistical Review of World Energy (2023)*, in 2022, the consumption of fossil energy accounted for 82% of primary energy consumption in major BRI participating countries. Slightly lower than that of 2020, which was 87%, the number is still higher than the average of major economies. At the same time, there is obvious regional heterogeneity in terms of primary energy consumption structure in major BRI participating countries. The share of fossil energy in total energy consumption is the highest in the Middle East (98.9%) and Africa (95.4%), followed by the CIS (88.4%) and Asia-Pacific (85.5%), and lower in Europe (80.5%) and the Americas (79.7%). The carbon emission per unit of coal and oil is higher than that of natural gas. However, coal and oil accounts for more than 50% of total energy consumption in the Asia-Pacific region (73.8%), Africa region (63.0%) and Europe region (51.4%), and lower in the Middle East region (43.2%), the Americas region (40.8%) and the CIS region (36.8%). If the traditional approach to economic growth which is heavily reliant on fossil energy remains unchanged, at the current economic growth rate, it is likely that BRI countries will become areas with high carbon lock-in in the future.

**(4)Overall carbon emissions are still on the rise**

Over the past 20 years, the ecological pressure on BRI countries has been very high, especially in resource-rich regions such as West Asia, North Africa and parts of Southeast Asia [12-13]. Although the per capita carbon emissions in BRI countries are lower than the global average, these countries are experiencing a faster increase in carbon emissions compared to the global average. The Central and Eastern European region, in particular, shows the most significant rise, while Southeast Asia and South Asia are home to countries with relatively high total carbon emissions. The total carbon emissions in Southeast Asia, South Asia, West Asia, and Central Asia are also on the rise. Despite these trends, a separate study indicates that Belt and Road cooperation has had a positive impact on reducing the carbon emission intensity of the countries along the route, which is especially notable in energy-intensive industries. The inhibiting effect on the carbon emission intensity of transportation, power and heat, manufacturing and construction industries is most obvious in countries with high

carbon emission intensity.[54]。

**(5)Insufficient funds and advanced technologies to address climate change**

Financing is the key to addressing climate change. The transition toward a low-carbon economy demands three to six times more funds than the current investment in green initiatives. Significant disparities persist between developed and developing countries in terms of the responsibilities in funding ecological protection and climate change efforts, resulting in a substantial financing gap for green development. The *UNEP Adaptation Gap Report 2022* shows that global efforts in adaptation planning, financing and implementation continues to make incremental progress but fail to keep pace with increasing climate risks[55]. According to the *Global Landscape of Climate Finance 2023* published by Climate Policy Initiative (CPI), average annual climate finance flows reached almost USD 1.3 trillion in 2021/2022, nearly doubling compared to 2019/2020 levels. In the average scenario, the annual climate finance needed through 2030 increases steadily from $8.1 to $9 trillion. Then, estimated needs jump to over $10 trillion each year from 2031 to 2050. This means that climate finance must increase by at least five-fold annually, as quickly as possible, to avoid the worst impacts of climate change[56]. Besides, most BRI countries, especially the least developed countries (LDCs) lag behind in the implementation of low-carbon emissions technologies and are in lack of the necessary technologies for climate change adaptation. There is an urgent need for actions to reduce climate vulnerability and bolster the resilience of socio-economic development through the transfer of appropriate technologies.

**(6)Facing the common challenge of pollution treatment and climate change response**

The combustion of fossil fuels in human energy activities generates greenhouse gases and air pollutants which are highly homologous. Consequently, the model of high-carbon economic development tends to give rise to high-pollution, high-emission production and lifestyle patterns. BRI countries exhibit significant disparities in their economic development levels, with a majority being developing nations. Many of these countries have limited capacity in ecological and environmental governance and

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[54] Wu, Y., C. L. Chen and C. Hu, 2021, "Does the Belt and Road Initiative increase the carbon emission intensity of participating countries?" China & World Economy, Vol. 29, No. 3, pp. 1-25.

[55] UN Environment Programme, (2022). Adaptation Gap Report 2022: Too Little, Too Slow—Climate Adaptation Failure Puts World at Risk—Executive Summary. Nairobi.
https://www.unep.org/adaptation-gap-report-2022https://wedocs.unep.org/bitstream/handle/20.500.11822/41079/AGR2022_ESCH.pdf?sequence=16

[56] Global Landscape of Climate Finance 2023.
https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/.

still rely on large-scale resource consumption and pollution emissions to drive economic growth. Moreover, the countries and regions along the Belt and Road exhibit overall ecological fragility with frequent occurrence of extreme weather events, serious air pollution and industrial pollution in some regions, and a general deteriorating trend of the ecological environment. Climate change and the massive emission of pollutants pose a great threats to human health, living environment, and food security in the region, which in turn restricts the development of the economy. At present, while combating environmental pollution and ecological degradation, the BRI countries are also confronted with the pressure and challenge of GHG emissions reduction and climate change response. Therefore, green and low-carbon development has become an imperative necessity.

### 1.2 Policies and actions on climate change in BRI countries

In response to global climate change, BRI countries have demonstrated proactive efforts by formulating and implementing a wide range of policies and measures. Most of these nations have set clear carbon neutral targets. As of July 2022, 100 BRI participating countries have proposed net-zero emission targets.

**(1)Asia**

**ASEAN member states**

As of September 2017, all ASEAN member states (AMS) have signed and ratified the Paris Agreement, and joined the global cooperative efforts on climate change mitigation and adaptation. The Agreement sets long-term goals to guide all nations to 1) limit the global temperature increase in this century to 2 degrees Celsius while pursuing efforts to limit the increase even further to 1.5 degrees; 2) improve the capacity to adapt to the impacts of climate change, and maintain low GHG emissions trajectory and high climate resilience in a way that does not threaten food production; and 3) provide financing to mitigate climate change, strengthen resilience and enhance abilities to adapt to climate impacts. With coal exit and decarbonization becoming a global trend, ASEAN member states submitted their updated Nationally Determined Contributions (NDCs) in 2021 according to the principle of common but differentiated responsibilities and respective capabilities. However, the NDCs submitted by ASEAN member states are not ambitious enough. Currently, nearly half of them still have yet to commit to carbon neutrality. Besides, under the impact of the global energy shortage in late 2021, many ASEAN member states became hesitant to coal exit. In other words, the green development process of

ASEAN member states is subject to changes in global and national situations, making it all the more urgent to promote green and low-carbon transition in ASEAN according to its own circumstances.

**Table 7.1 Committed Timetable of ASEAN Member States' Carbon Peak & Neutrality**

| Country | Carbon Peak | Carbon Neutrality |
|---|---|---|
| Singapore | 2030 | 2050 |
| Vietnam | Unstated | 2050 |
| Thailand | 2030 | 2065 |
| Cambodia | Unstated | Unstated |
| Brunei Darussalam | Unstated | Unstated |
| The Philippines | 2030 | Unstated |
| Laos | Unstated | 2050 |
| Indonesia | 2030 | 2060 |
| Malaysia | Unstated | 2050 |
| Myanmar | Unstated | Unstated |

Source: Nationally Determined Contribution (NDC) and Long-Term Low-Emissions Development Strategy (LEDS) of ASEAN member states as of April 2022

**Central Asian countries**

Climate change has become an integral part of Central Asian countries' policies, mainly including energy efficiency, low-carbon growth and climate change mitigation and adaptation.

**Table 7.2 NDC Policy Measures of BRI Countries in Central Asia**

| Country | Policy Measure |
|---|---|
| **Kazakhstan** | ● To amend and supplement related legislative acts on the transition to green economy<br>● To establish renewable energy reserve funds, and establish the mechanism for connecting renewable energy to its national grid. |
| **Kyrgyzstan** | ● Specialization of agricultural production; selection of drought and salt-tolerant crops; introduction and strict compliance with the pasture rotation system; development of animal husbandry; improvement of food security monitoring systems, including crop yield forecasting.<br>● Improvement of its climate monitoring system to forecast extreme weather events such as landslide, avalanche, debris flow; improvement of early warning system to minimize casualties and economic losses; development of weather and climate risk insurance systems; and prevention-oriented capacity building for the public and medical and social |

| Country | Policy Measure |
|---|---|
| | institutions. |
| **Tajikistan** | ● Means for reducing GHG emissions: improved practice of cattle industry, reasonable feeding and adjusted number of animals; power generation from agricultural biomass and $CH_4$ recovery from manure; improvement of rice cultivation techniques; optimization of the planting location of crops and improvement of the application methods and specifications of mineral and organic fertilizers; and training of farmers in using new methods and techniques.<br>● Measures for reducing natural disaster risks: grain crop rotation, agricultural technology development prediction, land and forest restoration, and soil conservation practices for preventing drought and water/wind erosion. |
| **Turkmenistan** | ● Energy sector's mitigation measures: improvement of energy efficiency and energy conservation, promotion of sustainable use of natural gas and petroleum products, as well as greater use of alternative energy sources.<br>● Agriculture sector's adaptation measures: reasonable spacing/distribution of agricultural production facilities; specialization of agricultural production; breeding of drought and salt-tolerant crops; and plant improvement efforts. |
| **Uzbekistan** | ● Energy sector's mitigation measures: reduction of energy consumption, implementation of energy-saving technologies in the economic and social fields; and development of renewable energy (solar energy and biogas). |

**(2)African countries**

Among African countries, Kenya, Nigeria, South Africa and Gabon have been active in addressing climate change. They have developed special national policies or action plans to address climate change, including comprehensive regulations on relevant issues.

**Table 7.3 NDC Policy Measures of Major BRI Countries in Africa**

| Country | Policy Measures |
|---|---|
| **Kenya** | ● Low-carbon and flexible development; formulation of policy and regulatory framework; development of technical measures and national action plans to adapt to and mitigate climate change; national performance and benefit measures; knowledge management and capability building; financing; cooperation and management. |
| **Nigeria** | ● Implementation of climate change mitigation measures to realize low-carbon and sustainable economic growth.<br>● Enhancement of the national capacity to adapt to climate change.<br>● Improvement of climate change-related science, technology and R&D level, so as to more effectively participate in international cooperation in the field of climate change. |

| Country | Policy Measures |
|---|---|
| **South Africa** | ● Substantial improvement of public awareness, to improve the involvement of the private sectors in coping with the challenges of climate change.<br>Strengthened construction of institutional mechanisms (including political, legal, and economic, etc.), to establish proper climate governance framework.<br>● In terms of adaptation to climate change, the White Paper has specified short-term and long-term priority areas for action. In the short term, areas requiring special attention include: water resources, agriculture, health, biodiversity, forestry, housing, etc.; in the long term, it is necessary to strengthen the resilience to extreme weathers and optimize the management of natural disaster risks.<br>In terms of climate change mitigation, according to the White Paper, on the one hand, South Africa should make its own contribution to the control of GHG emissions as a responsible country; on the other hand, under the pressure of economic development, South Africa needs time and space to reduce emissions. Thus the overall emission strategy of South Africa is: "rising-stable-declining", i.e., in the period of 2020-2050, GHG emissions will stop increasing and peak, and remain stable for about 10 years before it begins to decline |
| **Gabon** | ● To set up an independent climate change fund.<br>● By 2015, 60% reduction of waste from oil production.<br>● All new projects and private enterprises must have a carbon budget.<br>● A national carbon budget in every two years.<br>By 2020, 80% clean energy share in total energy mix. |

**(3)European countries**

According to its current plan, the European Union has identified energy transition as the top priority of its energy strategy. EU will increase the share of renewable energy in total energy consumption to at least 27% by 2030. Western European countries, relatively more developed within the EU with sufficient funds and advanced technologies, are the main driving force for energy transition in EU. Central and Eastern European countries that have joined the EU are willing to abide by EU environmental laws and policies, while those that have not yet joined the EU, in order to meet the requirements of the EU and integrate with the EU system as soon as possible, are also trying their best to adopt relevant EU regulations. The EU provides benchmarks and references for these CEE countries in the areas of water, gas, solid waste, biodiversity and climate change.

**Table 7.4 NDC Policy Measures of Some BRI Countries in Europe**

| Country | Policy Measures |
|---|---|
| **Greece** | ● Previous promulgation of special legislation supporting renewable energy development, and recent fulfillment of the established 2020 renewable energy development indicators.<br>● Ongoing implementation of fixed pricing policy for electricity generated from renewable energy.<br>● To further strengthen the financing mechanism of renewable energy, the ministerial command explicitly requires the income from carbon credits to go to the renewable energy special funds.<br>● Implement legal acts for using part of electricity fee as a special fund subsidy, adopt simplified procedures for power project application and reporting, and maintain the EU assured electricity price.<br>Further promote the development of biomass, geothermal energy, small hydro and small wind power. |
| **Serbia** | ● The 2013 formulation of the development goal of "renewable energy accounting for 20% of total energy consumption by 2020", and the introduction of renewable energy production subsidy in electricity pricing for encouraging renewable energy production such as wind power, small hydropower, biomass energy and solar energy.<br>● Having passed the "National Action Plan for Renewable Energy", and the commitment to increase the share of renewable energy power generation to 27% by 2020.<br>● The 2021 the Serbian Parliament passed the "Renewable Energy Utilization Act", the "Law on Energy Efficiency and Rational Utilization" as well as the Amendment to Energy Law, which has laid a foundation for new energy policies, mainly including energy security, green energy transition and policy on combating climate change, etc.<br>● The priority of climate change policies has shifted from mitigation to adaptation. However, due to lack of fund and insufficient institutional support, the implementation progress has been slow. The "Climate Change Protection Act" passed in 2019 requires the development of national adaptation plans, including the establishment of adaptation measures and associated financial assessment methods. |
| **Montenegro** | ● To support the 2030 energy development strategy plan, the Montenegrin government recently promulgated the latest national strategies and the "National Solid Waste Management Plan (2014-2019)".<br>● The government formulated the "Montenegro Land Protection National Action Plan" in response to possible land degradation as a result of climate change.<br>● In the first half of 2021, the Montenegrin Government, in collaboration with the UNDP and the Green Climate Fund, launched the project of "Enhancing Montenegro's Capacity to Integrate Climate Change Risks into Planning" with an overarching objective to improve Montenegro's institutional capacity for long term adaptation planning. |

**(4) Latin America and the Caribbean states**

The Latin America and the Caribbean region has been experiencing relatively slow economic development with weak economic foundation. Most of the countries in the region are developing countries. While trying to address climate change and bearing the cost of emission reduction, they have to give priority to economic development. Although these countries recognize and understand the threat of climate change, they are unable to fully implement relevant policy measures due to "practical factors".

**Table 7.5 NDC Policy Measures of Some BRI Countries in Latin America**

| Country | Policy Measures |
|---|---|
| **Chile** | ● Chile doesn't have any law on climate change, but it has been active and prompt in enacting policies to address climate change.<br>● In specific, previously the Chilean Government issued a "National Action Plan on Climate Change" as its strategic document in addressing climate change. According to the document, the specific measures to address climate change are divided into three parts, namely measures for mitigating climate change, measures for adapting to climate change, and capacity building.<br>● In terms of institutional construction, Chile established a Special Inter-ministerial Committee on Climate Change.<br>As part of the action plan for implementing the Paris Agreement, Chile has announced its NDC scheme, including a possible investment scheme of US$ 27.3 billion to US$ 48.6 billion in the next 3 decades. According to the plan, Chile will reduce carbon emissions in key economic sectors, including energy, mining, construction, industry and transportation, and promote the development of a green hydrogen economy in the country. Chile aims to keep carbon dioxide emissions equivalent below 1.1 billion tonnes in the period of 2020 to 2030. It is expected that Chile will have $CO_2$ emissions peak in 2025 and then reduced to 95 million tonnes in 2030. In addition, Chile has set an ambitious target for reducing emissions of black carbon -- a short-lived climate pollutant that may seriously affect air quality. In addition, its action plan has included social goals, such as water resources development, utilization protection and gender equality. As far as water conservation is concerned, Chile has committed to developing a strategic plan by 2030 for the comprehensive protection of its 101 reservoirs. |

| | |
|---|---|
| **Jamaica** | ● At present, Jamaica has only touched upon the issue of climate change in some national policies, but has not formulated any policies dedicated to climate change response.<br>● As a tropical island country, Jamaica is vulnerable to the impact of climate change. Therefore it has been actively participating in international negotiations on and related regional actions on climate change. Under the framework of CARICOM, Jamaica has successively participated in the Caribbean Programme under the Climate Change Adaptation Project (2001), the Caribbean Climate Change Adaptation Project (2001-2004) and the Cooperative Climate Change Adaptation Project (2004-2007).<br>Jamaica has never developed any law or policy on climate change. In recent years, under increasing pressure at home and abroad, Jamaica has begun to take measures to address climate change. The Jamaica Advisory Committee on Climate Change was established in April 2012 and put into operation in 2013. Besides, climate change-related policies are being developed. |
| **Panama** | ● Panama has ratified the UNFCCC and the Kyoto Protocol, and formulated its own "National Plan on Climate Change" and "National Strategy on Climate Change".<br>In 2014, as a developing country, Panama made a USD 1 million donation to the Green Climate Fund. By the time of the Paris Conference, Panama had not submitted its Nationally Determined Contributions (NDC), making itself one of the 11 countries out of 196 parties that did not announce emission reduction commitments on that year. |
| **Costa Rica** | ● Costa Rica has ratified the UNFCCC and the Kyoto protocol.<br>● The "National Strategy on Climate Change" (2007) and "Action Plan" and the Framework Convention on Climate Change" (2013) are the two most important domestic policy and legal documents in response to climate change.<br>● In March 2015, Costa Rica's state-owned power company announced that the country had been using only renewable energy for power generation for a consecutive 75 days, setting a new world record for the number of days without using fossil fuel for power generation.<br>Through the establishment of a domestic carbon market mechanism, Costa Rica has become a leading economy in terms of carbon reduction. In 2015, it further pledged to cut its GHG emissions by 25% by 2030 compared to the 2012 business-as-usual scenario, or an annual reduction of 170, 000 tons. In its "National Development Plan (2015-2018)", addressing climate change has been included as a national strategic goal. |

## 2. Prospects of Belt and Road Cooperation on Climate Change

### 2.1 BRI countries are in urgent need to promote green transition, creating huge potential for clean energy production capacity cooperation

With rich clean energy resource endowment, BRI countries and regions relatively lag behind in economic development and are in lack of technological and financial support. Therefore, there is a huge potential for them to carry out clean energy production capacity cooperation with China to promote economic growth and green transition in their own country.

From the perspective of green energy distribution in host countries, BRI countries and regions have rich resources for green development. In terms of different regions, Southeast Asian countries are rich in solar, wind and geothermal energy. Indonesia has the largest hydropower, geothermal and biomass energy resource reserves in the ASEAN region, and its geothermal resources account for 40% of the world's total. Vietnam, Laos and Thailand are endowed with rich wind energy resources. Central Asia has abundant solar thermal resources, with rich reserves of silicon and quartz, which are raw materials for the PV industry. South Asia is also rich in solar, hydro and wind energy resources. Bangladesh has an average daily sunshine of 4-7 Kwh/$m^2$. The Middle East and Africa are rich in solar and wind energy. The Sahara desert region of North Africa has huge solar potential, with more than 22 billion kilowatt-hours of solar energy available each year.

From the perspective of renewable energy utilization, BRI countries and regions have a relatively low RE utilization rate. The energy mix of these countries is still dominated by primary energy, and the share of RE is very small in total energy consumption. According to the BP Statistical Review of World Energy (2022), renewable energy (including hydropower) accounts for 19.7% of total primary energy consumption in Europe, 6.5% in the CIS countries, 1% in the Middle East, 9.6% in Africa and 12.7% in the Asia-Pacific region. In all these regions, renewable energy, excluding hydropower, accounts for less than 10% of primary energy. In addition, the installed capacity of renewable energy power generation is still low in all regions outside Europe. The development of hydropower is relatively mature compared with that of other renewable energy sources. The share of electricity generated from renewable energy sources (including hydropower) is only 1.8% in the Middle East and no more than 20% in CIS and African countries.

From the perspective of the development needs of the host countries, the majority of BRI countries are in the stage of industrial take-off or rapid development, such as Pakistan, Laos, Nepal and Bangladesh, with weak economic base, lack of infrastructure, and shortage of power and energy. Rapid industrialization in these countries has led to a rapid increase in their demand for energy. However, due to budget crunch, backward infrastructure, and lack of technology for energy development, they are unable to fully tap the potential of the rich clean energy resource reserves. By now, fossil energy still takes up the majority share of their total energy consumption. Therefore, BRI countries/regions urgently need to improve their capacity to develop and utilize clean energy, enhance energy security and reduce their dependence on fossil energy to achieve sustainable development. At present, an overwhelming majority of BRI participating countries have formulated national strategies to promote sustainable energy development, and established rigid targets and concrete policies for sustainable energy consumption in sectors such as power generation, heating, cooling and transportation, which has laid a solid foundation for sustainable energy investment cooperation under the framework of the BRI.

**2.2 Climate change adaptation is a priority area of cooperation for BRI countries, with funding gap as the biggest challenge**

For the developing countries, and least developed countries in particular, adaptation to climate change and South-South cooperation are priority areas. The past few decades have witnessed significant progress in cooperation on climate change adaptation. For example, in terms of planning for adaptation to climate change, most developing countries have developed special adaptation strategies. In terms of measures to enhance the capacity to adapt to climate change, developing countries have taken actions in priority areas, mainly in disaster risk management, housing, healthcare, water resources management, agriculture, forestry, sea level rise and infrastructure construction. In terms of adaptation technology, developing countries are promoting technology improvement through the establishment of climate change technical teams, technology research and development, capacity building, and so on.

However, cooperation on climate change adaptation also faces various challenges. First, the lack of fund is a shared obstacle for developing countries. According to AIIB, an extra annual investment of USD 4 billion is needed for LDCs to support climate change adaptation, which is expected to increase to USD 17 billion by 2030, falling far short of the USD 100 billion a year that governments have

pledged to provide through the GCF by 2020. The climate finance gap in developing countries is particularly significant. By 2030, the annual funding required for climate action in developing countries will rise to $340 billion, while the current number is only less than 1/10 of this amount. Second, developing countries lag behind in technology development. Compared with developed countries, the developing world lags behind in terms of economic development, science and technology and education with a lack of talent training mechanisms and insufficient funding for education. The lack of advanced technologies makes it impossible for developing countries to effectively implement adaptation actions. Third, most of the climate change strategies implemented by developing countries are policy-oriented with little mention of specific countermeasures, cooperation directions and effective actions against climate change.

**2.3 Coordination and collaboration among bilateral/multilateral cooperation mechanisms need to be further expanded and strengthened**

Currently, the alignment and coordination between “Belt and Road” cooperation mechanisms in the field of climate change is lacking as they are often on different levels and are interrelated. “Belt and Road” cooperation mechanisms need to be more coordinated. First, in the field of environment and climate change, in terms of South-South cooperation on climate change, some regional cooperation mechanisms, such as the China-ASEAN, BASIC Four and BRICS cooperation mechanisms all involve issues related to climate change and the environment. However, the implementation and coordination of these mechanisms are costly and time-consuming. Second, South-South cooperation on climate change needs to be further expanded and strengthened. South-South cooperation on climate change has made remarkable achievements since the launch of the “ten-hundred-thousand” program by China in 2016. However, the current South-South cooperation on climate change is mainly limited to assistance in kind and capacity building, and there is a lack of communication and collaboration with other mechanisms.

## 3. Recommendations for Addressing Climate Change under the Framework of the BRI

### 3.1 Improve top-level design and promote the alignment of green and low-carbon development strategies

#### (1) Improve top-level design and promote the alignment of green and low-carbon development strategies

First, top-level design should be strengthened, strategies should be aligned, plans should be made according to local conditions, and multi-level inter-governmental communication mechanisms should be established as soon as possible to promote project implementation. Once development strategies are aligned, we should speed up the establishment of a communication and exchange mechanism between government administrations to promote the coordination and alignment of policies, standards and rules for specific areas and projects, actively promote consensus building, and take joint actions to cope with difficulties and challenges. Second, new mechanisms and modes of cooperation should be introduced. The two parties involved in cooperation need to work together to identify new models and new paths to address the pain points and bottlenecks in the process of development. To innovate financing mechanisms and explore new models, we should not only give full play to the role of government departments and policy-based financial institutions on both sides, but also explore ways to implement public-private partnerships to attract private capital to engage in infrastructure development. We should not only actively seek investment and financing support from the Asian Infrastructure Investment Bank, the BRICS Development Bank, the Silk Road Fund and other multilateral/bilateral financial institutions, but also mobilize the financial resources of global long-term investment institutions and commercial institutions. For example, it is feasible to expand financing channels by issuing infrastructure bonds in the international capital market.

#### (2) Enhance cooperation in clean energy and facilitate energy transition in BRI participating countries

Through technology transfer, the export of clean energy equipment and infrastructure construction, China could help to promote technological progress and industrial development in the clean energy sector in BRI countries, facilitate the establishment of a cross-border clean energy market and expand high-quality production capacity cooperation. Giving full play to China's advantage in renewable energy industries (such as hydropower, photovoltaic solar power and wind power) in

terms of total installed capacity, investment scale and technology, we can work together with BRI participating countries to achieve the protection of resources and the environment, while realizing economic transformation and upgrading. It is important to unleash the potential of industrial parks as hubs of resources, talents and policy incentives to promote production capacity cooperation. At the same time, efforts should be made to develop relevant master plans, management regulations, eco-environmental protection rules and energy conservation and carbon emission standards to ensure the success of regional green development and production capacity cooperation. Distributed energy technologies need to be localized, and technical assistance and cooperative transfer should be realized through enterprise and project cooperation to improve the development and utilization of renewable energy. Based on the comparative advantages and the global industrial division of labor, the industrial chain, value chain and supply/demand chain of regional countries shall be connected to achieve deeper industrial integration and regional economic integration.

**(3) Encourage innovation in the development of the market mechanism to synergize the reduction of pollution and carbon emissions**

With concerted efforts of the international community in addressing climate change, the carbon pricing mechanism represented by carbon markets has been developing rapidly. According to the *State and Trends of Carbon Pricing 2023* report released by the World Bank, governments are prioritizing direct carbon pricing policies to reduce emissions. As highlighted in the 2023 report, almost a quarter of global greenhouse gas emissions (23%) are now covered by 73 instruments. In order to actively implement Article 6 of the Paris Agreement to "encourage the use of international carbon markets and other means of international cooperation to help countries achieve NDC emission reduction commitments", and cope with the shrinking carbon emission space in the world, it is recommended that based on the World Bank's average CPIA (Country Policy and Institutional Assessment) from public sector and institutional clusters, the 'Ease of Doing Business' index, the degree of corporate information disclosure index; the Rule of Law Index by World Justice Project; domestic and international carbon market policy papers issued by each country; and information concerning enterprises' participation in the carbon market released by the Carbon Disclosure Project (CDP), we explore for the possibility of the interconnection of carbon markets in China and some BRI countries (regions). To support the market-based emission reduction mechanism, a BRI case study database

for synergizing the reduction of pollution and carbon emissions should be established so as to promote the reserve and dissemination of green technologies.

**(4) Improve climate investment and financing and encourage the engagement of the whole society**

Climate financing is a key factor that will determine the results of climate change response under the framework of the BRI. The *Guidelines on Promoting Climate Change Investment and Financing*, jointly issued by the Ministry of Ecology and Environment and other ministries, set forth specific measures to strengthen climate actions and push forward the construction of climate investment and financing system from the perspectives of policy system, standard development, capital flow, local practices, international cooperation and mechanism innovation. In terms of promoting international cooperation, the Guidelines, for the first time, explicitly proposed to integrate climate investment and financing into the development of the BRI, promote the application of Chinese standards in overseas investment and construction projects, and actively participate in the formulation and revision of international rules and standards for climate investment and financing. It is recommended that we further improve the institutional mechanisms and system design of climate investment and financing with full consideration of the actual needs of BRI countries and encourage the engagement of the whole society, including international financial institutions and the private sector, to explore an innovative development path for overseas climate investment and financing. To achieve the goal, we should further improve the top-level design of overseas climate investment and financing, promote the alignment of China's climate investment and financing system with international standards, improve the transparency of environmental information of climate investment and financing projects under the framework of the BRI, encourage the flow of capital to green, low-carbon and sustainable clean energy projects, and continuously promote international cooperation, personnel exchanges and capacity building in the field of climate investment and financing.

**(5) Build a results sharing platform to achieve high-quality cooperation under the framework of the green BRI**

The "Belt and Road" Initiative, as a solution proposed by China for global green development, has brought opportunities for common development for all countries in the world, especially in the areas of infrastructure construction, trade connectivity and cultural exchanges. It has helped many developing countries to address bottlenecks in the process of development and enhanced exchanges and mutual trust among all

countries. After ten years of development, the “Belt and Road” Initiative has entered a stage of high-quality development, with a large number of successful cases in various fields that are worth sharing. Therefore, the establishment of a results-sharing platform will not only enable us to learn from the past and prepare the groundwork for high-quality cooperation in the future, but also help us to identify priority areas for cooperation among BRI countries. Moreover, the establishment of an open experience and results sharing platform will facilitate the construction of a green industrial system based on multilateralism and create new momentum for the developing world to achieve post-pandemic green recovery.

## References


[1]. J.L. Huang, Y.J. Wang, T. Fischer, B.D. Su, X.C. Li, T. Jiang. Simulation and projection of climatic changes in the Indus River Basin, using the regional climate model COSMO-CLM [J]. International Journal of Climatology: A Journal of the Royal , 2017, 37, 2545-2562.

[2]. J. Schilling, J. Vivekananda, P. Nisha, Moazzam Ali Khan. Vulnerability to environmental risks and effects on community resilience in Mid-west Nepal and South-east Pakistan. Environment [J]. Nat. Resour. Res., 2013, 3, 1-19.

[3]. B.D. Su, J.L. Huang, M. Gemmer, D.N. Jian, H. Tao, T. Jiang, C.Y. Zhao. Statistical downscaling of cmip5 multi-model ensemble for projected changes of climate in the Indus River Basin [J]. Atmos. Res., 2016, 178, 138-149.

[4]. J. Zhou, T. Jiang, Y.J. Wang, B.D. Su, H. Tao, J.C. Qin, J.Q. Zhai. Spatiotemporal variations of aridity index over the Belt and Road region under the 1.5 degrees and 2.0 degrees warming scenarios [J]. Journal of Geographical Sciences, 2020, 30, 37-52.

[5]. Y.Q. Bai, J.L. Wang, 2017. Time and space distribution of monthly drought dataset in One Belt One Road area (1998–2015). China Sci.Data, 2(3): 1-9.

[6]. H.J. Wang, G.L. Tang, H.S. Chen, et al. The Belt and Road region climate change: facts, impacts and possible risks[J]. Trans. Atmos. Sci., 43 (2020), pp. 1-9.

[7]. X.L. Xu, L. Wang, H.Y. Cai. Spatio-temporal characteristics of climate change in the Silk Road Economic Belt[J]. Resour. Sci., 38 (2016), pp. 1742-1753.

[8]. B.T. Zhou, Y. Xu, Z.Y. Han, et al. Projected changes in mean and extreme climate in the Belt and Road region[J]. Trans. Atmos. Sci., 43 (2020), pp. 255-264.

[9]. X.H. Huang, Q. Yue, M. Zhang. Analysis of future precipitation change in the belt and road under RCPs scenarios[J]. J. Yangtze River Sci. Res. Inst., 37 (2020), pp. 53-60.

[10]. Djaman Koffi, Ganyo Komla. Trend analysis in reference evapotranspiration and aridity index in the context of climate change in Togo[J]. Journal of Water and Climate Change, 2015, 6(4): 848–864.

[11]. P.T. Nastos, N. Politi, J. Kapsomenakis. Spatial and temporal variability of the aridity index in Greece [J]. Atmospheric Research, 2013, 119, 140-152.

[12]. H. Tabari, M.B. Aghajanloo. Temporal pattern of aridity index in Iran with considering precipitation and evapotranspiration trends [J]. International Journal of Climatology, 2013, 33, 396-409.

[13]. Murat Türke.Spatial and temporal variations in precipitation and aridity index series of Turkey [J]. 2003. DOI: 10.1007/978-3-642-55657-9_11.

[14]. L.J. Li, Understanding China’s Belt and Road Initiative: motivation, framework and assessment[J]. China Collective Economy, 2017(22):66-67.

# Chapter 8 Green Silk Road and Green Finance Development

In recent years, with the rapid industrialization, urbanization, economic development and the continuous expansion of the global population, environmental issues such as pollution, climate change and loss of biodiversity have gradually become prominent. In addition to targeted measures for pollution prevention, emission reduction and biodiversity conservation, a transition to low-carbon and green society is needed. As a market-based solution, green finance can leverage on the role of the market in allocating resources, and channel private capital to economic activities that help support environmental improvement, combat climate change, and enhance the efficiency of resource utilization.

Taking climate change as an example, it is estimated that in order to achieve the emission reduction goals set in the Paris Agreement, trillions of dollars of new green investment are needed every year globally, and it is almost impossible to fulfill such a huge demand for funding by the public sector alone. Therefore, participation by the private sector is particularly important. At present, the partner countries are still mainly developing countries with low economic development levels and have not yet gotten rid of the extensive growth model. They are facing relatively severe environmental and climate risks and are in a position of being assisted and constrained in global climate governance [1]. To jointly promote green development of the Belt and Road, it is necessary to give full play to the resource allocation function of the financial market, through product and mechanism innovation, with the public sector as the leader, to guide the private sector to participate in green investment and financing activities. In addition, it is necessary to use the role of financial instruments such as hybrid financing to build a set of investment and financing systems that support green development, thereby providing strong support for the green, low-carbon and sustainable development of the partner countries.

Against the backdrop of highly active regional economic and trade cooperation, outbound investment has become an important driving force for promoting the greening of the BRI. *The China Bilateral Investment Report 2023* shows that between 2013 and 2022, China's direct investment in partner countries reached more than 180 billion US dollars, and the cumulative investment of partner countries in China reached more than 80 billion US dollars, with a total bilateral investment of more than

270 billion US dollars. This has brought extremely valuable opportunities to promote the green development of the BRI through green financial means.

Since 2016, the Chinese government has successively issued *the Guidelines for Establishing the Green Financial System* and a series of supporting policies, aiming to systematically promote the construction of a green financial system, thereby promoting the growth of China's domestic green financial market. The latest policy is *the Guiding Opinions on Further Strengthening Financial Support for Green and Low-Carbon Development* issued by the People's Bank of China and 6 other departments in March 2024, which proposes to gradually include overseas green financial assets held by financial institutions in green financial evaluation, further enhancing the motivation of Chinese financial institutions to expand green investment in the BRI. At the same time, many Chinese financial institutions and enterprises have also actively participated in the construction of green BRI projects through diversified green financial instruments such as loans, equity investments, and debt investments. In the first half of 2020, China's investment in renewable energy in partner countries exceeded that of fossil energy for the first time. [2] In October 2023, at the High-Level Forum on Green Development of the Third Belt and Road Forum for International Cooperation, the BRI International Green Development Coalition (BRIGC) and 15 other Chinese and foreign partners jointly launched the Green Investment and Finance Partnership (GIFP), which is committed to promoting the implementation of green projects by building a green project service platform and improving the investment and financing preparation mechanism, so as to solve the funding and technology shortage problems faced by developing countries in the process of green development. These actions provide a diversified source of funds for the economic recovery and green transformation of the partner countries.

## 1. Current Status of BRI Green Finance Development

In recent years, green finance has gradually become a mainstream topic worldwide, and international cooperation has continued advancing. In addition, in many countries, domestic policies and markets in this regard have also evolved simultaneously and rapidly, with improved policy guidelines and frameworks as well as enhanced market participation.

### 1.1 Policy Development Status

**(1) The Chinese government has accelerated the green development of the BRI investment and financing by formulating and improving policy guidelines**

In order to accelerate green development, the Chinese government has taken a series of policy measures to accelerate the green development of the BRI investment and financing. Focusing on top-level design and construction, it has continuously proposed and improved relevant policy guidelines to clarify the source of foreign investment. The successive release of these policy documents reflects the determination and requirements of the Chinese government to promote the green development of the BRI, and also injects strong impetus into the BRI green finance development.

In terms of top-level design, the *Vision and Actions on Jointly Building the Silk Road Economic Belt and the 21st Century Maritime Silk Road* issued in March 2015 clearly stated that the concept of ecological civilization should be highlighted in investment and trade. It also underlined cooperation on environmental protection, biodiversity conservation and climate action, for jointly building a green silk road. In October 2021, the Chinese government issued the *Action Plan for Carbon Dioxide Peaking before 2030*, further clarifying the need to strengthen cooperation with other participants on green infrastructure, green energy, and green finance as well as bring into full play the role of cooperation platforms such as the BRIGC and advocate the Green Investment Principles to promote the green development of the Belt and Road.

In terms of policy guidelines, in 2017, the Ministry of Ecology and Environment (formerly the Ministry of Environmental Protection) issued the *Belt and Road Ecological and Environmental Cooperation Plan*, and jointly issued *Guidance on Promoting Green Belt and Road*, with the Ministry of Foreign Affairs, the National Development and Reform Commission, and the Ministry of Commerce. The cited document makes green finance one of the key work areas, emphasizes strengthening environmental management of foreign investments, promotes the development of the green finance system, and guides investment decision-making towards green practices. It also proposes specific actions such as enhancing environmental information disclosure levels, using green bonds and other green financing tools to raise funds, establishing and utilizing environmental pollution compulsory liability insurance in high environmental risk areas to conduct environmental risk management. In 2019, the Ministry of Finance issued the *Debt Sustainability Framework for participating*

*countries of the Belt and Road Initiative*, based on the International Monetary Fund and the World Bank's Debt Sustainability Analysis Framework For Low-Income Countries (LIC DSF), as well as the status and needs of the partner countries. The DSF aims to support partner countries in ensuring debt sustainability while promoting sustainable economic and social development. In 2021, the Chinese Ministry of Commerce and the Ministry of Ecology and Environment jointly issued the *Guidelines for the Green Development of Foreign Investment and Cooperation*, proposing ten key tasks such as managing ecological and environmental risks, following international green standards, building green infrastructure, and promoting green production and operation. It provided guidance for Chinese enterprises investing and operating in partner countries, and pointed out directions for green investment and cooperation. In 2022, the Ministry of Ecology and Environment and the Ministry of Commerce jointly issued the *Guidelines for Ecological Environmental Protection of Foreign Investment Cooperation and Construction Projects*, requiring Chinese enterprises to implement foreign investment and cooperation construction projects, comply with the laws, regulations, and policy standards of the host country (region) ecological environment, and apply for the necessary ecological environment protection permits as required. If the host country (region) does not have relevant standards or has low standard requirements, on the basis of ecological environment protection permits, it is encouraged to adopt internationally accepted rules and standards or stricter standards from China. At the same time, the National Development and Reform Commission, the Ministry of Foreign Affairs, the Ministry of Ecology and Environment, and the Ministry of Commerce jointly issued *the Opinions on Jointly Promoting Green Development of the Belt and Road*, which clearly defined the overall requirements for jointly promoting the green development of the Belt and Road, coordinated the promotion of international cooperation and capacity building in green infrastructure, green energy, green finance, green standards, and deployed key tasks and work arrangements.

**Table 1. Summary of China's Policies and Initiatives on Green Investment and Cooperation**

| Year | Regulatory Body | Name of Policy Document or Initiative | Contents Related to Green Investment of the Belt and Road |
|---|---|---|---|

| Year | Regulatory Body | Name of Policy Document or Initiative | Contents Related to Green Investment of the Belt and Road |
|---|---|---|---|
| 2015 | National Development and Reform Commission, Ministry of Foreign Affairs, Ministry of Commerce | Vision and Actions on Jointly Building Silk Road Economic Belt and the 21st Century Maritime Silk Road | Jointly build the "Green Silk Road " has become an important part of the top-level design of the "Belt and Road" |
| 2017 | China, Argentina, Saudi Arabia, and 26 other countries' finance ministries | Guiding Principles on Financing the Development of BRI | Promote the establishment of a long-term, stable, sustainable and risk-controllable financing system in partner countries, to achieve a balance between fund mobilization and debt sustainability |
| 2017 | Former Ministry of Environmental Protection, Ministry of Foreign Affairs, National Development and Reform Commission, Ministry of Commerce | Guidance on Promoting Green Belt and Road | Comprehensively build a Green "Belt and Road" to support partner countries in achieving the 2030 SDGs |
| 2017 | Former Ministry of Environmental Protection | Belt and Road Ecological and Environmental Cooperation Plan | Apply green financial tools to investment and trade projects |
| 2017 | Seven institutions including the Green Finance Committee of China Society for Finance and Banking, Foreign Environmental Cooperation Center (FECO) of Ministry of Ecology and Environment | Environmental Risk Management Initiative for China's Overseas Investment | Promote the greening of trade financing and supply chain financing, and strengthen capacity building in environmental risk management |

| Year | Regulatory Body | Name of Policy Document or Initiative | Contents Related to Green Investment of the Belt and Road |
|---|---|---|---|
| 2018 | Green Finance Committee of China Society for Finance and Banking, City of London | Green Investment Principles (GIP) for the Belt and Road | Incorporate the sustainability into the whole process of project development, product design and risk control |
| 2019 | Ministry of Finance | Debt Sustainability Framework for partner countries of the BRI | Learning from the relevant practices of the International Monetary Fund and the World Bank, develop sustainability analytical tools based on the actual conditions of partner countries, to improve the scientific validity of investment and financing decisions |
| 2021 | Ministry of Industry and Information Technology, People's Bank of China, former China Banking and Insurance Regulatory Commission, China Securities Regulatory Commission | Guiding Opinions on Strengthening the Industry-Finance Cooperation to Promote Green Industrial Development | Step up support for green financing, encourage the adoption of *the Green Investment Principles (GIP) for the Belt and Road,* further develop cross-border green investment and financing, and support low-carbon investment |
| 2021 | Ministry of Commerce, Ministry of Ecology and Environment | Guidelines for the Green Development of Foreign Investment and Cooperation | Encourage enterprises to invest and operate overseas, in alignment with the UNFCCC, the Convention on Biological Diversity, the 2030 SDGs, and the GIP |
| 2021 | President of the People's Republic of China | Declaration at the United Nations General Assembly | President Xi Jinping announced at the General Debate of the 76th Session of the United Nations General Assembly that "China will vigorously support the green and low-carbon development of energy in developing countries and will no longer build new overseas coal power projects", contributing to the green energy transition of the partner countries. |
| 2021 | State Council | Action Plan for Carbon Dioxide Peaking Before 2030 | Promote cooperation platforms such as the BRIGC, prompt the implementation of the GIP for the BRI |

| Year | Regulatory Body | Name of Policy Document or Initiative | Contents Related to Green Investment of the Belt and Road |
|---|---|---|---|
| 2022 | Ministry of Ecology and Environment, Ministry of Commerce | Guidelines for Ecological Environmental Protection of Foreign Investment Cooperation and Construction Projects | Enterprises should abide by the environment laws, regulations and policy standards of the host country (region), and apply for the mandatory permits as required, when investing and operating overseas. If the host country (region) has no relevant standards or the standards are relatively low, it is encouraged to adopt international standards or stricter Chinese standards on the basis of ecological and environmental protection permits |
| 2022 | National Development and Reform Commission, Ministry of Foreign Affairs, Ministry of Ecology and Environment, Ministry of Commerce | Opinions on Jointly Promoting Green Development of the Belt and Road | Clarify the general requirements for jointly promoting the green development of the Belt and Road, coordinate and promote international cooperation and capacity building in the fields of green infrastructure, green energy, green finance, and green standards, and deploy key tasks and work arrangements |
| 2022 | Former China Banking and Insurance Regulatory Commission | Guidelines for Green Finance in the Banking and Insurance Sector | Banking and insurance institutions should actively support the green and low-carbon construction of the BRI, strengthen the environmental, social and governance risk management of overseas projects to be granted credit and invested, and require project sponsors, their main contractors and suppliers to comply with the relevant laws and regulations on ecology, environment, land, health and safety in the country or region where the project is located, follow relevant international practices or guidelines, and ensure that the management of projects is substantially consistent with international good practices. |
| 2023 | More than 30 co-sponsors, including government and environmental authorities, international organizations, research | the Beijing Initiative for Belt and Road Green Development | Strengthen cooperation in the field of green finance. Encourage countries and financial institutions to strengthen the development and use of green financial instruments, encourage financial institutions to implement *the Green Investment Principles for the Belt and Road,* deepen exchanges and cooperation on climate investment and financing among countries, support the |

| Year | Regulatory Body | Name of Policy Document or Initiative | Contents Related to Green Investment of the Belt and Road |
|---|---|---|---|
| | institutions, financial institutions and enterprises from 21 countries | | establishment of green development investment and financing partnerships, promote innovation in investment and financing cooperation mechanisms for green and low-carbon projects, and promote all parties to strengthen financing for climate-change and environment-friendly projects. |
| March 2024 | The People's Bank of China and 6 other departments. | Guidelines for Further Strengthening Financial Support for Green and Low-Carbon Development | Promote BRI green investment. Encourage banks, equity investment institutions, fund companies and other financial institutions to carry out green and low-carbon investment in the partner countries and regions. |

**(2) The construction of green finance-related policy systems in partner countries has made rapid progress and has outstanding highlights**

**Overall, the number of green finance-related policies in partner countries has continued to increase.** Preliminary statistics from the Green Finance Platform show that by the end of 2021, over 70 partner countries had issued at least one green finance-related policy or regulation, covering various types such as regulatory frameworks, green finance taxonomy standards or principles, and issuance rules for green financial instruments. In terms of policy numbers (as shown in Figure 8.1), from 2014 to 2022, the number of green finance-related policies and regulations issued by partner countries' governments increased from 10 to 231, with the overall trend showing a year-by-year increase in policy releases. The year 2021 saw the highest number of policy releases, totaling 37.

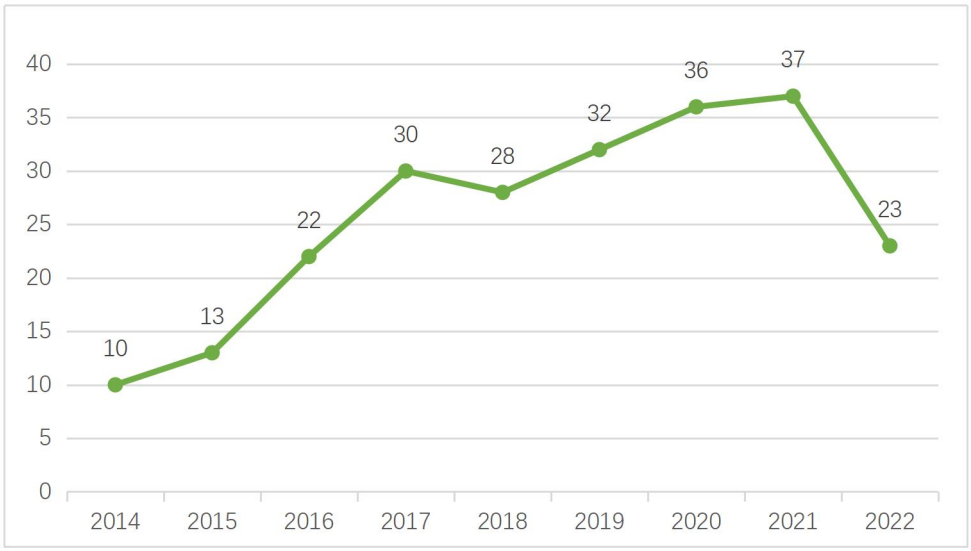


**Figure 8.1 Number of green finance-related policies issued by partner countries from 2014 to 2022**.

**In the process of exploring the establishment of a green finance policy framework[57], some partner countries have made positive progress with reference to international advanced experience and with the assistance of international institutions.** For example, Kazakhstan, with the assistance of the European Bank for Reconstruction and Development (EBRD), has developed a regulatory framework[58] for green finance covering green bonds, loans, technologies and projects, developed a green bond issuance mechanism and related rules (including policy incentives for green bond issuance) benchmarking against international standards, and is currently focusing on improving the rules for ecological risk and impact information disclosure and launching a wider range of green financing instruments. South Africa[59], with the support of the International Finance Corporation (IFC), the Switzerland State Secretariat for Economic Affairs (SECO) and the Swedish International Development Cooperation Agency (SIDA), has published a technical paper on financing a sustainable economy, including the development of a green finance taxonomy, environmental and social risk management requirements for financial institutions, climate-related risk disclosures and risk stress testing guidelines.

[57] According to SBFN (2021), the green/sustainable policy framework refers to a series of policies, plans, guidelines, regulations, or voluntary principles issued by national regulators or industry associations.

[58] SBN. 2021, Accelerating Sustainable Finance Together： Global Progress Report of the Sustainable Banking and Finance Network

[59] South Africa SFI, 2021, National Treasury publishes updated Technical Paper on Financing a Sustainable Economy

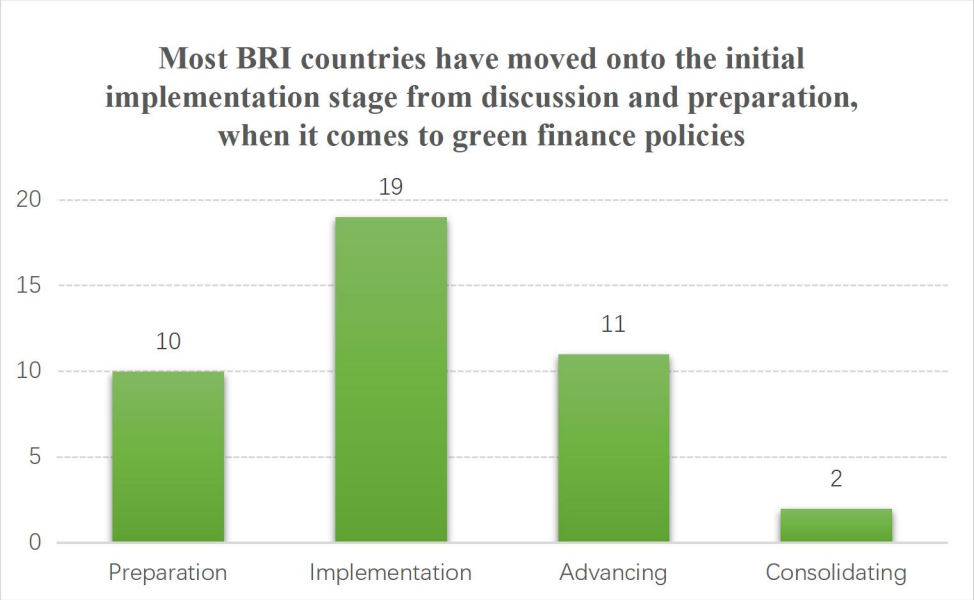


**Figure 8.2 The distribution of partner countries across different stages of development of green finance policies.**

Source: sorted by authors based on the SBN 2021 Global Progress Report

**Case Study 1： China's Experience in Developing Green Finance Helps Mongolia Formulate their Green Finance Taxonomy**[4]

Mongolia is a landlocked country bordering China. Relying on the abundance of natural resources, the mining industry has become the main driver behind Mongolia's economic growth. However, the extensive economic growth model of over-exploitation of resources, rapid urban expansion and massive population migration, has also brought enormous environmental pressure to Mongolia. It faces serious sustainable development challenges in terms of climate change, soil degradation, water scarcity, environmental pollution and underdeveloped urban infrastructure. Faced with such pressures and challenges, the Mongolian government has introduced a series of national policies, expecting to promote the green transition of the economy through top-level design. Mongolia released its "National Sustainable Finance Roadmap" (the Roadmap) in 2018, based on recommendations from international institutions such as the United Nations Development Programme and the Asian Development Bank.

With holistic planning of the Roadmap, Mongolia has promoted the compilation of the Mongolia Green Finance Taxonomy in an orderly manner by drawing on China's practical experience and taking into account its own national conditions. With the support of the Green Finance Committee of China Society for Finance and Banking, the Mongolian Sustainable Finance Association exchanged ideas with China's regulatory authorities, exchanged experience with China's industry authorities, absorbed the experience of multi-party cooperation formed in the process of building China's green financial system, and drew on the content of the "China

Green Bond Endorsed Project Catalogue" and other deliverables. In December 2019, the Mongolian Financial Stability Council officially approved the "Mongolia Green Finance Taxonomy", which clearly defines green projects in Mongolia and provides guidance for financial institutions on green investment and financing.

**The partner countries have continued to make efforts in green finance taxonomy standards, and the demonstration role of China-EU cooperation is obvious.** As the "cornerstone" of the green finance policy framework, the green finance taxonomy provides clear guidance for market participants to further regulate market behavior to avoid "greenwashing", and its importance is self-evident. According to public information, by the end of 2021 (see Table 8.2), in addition to the regional green finance taxonomy released by ASEAN, 16 partner countries have published or are in the process of developing green finance taxonomies, of which 13 countries have released green finance taxonomies or schemes with local characteristics based on the experience of China and the EU in jointly developing the Common Taxonomy for Sustainable Finance. From the perspective of the scope of application, the green finance classification standards issued by the partner countries are mainly applicable to the bond and credit markets in the initial stage, and are gradually expanding to more financial market segments.

**Table 8.2 Major green finance taxonomies in the world**

| Countries or regions | Green finance standard or the name of the policy it belongs to | Standard / Policy Status | Based on economic activity or project type | Format | Main users and financial instruments applicable | Reference Framework |
|---|---|---|---|---|---|---|
| China and EU | Common Ground Taxonomy – Sustainable Finance | Published | Economic activity | Classifies standards and catalogue | Applicable to financial institutions, also for the reference of policy makers and enterprises, application on financial instruments is not limited | Benchmarking against the EU Sustainable Finance Taxonomy and China's "Green Bond Endorsed Project Catalogue (2021 Edition)" |
| ASEAN | ASEAN Taxonomy for Sustainable Finance | A second edition has been published | Economic activity | Mainly classifies standards, and the second edition may provide a more detailed catalogue | This taxonomy is a general guide, and its scope of application will depend on the respective green and sustainable finance taxonomy or regulations of each ASEAN country | Referring to the EU Sustainable Finance Taxonomy |
| China | Green Bond Endorsed Projects Catalogue (2021 Edition) | Published | Project type | Catalogue | Applicable to the bond market | / |
| China | Green Industries Guidance Catalogue (2019 Edition) | Published | / | Catalogue | Applicable to policy makers of all relevant departments with no limitation | / |
| Mongolia | Mongolia Green | Published | Both economic | Catalogue | Applicable to | Referring to China's |

| Countries or regions | Green finance standard or the name of the policy it belongs to | Standard / Policy Status | Based on economic activity or project type | Format | Main users and financial instruments applicable | Reference Framework |
|---|---|---|---|---|---|---|
| | Taxonomy | | activity and project type, not clearly differentiated | | financial institutions, financial instruments are not limited | "Green Bond Endorsed Project Catalogue" |
| Kazakhstan | Classification (taxonomy) of the green projects | Published | Project type | Catalogue | Applicable to credits and bonds | Referring to China's "Green Bond Endorsed Project Catalogue" |
| Bangladesh | Sustainable Finance Policy for Banks and Financial Institutions | Published | Both economic activity and project type, not clearly differentiated | Classification standards and catalogue | Applicable to financial institutions to encourage green sustainable credit and investment; in addition, a "Green Bond Taxonomy" is being drafted | Referring to the EU Sustainable Finance Taxonomy |
| Malaysia | Climate Change and Principle-based taxonomy | Published | Both economic activity and project type, not clearly differentiated | Classification principles | Applicable to financial institutions, financial instruments are not limited | / |
| Singapore | Singapore-Asia Taxonomy for Sustainable Finance | Published | Economic activity | Classification standards and catalogue | Applicable to financial institutions, also for the reference of policy makers and enterprises, application on financial | Referring to the European Union's "Sustainable Finance Taxonomy" |

| Countries or regions | Green finance standard or the name of the policy it belongs to | Standard / Policy Status | Based on economic activity or project type | Format | Main users and financial instruments applicable | Reference Framework |
|---|---|---|---|---|---|---|
| | | | | | instruments is not limited | |
| South Africa | South Africa Green Finance Taxonomy | Published | Economic activity | Classification standards and catalogue | Applicable to government departments, financial institutions, financial regulators, etc., application on financial instruments is not limited | Referring to the EU Sustainable Finance Taxonomy |
| Sri Lanka | Green Finance Taxonomy | Published | Economic Activity | Catalogue | Applicable to financial institutions, financial instruments not limited | Referring to multiple frameworks including that of China, EU, IPSF, and CBI |

| **Countries where green finance taxonomies are still under development or discussion** | |
|---|---|
| **Countries** | **Frame of reference** |
| Vietnam, Chile, Georgia | Plan to refer to the EU Sustainable Finance Taxonomy |
| Philippines, Dominica, Thailand | Related information has not been made public |

## 1.2 State of the Market

**(1) The demand for green finance is increasing day by day**

The green development trends in partner countries have created a huge demand for green finance, while the shortage of public financial resources has highlighted the necessity of private capital in supporting green economic activities. Taking climate change as an example, a number of calculations based on the Paris Agreement emission reduction goals and key industries for greenhouse gas emission reduction show that the global annual demand for green investment may stand at the level of hundreds of billions or even trillions of dollars.

The calculation of Cabré et al.[5], based on the renewable energy demand in 112 partner countries showed that the scale of renewable energy investment in the next ten years will be about 1.03 trillion US dollars. Considering that many countries have updated their nationally determined contribution (NDC) targets in 2021, this demand may continue to increase.

A 2019 study by Vivid Economics and Tsinghua University pointed out that in order to achieve the goal of limiting global temperature rise within 2℃, the volume of green investments between 2016 and 2030 needed by 126 partner countries in four key industries, power, transportation, construction and manufacturing, amounts to 11.8 trillion USD, and the average annual capital demand is about 785 billion USD.

A 2021 research by the CICC Research Institute estimated that the demand for green investment will reach 3.6 trillion USD between 2021 and 2030, based on calculation of 117 national samples from the partner countries. The main demand lies in climate mitigation, with more than 2.5 trillion USD needed. The investment demand of renewable energy will reach 1.6 trillion USD. This study also pointed out that if based on the assumption of Liu and Raftery (2021) that "countries' emission reduction efforts should be increased by 80% on the basis of NDC before they are expected to achieve long-term climate goals", the scale of renewable energy investment of the partner countries in the next 10 years will be as high as 2.84 trillion dollars.

Geographically, according to an Economic Outlook report released by the African Development Bank, in order to implement climate action commitments and nationally determined contributions, the African continent will need investment and financing of about 118.2 billion to 145.5 billion USD per year during the period 2020-2030, but the funds currently obtained are not enough to cover even 20% of this

sum.

In terms of biodiversity financing, according to the Nature Conservancy's[4] 2021 estimates, as of 2019, the annual expenditure on biodiversity conservation was between 124 billion USD and 143 USD billion, while the annual funding for biodiversity conservation was 722 billion USD to 967 billion USD, with an annual financing gap of 598 billion USD to 824 billion USD.

**(2) Market potential needs to be tapped**

At the current stage, the global green financial market still lacks a unified data measurement and statistical system. However, with a high degree of information disclosure and wide application, the data of green bonds still reflects the basic development trend of the market to a certain extent. According to the Climate Bonds Initiative (CBI), the total amount of global green bond issuance in 2021 reached 596.3 billion USD, while the total issuance in 2022 has slightly declined to 443.7 billion USD. In terms of issuance volume, most issuance is concentrated in Europe, North America, and the Asia-Pacific region. In particular, China, as the world's second largest green bond market, cannot be ignored. With the exception of China, the issuance of green bonds in other developing countries ranges from 1 billion USD to 10 billion USD, showing great potential for growth. According to the G20 report, despite the remarkable progress made in the development of global green and sustainable finance in recent years, the 55 low- and middle-income countries issued green bonds accounted for only 1.7% of the global total.

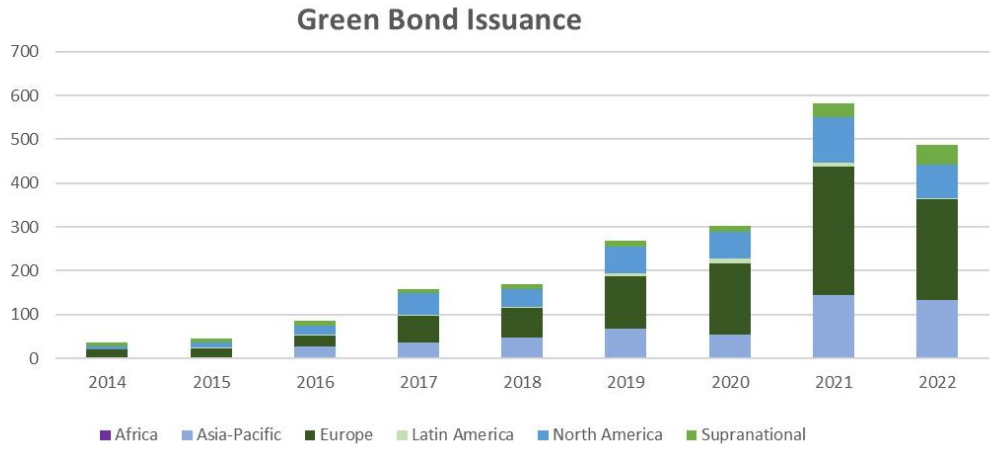


**Figure 8.3 Total global green bond issuance (By Region, 2014-2022).**

**(3) Chinese financial institutions continue to make efforts**

Chinese financial institutions participate in the investment and financing of green

BRI projects through diversified channels such as loans, equity investment and debt investment. According to statistics, from 2014 to 2018, the total installed capacity of wind power projects in South and Southeast Asia in the form of equity investment was 397.5 MW, and 1362 MW of wind power projects were under construction or planning.

For the period 2013 to 2019, Refinitiv calculated the total value of all 1350 BRI projects as 1.7 trillion USD. Among these projects, the total value of clean energy projects was 104.95 billion USD, and the number of projects reached approximately 100, covering natural gas pipelines, wind energy, hydro, nuclear and others.

According to the FISF Green Finance Research Center at Fudan University, in 2022, the scale of Chinese investment in wind power and photovoltaic projects in partner countries accounted for 26 % of overall energy investment.

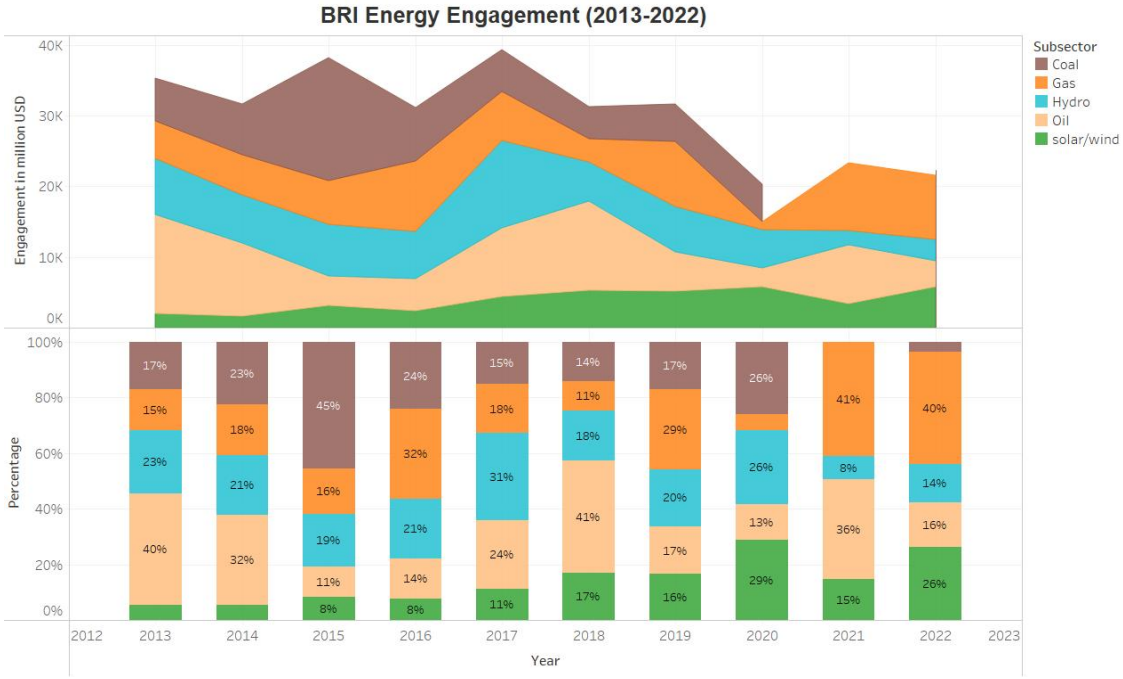


**Figure 8.4 Proportion of China's BRI energy investment (2013-2022)**

**(4) More attention given to environmental management and sustainable development of BRI investments**

In recent years, China's overseas investment environment management policies have tightened, and at the same time, the environmental awareness of investors has been continuously improved, and relevant environmental risk assessment practices, management frameworks and management tools have been developed and improved. For example, The BRIGC officially launched the Joint Research on Green Development Guidance (GDG) for BRI Projects in 2019. In December 2020, it

published a baseline study as the deliverable of the first phase, which put forward "1 set of project classification system" and "9 recommendations" to promote the green development of BRI projects and reduce the ecological and environmental risks of projects for the 3 main environmental objectives of pollution prevention and control, climate change mitigation and biodiversity conservation. The hierarchical classification system will conduct a preliminary evaluation according to the degree of positive and negative impact of the project in terms of ecological environment, and dynamically assess and classify the environmental impact mitigation and compensation measures taken, and divide the BRI investment projects into “red” (requiring stricter supervision and regulation), “yellow” (neutral projects with moderate impacts) and “green” (encouraged) categories. In December 2021, the "Application Handbook for Enterprises and Financial Institutions" and the "Green Development Guide for the Railway and Highway Industry" were published as the deliverables of the second phase, which focused on application practices to help enterprises, financial institutions and other stakeholders identify, assess, manage and improve the environmental performance of BRI projects. The deliverables of the third phase published in May 2023 focused on the foreign investment cooperation funds that provide financial support for the BRI projects, and put forward policy recommendations to promote the high-quality development of foreign investment cooperation funds.

In addition, the Foreign Environment Cooperation Center (FECO) of the Ministry of Ecology and Environment has also cooperated with the Paulson Institute to jointly develop the Rapid Environmental Risk Screening Tool (ERST) for China's overseas investment projects. Using GIS technology, this screening tool integrates internationally compatible global biodiversity data. Through spatial analysis, the area where the investment project is located can be compared with geographic distribution of biodiversity and nature conservation zones. It can quickly identify and warn about the possible environmental risks of the investment project and provide reference information on such risks for regulatory authorities of overseas investments, financial institutions, and investment companies. This analysis can be carried out in an intuitive and convenient manner.

In November 2018, the Green Finance Committee of China Society for Finance and Banking (GFC) and the City of London, together with a number of international institutions, jointly developed and launched the Green Investment Principles (GIP) for

the Belt and Road Initiative. The promulgation of this "Principle" marks a new stage of development for the green BRI investment. As a set of codes of conduct that encourage voluntary participation and signatory by investment enterprises, the GIP has formulated 7 principled initiatives around the 3 levels of strategy, operation and innovation, covering corporate governance, strategy formulation, project management, external communication and the use of green financial instruments, providing concrete and feasible guidance for global financial institutions and enterprises participating in BRI investment to adopt and implement on a voluntary basis.

## 2. Prospects for Promoting the BRI Green Finance Development

### 2.1 The Topic of Green Finance is Constantly Expanding

#### (1) Climate Finance

As can be seen from the theme of the United Nations Climate Change Conference in recent years, finance has become one of the main tools to promote global climate action, and addressing climate change and promoting the low-carbon transformation of the global economy and society requires extensive financial participation. In particular, during the 28th United Nations Climate Change Conference (COP28), the parties agreed on a historic "loss and damage" fund to define the future global action pathways for climate mitigation, adaptation, loss and damage. The U.A.E. presidency of COP28 was the first to commit 100 million USD to the fund, with advanced economies subsequently committing more than 700 million USD.

However, challenges such as the lack of climate finance, uneven distribution and insufficient capacity of participants continue to pose significant obstacles to developing countries. The COP28 Global Stocktake predicts that developing countries will face a financing gap of 5.9 trillion USD by 2030, of which adaptation finance will be needed between 215 billion USD and 387 billion USD per year, with clean energy investment of 430 million USD per year, and 5 trillion USD per year thereafter to help developing countries achieve net-zero emissions by 2050. COP28 President Sultan al-Jaber called for a doubling of adaptation finance for developing countries to 40 billion USD by 2025. He urged investors in both the public and private sectors to provide more accessible and affordable climate finance.

Looking ahead, climate finance remains a key issue in green and sustainable finance. Tackling climate change requires not only the mobilization of finance, but also market regulation, capacity building, and synergies between sustainable goals. Developing countries, especially partner countries, need more capacity building to create an environment conducive to the development of green finance, including greater market transparency, stronger policy signals, and innovation of more diversified financial products.

**(2) Transition Finance**

Another notable trend in green finance is the discussion of **transition finance.** Economic activities in the low-carbon transition require significant financial support and do not always fit perfectly with the current "green" taxonomy. As a result, there is a growing awareness of the need for more inclusive approaches to finance and investment to drive the transition to carbon-intensive industries that are difficult to abate, often referred to as transition finance. In 2022, the G20 Sustainable Finance Working Group developed a transition finance framework that includes five comprehensive pillars: taxonomy, disclosure, financial instruments, policy incentives, and a just transition, which is similar to the existing green financial system. In terms of policy development, financial regulators in 7 countries, including China and Singapore, have begun to study taxonomies and policies related to transition finance, with the aim of establishing clear definitions and classifications, and introducing policy incentives to support this process. On the market side, some financial institutions have launched transition finance products, such as sustainability-linked loans and bonds, and are actively exploring ways to enhance market confidence and address concerns about the potential risks of "false transitions" through transparent disclosure practices and product-level design of incentives or penalties.

**(3) Biodiversity Finance**

**Biodiversity finance** has also become a new topic that has attracted much attention. The international community's awareness of biodiversity risks has deepened and increased. The 2022 World Economic Forum's Global Risks Report ranked nature as one of the top 10 sustainability-related business risks. In December 2022, at the COP15 to the Convention on Biological Diversity, 196 countries adopted the Kunming-Montreal Global Biodiversity Framework. In the face of unprecedented biodiversity loss, the GBF aims to integrate biodiversity into investment decisions through innovative financial solutions, while assessing and disclosing nature-related

dependencies, impacts, risks and opportunities in line with the GBF targets. At the same time, private companies and investors are increasingly recognizing the critical role of stable, resilient ecosystems in sustaining their business operations, and that biodiversity loss crises can lead to financial, reputational, transformational and operational risks. In addition, the interaction between biodiversity loss and climate change can trigger a vicious circle that reinforces each other, and a unified approach is needed to address both crises simultaneously.

**(4) Responsible Investment**

On the broader environmental, social and governance (ESG) theme, developing countries lifted out of the impact of the pandemic are also beginning to pay attention to responsible investment, which has a richer connotation. From the perspective of developing countries, balancing the different sustainable development goals is crucial and requires a more integrated approach to investment activities to achieve environmental and social goals that include gender equality and community equality. Some countries, including Mongolia, are developing sustainable development goal taxonomies, while some market participants are issuing social or sustainability-themed bonds to support projects with multiple benefits.

### 2.2 Trends and Opportunities for Multilateral Cooperation

In recent years, China has actively promoted international cooperation in green finance. In 2016, when China served as the presidency of the G20, the People's Bank of China introduced green finance into the G20 agenda for the first time, led the establishment of the G20 Green Finance Research Group, and co-chaired another group with the Bank of England to identify institutional and market obstacles faced in the mobilization of social capital to support green economic activities. These study group have put forward policy recommendations over three consecutive years. They have been written into leader’s communiques, accelerating the formation of a global consensus on green finance.

In 2017, eight central banks, including the People's Bank of China, jointly launched the *Central Banks and Regulators’ Network for Greening the Financial System (NGFS)* to promote green financial cooperation among central banks and regulators. NGFS focuses on the impact of climate change on macro-financial stability and micro-prudential regulation. It aims to enhance the risk management of the financial system and mobilize capital for green and low-carbon investment. At present, the number of members has expanded to 108, and it has become an important

international platform for cooperation on green finance between central banks and financial regulators.

In 2018, China and the EU jointly launched the *International Platform for Sustainable Finance (IPSF)* to promote the harmonization of green financial standards. The IPSF aims to deepen international cooperation and mobilize private sector finance for environmentally sustainable investments. In June 2022, IPSF officially released a "Common Ground Taxonomy", which includes a total of 72 economic activities that make significant contribution to climate change mitigation and are both recognized by the China-EU taxonomy. A major addition is in economic activities relating to the green construction and manufacturing sectors.

In terms of BRI green finance development, China has also actively initiated multilateral cooperative mechanisms at the level of financial institutions. In 2017, the Industrial and Commercial Bank of China initiated the establishment of a regular inter-bank BRI cooperation mechanism, and in 2019 released the Belt and Road Green Finance Index with the European Bank for Reconstruction and Development, Credit Agricole CIB from France and Mizuho Bank from Japan.

*The Green Investment Principles for the Belt and Road* integrate low-carbon and sustainable development issues into the BRI, which aims to incorporate low-carbon and sustainable development, aiming to ensure that new investment projects are environmentally-friendly, climate-resilient and socially-inclusive. So far, 45 global financial institutions from 18 countries and regions have signed up to the Principles, including China's state-owned commercial banks and policy banks, as well as those from France, Germany, the United Kingdom, and Singapore, as well as large financial institutions in Mongolia, Kazakhstan, Thailand, and South Africa. The members managed or held total assets of 42 trillion USD.

### 2.3 Opportunities and Challenges

As mentioned above, the partner countries have made positive progress in the development of green finance in recent years, but to further scale up green finance, they often face challenges in the policy environment and market mechanisms:

**Energy demand is still on the rise and there is great pressure for low-carbon transition**. In the partner countries, coal power still takes up a significant position in the energy mix. Abrupt retirement of coal power for the large-scale development of renewable energy and nuclear power will not only lead to the waste of coal power investment already in place and the shortage of power supply, but also increase the

investment pressure on the government side of the host country. For most of the partner countries with low levels of economic and social development, basic livelihoods are likely to be significantly affected. In addition, some of the partner countries are rich in fossil fuel endowments, and energy exports are an important source of foreign exchange and fiscal revenue. If there is no science-based pathway for transition, any uncoordinated delayed, or disorderly phase-out will have a negative impact on the oil and gas industry and the national economy.

**The green finance policy system has not yet been established, and the development of green finance is facing capacity bottlenecks.** The size of the global green and sustainable finance market has grown at least tenfold in the past decade, but progress in developing green finance markets has been uneven across countries and regions. In recent years, large-scale green finance transactions have mainly occurred in developed economies and China, and most of the partner countries have not yet received sufficient domestic policy support for green finance, the construction of green financial systems is not perfect, and the capacity of domestic financial institutions is not fully prepared.This has led to a rather small proportion of green finance transactions, significantly lagging behind green finance pioneers such as OECD countries and China.

**There are still limitations in the scale and types of financial instruments provided by developed countries to developing countries, including insufficient capital and instruments, and structural mismatches**. According to the Paris Agreement, developed countries should provide at least 100 billion USD in financial support to developing countries before 2025. However, data show that from 2016 to 2018, developed countries provided less than 80 billion USD in climate finance to developing countries, which is still far from the goal. In terms of financial instruments, loans accounted for more than 70% of the public climate funds provided by developed countries to developing countries from 2016 to 2018, followed by grants, accounting for an average of 23% with a downward trend year by year. Equity investment account for less than 2%, which is relatively limited. In terms of structure, the funds used for mitigation and adaptation accounted for 72% and 19% respectively. There is also a certain mismatch in the structure, and the efficiency of capital allocation is to be improved.

**The multilateral financial institutions need to play a stronger role.** Multilateral financial institutions can not only provide financing support to make up

for the funding gap, but at the same time, with their rich experience in green finance development and the credit endorsement of international government organizations, they can effectively leverage all kinds of social capital to invest in some green projects with clear environmental benefits, but the ROI does not necessarily meet commercial requirements. However, in reality, the financing capacity and investment scale of multilateral financial institutions are relatively limited, and their role in supporting the green development of partner countries needs to be further improved.

**The capital market is not mature enough and financing costs are high**. The political and economic conditions of some partner countries are not stable enough, with lower sovereign ratings, which means they have higher country risk profiles from the perspective of investors. At the same time, since the development of the capital market is still at a relatively early stage, there aren't many viable financing channels. In addition, there is still a lack of commonly recognized green finance taxonomies globally, and different countries are developing their own taxonomies based on their own national conditions, which has caused certain difficulties in cross-border mutual recognition and interoperability of standards, and the transaction costs faced by investment and financing have also increased.

**Lack of necessary information disclosure and supporting services.** Green projects require a high level of transparency, not only certification by a professional third-party organization and regular environmental performance assessments, but also disclosure of compliance with a set of internationally recognized standards for the use of funds and environmental benefits. Inadequate information disclosure increases the risk of "greenwashing", so establishing transparency and supporting professional services is key to improving trust and reducing these risks.

## 3. A New Platform for BRI Green Finance Cooperation: Green Investment and Finance Partnership

In order to help solve the problem of financial and technological shortages faced by developing countries in the process of green development, and promote the green transformation of countries in the Global South, the BRIGC and 16 other Chinese and foreign partners jointly launched the Green Investment and Finance Partnership (GIFP) [7] at the Third Belt and Road Forum for International Cooperation High-level Forum on Green Development held in October 2023. The GIFP was included in the Chair's

Statement of the Third Belt and Road Forum for International Cooperation and the List of Multilateral Cooperation Deliverables of the Third Belt and Road Forum for International Cooperation.

### 3.1 An Overview of Green Development Investment and Finance Partnership

With the tenet of "Green, Openness, Innovation, Collaboration and Win-Win", the goal of GIFP is to formulate a plan and start the operation of relevant mechanisms in a short period of time. In the medium term, GIFP will establish a green project service platform and an investment and financing preparation mechanism to promote the implementation of green demonstration projects in the partner countries; In the long term, GIFP will promote the construction of a green Belt and Road investment and financing ecosystem, and establish an open and inclusive international cooperation network to serve the green transformation needs of developing countries.

The basic content of GIFP includes four parts: green project platform services, green project design services, green investment and financing docking services, and international cooperation communication services.

- Green project platform services. Build a green project pool platform to form a green project reserve, promotion pool and demonstration pool; at the same time, carry out research on the investment environment of key countries and clarify the macro, meso, and micro policies of the partner countries in the field of green investment.
- Green project design services. Establish a project preparation mechanism to assess the project's environmental risk tolerance and environmental and climate benefits, and improve the project's green income and comprehensive rating; establish an environmental, social and governance (ESG) mechanism for green projects, and build an ESG evaluation system for BRI projects, based on which projects are selected and designed; establish a feedback mechanism for project effectiveness to help serve project implementation and promotion.
- Green investment and financing docking services. Closely connect with the tripartite groups such as the partner countries, domestic enterprises, as well as domestic and foreign financial institutions, collect the investment needs of the partner countries, serve the needs of enterprises in project design, project push, demand matching and project financing, serve the needs of financial institutions in the identification and screening of green projects, and serve the promotion and

implementation of projects to the greatest extent.

- International cooperation and communication services. Carry out international cooperation and dissemination activities such as information exchange, experience sharing, and capacity building, and enhance communication capacity and international influence.

### 3.2 Development Potential

GIFP can help the green and low-carbon energy transformation of partner countries. On the one hand, GIFP can leverage funds for green projects such as the energy transition. In addition to project financing through traditional financing means such as free aid, preferential loans, and market-rate loans, for projects with high risk levels, immature technology, or other financing difficulties, the project risk can be reduced through a mixed financing model, and the willingness of charitable organizations, multilateral financial institutions, commercial banks and other groups to contribute can be fully mobilized. In addition, GIFP can also explore the use of carbon pricing mechanisms to promote the early retirement of coal-fired power plants and replace them with carbon credits generated by clean energy, so as to maximize the financing of relevant enterprises. Explore the inclusion of emission reductions generated by Chinese enterprises' overseas investment projects into China's carbon emission trading market through appropriate channels, and use the resulting carbon trading income as corporate income to reduce corporate investment and financing costs. On the other hand, through a sound project preparation mechanism, in the early stage of project preparation, GIFP will find out the potential factors that affect investment returns, such as ecological and environmental regulations and standard requirements in the field of green projects of partner countries, potential factors such as feed-in tariffs and carbon pricing mechanisms, and the actual requirements of ESG management, so as to help improve the green income and comprehensive rating of projects, reduce project financing costs and negative environmental and climate impacts, and lay the foundation for subsequent investment and financing projects.

## 4. Recommendations for BRI Green Finance Development

There are many stakeholders in the BRI development. If different parties can work together, they can create a synergistic push in promotion of green finance. This chapter puts forward suggestions for promoting the development of BRI green finance from three perspectives: mechanism, public sector, and private sector.

In terms of mechanisms:

**Accelerate the alignment of China's green investment standards and international standards**. The China-EU common ground taxonomy has great potential to be widely applied. On the one hand, partner countries should be assisted to issue their own green financial standards based on the common taxonomy while taking into account their own national development contexts. On the other hand, green financial instruments that are aligned with these standards should be developed, including bonds, loans, insurance and other products, to support BRI green investment projects.

**Provide capacity building for partner countries**. By relying on multilateral cooperation mechanisms, establish platforms for green finance knowledge sharing and capacity building, and provide capacity building training for the joint countries to improve the green finance policy framework, develop green financial instruments, and implement green projects.

**Establish assessment mechanisms for green investment and financing activities**, including regulatory requirements or guidelines such as green assessment methods, third-party certification, and information disclosure. At present, although China's green finance standards frame green economic activities based on corresponding technical standards, there is still a lack of detailed guidance on the assessment, certification and disclosure requirements of green investment and financing activities, especially for overseas investment and financing projects, which need to be further regulated.

**Strengthen information interconnections.** Build an information platform for BRI green projects and investments, with tracking, data collection, and disclosure, and connect it with existing domestic mechanisms, in order to form a complete disclosure system for ecological and environmental information. On such platforms, the environmental impact assessment and green certification reports should be publicized—to improve transparency, and to invite public scrutiny. At the same time, a green project docking mechanism will be established to provide a docking platform for both supply and demand sides of project investment.

**Formulate technical standards and operational guidelines for environmental and social risk assessment,** in order to provide quantitative standards for identifying, evaluating and managing ecological and environmental risks of investment projects. Financial institutions and entities that invest overseas should actively refer to the

Green Investment Principles and the Green Development Guidelines, as well as utilize relevant environmental risk assessment and management tools to improve their environmental risk management capacity.

For the public sector:

**Encourage Chinese development financing institutions to play a greater role**. Development financial institutions such as the Asian Infrastructure Investment Bank, the Silk Road Fund, the China Development Bank, and the Export-Import Bank of China can play significant leading roles in the financing for sustainable infrastructure. Encourage these financing institutions to actively lay out green projects and establish more exemplary cases.

**Strengthen cooperation with development financial institutions, international financial institutions, and international business consortia in partner countries**. Through the innovation of mixed financing and other mechanisms, it's feasible to reduce project risks, attract and provide green investment and financing, expand the scale of green investment and financing, and broaden financing channels for green projects.

On the private sector side:

**Encourage private capital to enter the green investment and financing market in partner countries.** Private capital has its own advantage in cost management, risk awareness, and operational flexibility, and encourage private capital to participate in the BRI green investment and financing through equity investment, PPP and other forms.

**Develop innovative green financial products, particularly green bonds, green funds and green insurance.** Viable options will include expanding the scope of credit collateral, increasing the line of green credits; increase support for the green, low-carbon and circular economy. Expand the scale of the green bond market and appropriately reduce the market access conditions for green bonds. Establish a BRI environmental protection fund or PPP green industry fund, to primarily support green projects such as energy efficiency, environmental protection, and clean energy. Give full play to the role of green insurance in risk prevention in partner countries' investment projects, and improve the compensation mechanism for environmental and social risks. Actively explore innovative investment and financing solutions and transition financial products to deal with risks in the transition period, resolve the problem of overcapacity in traditional high-carbon industries through market-oriented

approaches, and support the partner countries to achieve the orderly transformation of high-carbon emission projects and the green upgrading of industrial institutions.

## References


[1]. Wang Fei. Dilemma and breakthrough of climate finance in developing countries: A case study of Latin America and the Caribbean [J]. Urban and Environmental Studies, 2017, (2): 17.

[2]. People's Daily. Promote clean energy and share green development [EB/OL]. (2020-12-21)[2023-04-10]. https://www.gov.cn/xinwen/2020-12/21/content_5571414.htm.

[3]. Scott P., Amrith R.. Green finance goes mainstream, lining up trillions behind global energy transition[EB/OL]. (2021)[2023-04-10]. https://www.wsj.com/articles/green-finance-goes-mainstream-lining-up-trillions-behind-global-energy-transition-11621656039.

[4]. Wang Bolu, et al. “Belt and Road” Green Finance Country Case Study: Mongolia[J]. Tsinghua Financial Review, 2021.

[5]. Cabré M. M., Gallagher K.P., Li Z.. Renewable energy. The trillion dollar opportunity for Chinese overseas investment[J]. China & World Economy, 2018, 26(6), 27-49.

[6]. Chen Guojing. Difficulties and strategies in building green financial power - construction of policy system[N]. Modern Business, 2021.

[7]. Ministry of Ecology and Environment of the People's Republic of China. Green development investment and financing partnership launched in Beijing[EB/OL].(2023-10-24).https://www.mee.gov.cn/ywgz/gjjlhz/lsydyl/202310/t20231029_1044244.shtml.

# Chapter 9 Sustainable Development of the Ocean

The ocean is of great significance to human survival and development. It provides many products such as oxygen, food, medicine and essential ecosystem services, determines local, regional and global climate and weather, and paves the way for energy, trade, transportation and many other traditional and emerging industries. At the same time, the ocean is the largest active carbon sink and a regulator of climate change, promising great potential in mitigating and adapting to global climate change. As economic globalization and regional economic integration advance, countries are deepening cooperation in market, technology and information. The development of blue economy has gradually become an international consensus. At present, the global ocean is facing multiple challenges, such as environmental pollution, biodiversity loss, ocean acidification, plastic waste discharge, global warming and sea level rise, mangrove destruction, and over-exploitation of natural resources. For example, under the influence of climate change, global coral bleaching becomes more frequent and serious. A recent study in April 2024[58] showed that the world is currently experiencing the fourth global coral bleaching event on record, also the second in the last 10 years. Over 54% of global coral reefs have experienced bleaching.

Marine protection is urgent. In 2015, the United Nations published the *2030 Agenda for Sustainable Development*, which adopted "conserve and sustainably use the oceans, seas and marine resources for sustainable development" as one of the 17 global sustainable development goals. In 2017, the 72nd Session of the UNGA proclaimed 2021–2030 as the Decade of Ocean Science for Sustainable Development, highlighting the importance of healthy and sustainable marine management for sustainable development. The 15th meeting of the Conference of the Parties (COP) to the *Convention on Biological Diversity* (CBD) in 2022 adopted the 30 by 30 target, and countries promised effective conservation and management of at least 30% of the world's lands, inland waters, coastal areas and oceans by 2030, which means that the current marine protected areas around the world will be expanded by at least four times. In April 2024, the 2024 Ocean Decade Conference and the Ninth Our Ocean Conference were held in Spain and Athens respectively, and a series of new commitments and initiatives aimed at protecting marine ecological environment and

[58] https://www.noaa.gov/news-release/noaa-confirms-4th-global-coral-bleaching-event

promoting sustainable use of marine resources were reached at practical and scientific levels.

The flowing nature of the ocean, increasingly complex regional marine problems and urgent goals for marine protection gradually highlight the importance of international cooperation on marine sustainable development. The 21st Century Maritime Silk Road is an important part of China's Belt and Road Initiative, and promoting marine sustainable development is an important part of the Green Silk Road. To this end, it is necessary to further strengthen cooperation on marine eco-environmental protection between countries and regions along the Maritime Silk Road, and jointly promote marine response to climate change, marine biodiversity conservation, green shipping, green ports, plastic waste treatment, and sustainable fisheries, explore the path of marine sustainable development with joint consultation, share the benefits brought by marine resources, and build a marine community of shared future.

## 1. Current status of BRI marine sustainable development

### 1.1 Marine plastic waste

Marine plastic waste causes local and transboundary pollution to the ocean, which directly or indirectly affects marine biodiversity, fishery resources, tourism and shipping safety, making it an important challenge for global marine environmental governance [1]. In October 2021, the United Nations Environment Programme published a report entitled "From Pollution to Solution: A global assessment of marine litter and plastic pollution", pointing out that marine plastic litter account for at least 85% of total marine waste. In recent years, the amount of marine plastic litter has been growing rapidly. Plastic waste into aquatic ecosystems are projected to nearly triple by 2040. The estimated emissions of plastic waste entering aquatic ecosystems will reach about 23-37 million metric tons per year, which is equivalent to 50 kg of plastic per meter of coastline worldwide. This will have an impact on human health, global economy, biodiversity conservation and climate change response. According to the report, the cumulative global production of primary plastic between 1950 and 2017 was estimated at 9.2 billion metric tons, while less than 10% was recycled. Addressing global plastic pollution is also one of the most important topics for the resumed 5th United Nations Environment Assembly (UNEA 5.2), and the

resolution of "End Plastic Pollution" was adopted[59], which proposed to convene an Intergovernmental Negotiating Committee (INC) and develop relevant legally binding agreements by the end of 2024.

The *2030 Agenda for Sustainable Development* of the United Nations and the *G20 Action Plan on Marine Litter* have gradually brought prevention and control of marine litter and plastic pollution to the attention of global governance. International conventions, such as the *United Nations Convention on the Law of the Sea*, *Stockholm Convention on Persistent Organic Pollutants* and the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* have also brought the issue of marine plastic litter into the scope of conventions [2].

As regional hotspots of marine plastic litter increase in number, the potential risks for ecosystem functions and human health are increasing, and the East Asia and ASEAN region, the Mediterranean Sea and the Arctic Ocean are examined as hotspots of marine plastic litter[60]. Due to population density and insufficient waste management systems, significant volumes of uncontrolled waste threaten coastal populations who are highly dependent on the marine environment for survival. The control of plastic litter has become a key issue in global marine pollution control. In this context, countries along the Maritime Silk Road have worked together to control marine plastic waste. In 2017, the UNESCO/IOC Sub-Commission for the Western Pacific (WESTPAC) launched the international cooperation project of "Distribution, Source, Fate and Impacts of Marine Microplasitic in Asia and the Pacific". The project established standardized monitoring methods and baseline databases of marine microplastics in the Asia-Pacific region, gave play to the roles of regional cooperation mechanisms, analyzed the distribution, source and fate of marine microplastics, and evaluated the impact on marine ecosystems. ASEAN is building a regional marine plastic waste treatment mechanism. It published the *ASEAN Regional Action Plan for Combating Marine Debris in the ASEAN Member States (2021-2025)*, and is formulating the *ASEAN Blue Economy Framework*. At the meetings of regional mechanisms, such as the ASEAN-United Nations Summit and the ARF Inter-Sessional Meeting on Maritime Security (ISM-MS), marine litter was selected as a main topic, and the *Bangkok Declaration on Combating Marine Debris* was

[59] https://www.unep.org/zh-hans/xinwenyuziyuan/xinwengao-35.

[60] United Nations Environment Programme, From Pollution to Solution: A global assessment of marine litter and plastic pollution, 2021.

adopted. China and ASEAN promoted Marine Plastics Reduction Initiative under the framework of China-ASEAN Eco-Friendly Cities Partnership, and identified marine plastic reduction as one of the four strategic directions in the *Framework of ASEAN-China Environmental Cooperation Strategy and Action Plan 2021-2025*. On land-based pollution prevention and control, the Coordinating Body on the Seas of East Asia (COBSEA) has regarded marine litter and microplastics as a focus of its work, and started the revision of *COBSEA Regional Action Plan on Marine Litter*. **Indonesia** has set a goal of reducing marine plastic waste by 70% by 2025, and has already achieved positive results. According to the Coordinating Ministry of Maritime Affairs and Investment, Indonesia[61], it is found that there was a 15.3% decrease of plastic waste that leaked into the Indonesian ocean since 2018 until 2020. Thailand set the target that 100% of target plastic wastes will be recycled by 2027 in *Thailand's Roadmap on Plastic Waste Management 2018-2030*, and established a database tracking plastic waste. In 2021, it already recovered 25% of seven kinds of plastic waste. **Sri Lanka** plans to reduce land-based plastic pollutants by 80% by 2030. In addition, **Argentina, the ROK, Chile** and other countries have enacted laws on the treatment of marine debris, marine floating objects and marine microplastics, while **China, Chile, Kenya, Tanzania** and other countries have issued plastic ban orders or plastic restriction orders to control plastic waste. In terms of marine plastic management and innovation, China's "Blue Cycle" marine plastic waste treatment project uses digital technology to monitor the entire lifecycle of plastic pollution, encompassing traceability, recycling and reuse of marine plastic waste that are visually representable (Box 1), and Mombasa, **Kenya**, builds durable school desks and chairs with plastic waste collected on the beach.

**Box 1 "Blue Cycle" Marine Plastic Waste Treatment Project in China**

"Blue Cycle" is a sustainable marine plastic control model explored and implemented in the Zhejiang Province of China since 2020, which has resolved the difficulties in collection, high costs of disposal and low recycling rate for marine plastic waste. At present, 80 frontline marine waste collection sites, such as "Ocean Cloud Warehouse" and "Little Blue House", have been established in Taizhou, Zhoushan, Ningbo and other coastal cities in Zhejiang, serving more than 10,000

[61]https://www.iges.or.jp/sites/default/files/inline-files/S1-3_20210222_Achievement%20of%20NAP%20for%20Marine%20Debris%20Handling%20%28Rofi%29.pdf.

marine fishing boats, merchant ships and part of the coastline. After they started operations, more than 10,000 tons of marine waste has been recycled, including more than 2,200 tons of plastic waste, making it China's largest marine plastic waste recycling program. Blue Circle (China) was honored in the Entrepreneurial Vision category of the 2023 Champions of the Earth award. Inger Andersen, the Executive Director of the United Nations Environment Programme (UNEP), praised it for "demonstrating that innovative solutions are available that can inspire us to rethink our relationship with plastic".

The "Blue Cycle" model uses blockchain technology and the internet of things to track and monitor the full visualized lifecycle of marine plastic pollution, from collection to regeneration, re-manufacturing and re-sale, "from the ocean to the shelf", and solves the problem of certification for marine plastic waste. The "Blue Cycle" has attracted stakeholders at all levels, including more than 6,300 low-income people and fishers, 10,180 ships and more than 230 enterprises. By attracting coastal residents to jointly collect marine plastic waste, uniting enterprises using plastic and setting up a "Blue Alliance Common Wealth Fund" for secondary distribution of value, the project brings benefits to the front-line collection groups and achieves "win-win" results for ecosystems while improving people's lives.

### 1.2 Conservation of marine biodiversity

Most global hotspots of biodiversity are found in BRI countries, as they cover 27 of the 36 globally recognized hotspots of biodiversity. BRI countries are rich in marine biodiversity, and the number of key marine biodiversity areas in countries evaluated by this report accounts for 11.5% of the global total (see Table 9.1). However, the need for economic growth often drags the progress of marine biodiversity conservation, and BRI countries have long faced many marine ecological problems, such as coastal erosion, frequent ecological disasters, excessive land-based emissions, and depletion of fishery resources [3]. Promoting sustainable development and high-standard conservation of marine biodiversity in countries along the Maritime Silk Road has become a focus of BRI development.

**Table 9.1 Key marine biodiversity areas in major coastal BRI countries**

| Country | Amount | Area (Square kilometers) | Country | Amount | Area (Square kilometers) |
|---|---|---|---|---|---|
| China | 65 | 28,957 | Bangladesh | 3 | 2,152 |
| Indonesia | 171 | 128,746 | Saudi Arabia | 16 | 12,326 |
| Thailand | 15 | 6,399 | United Arab Emirates | 9 | 6,504 |
| Malaysia | 14 | 2,008 | Greece | 81 | 15,518 |
| Vietnam | 15 | 2,076 | South Africa | 27 | 2,261 |
| Cambodia | 6 | 640 | Panama | 20 | 3,733 |
| Myanmar | 24 | 78,890 | Egypt | 12 | 3,824 |
| Sri Lanka | 16 | 909 | Kenya | 9 | 2,155 |
| Pakistan | 3 | 10,037 | Tanzania | 12 | 2,829 |

Note: Data is derived from Key Biodiversity Areas (KBAs) as of March 2024.

To protect marine biodiversity, countries have launched a series of actions. **Indonesia**'s coral reefs account for 16% of the global total area, but over 95% of coral reefs are threatened by overfishing. Indonesia has launched a wide variety of coral reef restoration projects all over the country, with the extensive participation of government agencies, researchers, enterprises, fishers and other stakeholders. The innovative and diverse restoration methods are well based on local conditions. In 2020, the Coordinating Ministry of Maritime Affairs and Investment of Indonesia implemented the Indonesian Coral Reef Garden (ICRG) project, which attracted more than 10,000 people to participate in four months and planted nearly 96,000 units of artificial reefs and coral transplants in Bali, covering an area of 74.3 hectares[4]. Located between Indonesia, Philippines, Malaysia, Papua New Guinea, Solomon Islands and Timor-Leste, the Coral Triangle is one of the most biodiverse marine ecosystems in the world, but its coral reefs and mangroves were once at risk of gradual disappearance. In 2009, the six countries and a group of Development Partners formed the *Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF)*, rescuing and maintaining the region by expanding protected areas, jointly cracking down on illegal fishing and acts causing environmental damage, and investing more to support marine sustainable development, highlighting the importance of international cooperation for marine governance and protection.

According to the "Status of Coral Reefs of the World: 2020" report[62] by UNEP, according to the research of the Global Coral Reef Monitoring Network (GCRMN), between 2009 and 2018, there was a progressive loss of about 14% of coral from the world's coral reefs, and the Coral Triangle was the only area which had more coral in 2019. **Saudi Arabia** has launched a series of marine biodiversity conservation projects, including the establishment of 6,693 square kilometers of marine protected areas in the Red Sea, and starting the turtle nesting rehabilitation programs to increase the nesting rate of sea turtles by 20% by 2023 and the survival rate of young turtles by 30% by 2025, among others.

During BRI development, China also cooperated with BRI countries to protect marine biodiversity. For example, a Bali Power Plant, which is invested by China Huadian Engineering Co., Ltd. with a controlling interest, worked with an Indonesian environmental protection institute to establish a coral research and restoration center, with the aim to track and analyze changing corals in relevant sea areas. It also worked with research teams from China to transplant coral in the nearby waters, which has a positive impact on the restoration of coral diversity in the waters near the power plant.

### 1.3 Addressing climate change in the marine sector

The ocean is the largest carbon pool in the earth's ecosystem, and is widely recognized as a buffer for global climate change. It absorbs 90% of the heat generated by climate change and is an important part of the solution to mitigate climate change [5]. It is estimated that since the 18th century, $CO_2$ absorbed by the ocean has accounted for about 41.3% of fossil fuel emissions and about 27.9% of man-made emissions[63], and 55% of biological or green carbon on the earth is captured by marine organisms[64]. Developing marine carbon sinks and tapping the potential of marine negative emissions are important ways to achieve the goal of carbon neutrality. A new research of the High Level Panel for a Sustainable Ocean Economy shows that ocean-based climate action could deliver up to 35% of emission cuts needed to limit temperature rise to 1.5°C by 2050, a necessary threshold to avoid the worst outcomes of climate change. These solutions include: marine renewable energies, such as tidal energy and offshore wind power, shipping emissions reduction, sustainable marine

[62] https://gcrmn.net/2020-report-v1-2023/.
[63] https://www.ckcest.cn/home/focus/details/c9c51961c2000001a2d41a391e6d1d00.
[64] United Nations Environment Programme (UNEP), UN Food and Agricultural Organization (FAO) and the UNESCO International Oceanographic Commissions, Blue Carbon: The Role of Healthy Oceans in Binding Carbon: a rapid response assessment, 2009.

food, marine carbon sequestration, and reduction of offshore oil and gas exploitation[65]. While the ocean plays an important role in climate change mitigation, it is also negatively affected by climate change, such as ocean hypoxia, ocean acidification, rising sea surface temperature and sea level, which will lead to a decline of offshore ecosystem resources and directly threaten the health of marine ecology and the sustainable utilization of marine natural resources.

Healthy "blue carbon" ecosystems, such as mangroves, seaweed meadows and tidal marshes, are powerful carbon sinks. Their carbon storage per unit area is five times that of tropical rainforests, and their speed of removing carbon from the atmosphere is three times that of tropical rainforests. Protecting and restoring coastal ecosystems, such as mangroves, salt marshes and seaweed meadows, can increase carbon removal and storage, while helping shield nearby communities from climate impacts, making it a good practice of nature-based solutions for climate change mitigation. Strengthening protection, restoration and sustainable management of blue carbon ecosystems can greatly help realize global climate goals, that is, achieving annual GHG reduction equivalent to 76 coal-fired power plants by 2050, and also help realize the CBD goals (including the 30 by 30 target) and the SDGs. However, under the influence of climate and rapid economic development and construction in coastal areas, blue carbon ecosystems are rapidly disappearing, while actions to address and reverse such degradation remain severely insufficient. At present, marine actions is still the least funded among UN SDGs, and the funds for mangrove restoration and conservation are woefully inadequate, accounting for only 1% of climate financing[66].

During COP28, 21 countries formally endorsed the Mangrove Breakthrough, and promised to restore and protect 15 million hectares of mangroves worldwide by 2030 with a new investment of USD 4 billion. Since its inception, the program has been supported by 49 governments (accounting for about 60% of the world's mangrove areas) and more than 50 organizations. How to better adapt to climate change is also a common concern of countries along the Maritime Silk Road. **Saudi Arabia** plans to plant 100 million mangrove trees on its coastline by 2030, which is an important action under the framework of its ambitious "Saudi Green Initiative". With the

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[65] World Resources Institute. Ocean-based Climate Action Could Deliver Up to 35% of Emission Cuts Needed to Limit Temperature Rise to 1.5°C by 2050. September 2023.

[66] https://climatechampions.unfccc.int/a-breakthrough-moment-for-mangroves-delivering-global-action-on-mangrove-restoration-and-protection/?gad_source=1&gclid=CjwKCAjwx-CyBhAqEiwAeOcTdX47A_yckiMkpEXb_kYFldSA-2tmKmypxvai46LbDkNcdPGE3_JRGRoCI_QQAvD_BwE.

support of the Global Environment Facility and the United Nations Development Programme, the **Bangladesh** government has adopted the model of "afforestation-fish farming-fruit trees", or reforestation with different kinds of mangroves in four coastal areas, intercropping forest and fruit trees, and building fish ponds in forests. The project planted 9,650 hectares of mangroves, including 10 key mangrove species. It is estimated that they can absorb 965,000 tons of carbon dioxide per year, and can also reduce the impact of typhoons, floods, coastal erosion, saltwater intrusion and sea level rise. The mangrove area in **Southeast Asian countries** accounts for one-third of the world, and Indonesia alone accounts for 20%. The practice of sustainable utilization of mangrove resources in ASEAN countries at the community level has well adopted the community co-management model, improving local livelihoods while protecting mangrove wetlands. For example, **Cambodia, Myanmar, the Philippines and Vietnam** have also established mature community management systems for forests. **Indonesia** has not only increased the income of local residents, but also increased its fishery output, protected its coastline and contributed to climate change mitigation by funding local residents to plant mangroves with rewards. **Kenya** has incorporated a series of measures related to blue carbon ecosystems into its Updated Nationally Determined Contribution (NDC) 2020-2030, including mangrove protection, seaweed culture, etc.

China has actively cooperated with countries along the Maritime Silk Road on marine climate change responses. In June 2017, the *Vision for Maritime Cooperation under the Belt and Road Initiative* was published, which explicitly laid out the ideas of "strengthening marine cooperation in addressing climate change" and "strengthening international blue carbon cooperation". In October, 2021, during the first phase of the 15th meeting of the Conference of the Parties (COP15) to the UN *Convention on Biological Diversity*, the *China-ASEAN Mangrove Conservation Initiative* was announced. It called for the foundation of a China-ASEAN Mangrove Conservation Network, made up of local non-governmental organizations from China and ASEAN countries, and restore and manage mangroves through regional cooperation with science, so as to curb the degradation of mangrove ecosystems and enhance carbon fixation capacity of mangrove "blue carbon" ecosystems. In April 2023, China and **Singapore** signed a memorandum of understanding on wetland and mangrove conservation, which promoted their cooperation in mangrove and small wetland protection, and strengthened the important role of marine blue carbon in

carbon sequestration and climate change mitigation.

**Box 2 Exploration of mangrove protection in China**

Since 2010, China has carried out coastal belts protection and restoration project, Blue Bay environmental improvement initiative, and a special action for mangrove conservation and restoration, among other projects for the conservation and restoration of marine ecosystems. These efforts have restored 1,500 kilometers of coastline and 30,000 hectares of coastal wetlands, and built 72 kilometers of seawalls with eco-engineering. The restoration has produced initial results, with steady growth in mangrove area. By November, 2022, more than 55% of the mangroves in China had been covered by nature reserves, making it one of the few countries with a net increase in mangrove area in the world, and there are five internationally important wetlands that focus on the protection of mangroves.

China is also actively exploring the conservation, restoration and rational use of mangroves, striving to balance protection and development. In 2015, the SEE Foundation, the Administration of Zhanjiang Mangrove International Nature Reserve and Third Institute of Oceanography of the Ministry of Natural Resources of China jointly launched the Zhanjiang Mangrove Afforestation Project, planting four kinds of local mangroves on an area of 380.4 hectares, and restoring the degraded local mangrove ecosystem. In 2021, the carbon sink generated by mangroves planted by the project were fully developed and started being traded online, making it the first mangrove carbon sink project in China that meets the Verified Carbon Standard (VCS) and the Climate, Community and Biodiversity (CCB) Standards. Funds generated from carbon sink trading will in turn contribute to the management and conservation of restored mangrove later and community participation in the work.

It is of great significance to promote international cooperation in mangrove wetland protection. In November 2022, at the Opening Ceremony of the 14th Meeting of the Conference of the Contracting Parties to the *Ramsar Convention on Wetlands*, Chinese President Xi Jinping pointed out in his remarks that China will promote international exchanges and cooperation, and build an international mangrove center in Shenzhen. China will build the first global exchange and cooperation platform on mangrove conservation, enhance the role of global mangrove wetlands in responding to climate change, biodiversity conservation, disaster and poverty reduction, improve the wellbeing of mankind, and provide tangible services to developing countries in

technical support, information sharing, monitoring and evaluation of mangrove conservation.

### 1.4 Marine protected areas

The 15th meeting of the Conference of the Parties (COP) to the *Convention on Biological Diversity* (CBD) in 2022 adopted the 30 by 30 target, or at least 30% of the world's lands and oceans should be protected by 2030. In order to achieve this target, countries have increasingly focused on the development of marine protected areas, and taken such measures as prohibiting fishing or exploitation or restricting the navigation of commercial vessels in protected areas to prevent over-exploitation of marine resources and protect marine ecology [6]. According to the World Protected Area Database (WDPA), the number and scope of marine protected areas have increased significantly. Since 2000, the area of marine protected areas has increased by over 10 times, and the global coverage of marine protected areas reached 8.01% in 2021. Global oceans can be divided into areas within national jurisdiction (national waters) and areas beyond national jurisdiction (BBNJ), and the proportion of marine protected areas built within national waters is about 17.86%, much higher than 1.18% for BBNJ. The *Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction* (the "BBNJ Agreement") was adopted and opened for signature in 2023, thus the protection of marine biodiversity on the high seas and the seabed beyond the limits of national jurisdiction and the construction of a network of marine protected areas are also included in the scope of management. At present, 66.1% of marine and coastal key biodiversity areas (KBA) are partially or completely covered by marine protected areas[67]. Table 9.2 counts marine protected areas in 18 countries covered by this chapter, among which South Africa, Indonesia, Panama, China, Greece and other countries have relatively extensive protected areas, but their overall coverage is lower than the global average.

**South Africa** has set up 42 marine protected areas, protecting 5% of its domestic sea area[68]. Among marine species found in South Africa's territorial waters, 33% are endemic, which makes South Africa one of the three countries with the largest number of endemic marine species. Of the 150 marine ecosystems found in South Africa, 87% are planned within the scope of marine protected areas. In March 2023,

[67] https://livereport.protectedplanet.net/chapter-5.

[68] https://www.marineprotectedareas.org.za/explore.

the **Panama** government announced that it would expand the area of marine protected areas in the Caribbean by six times, with the area after expansion exceeding 93,000 square kilometers, covering four ocean ridges and several abyssal plains, and protecting at least 120 species of pelagic fish, including three kinds of critically endangered marine species. Through this measure, Panama's marine protected areas account for 54.33% of the sea area, far exceeding 30% as previous stipulated in the *Kunming-Montreal Global Biodiversity Framework*. As early as in 2021, Panama already achieved the goal of "increasing the share of marine protected areas to 30% by 2030" in advance by expanding the Coiba Ridge Marine Protected Area in the Pacific. In April 2024, **Greece** announced that it would ban bottom trawling in all its marine protected areas by 2030, making it the first country in Europe to ban bottom trawling in marine protected areas. This historic move enabled Europe to further ensure that its marine protected areas could give full play to their benefits, including biodiversity conservation and carbon sequestration. In addition, the Greek government will invest about EUR 9.4 billion in environment-related projects, of which EUR 780 million will be used for marine protection. As part of its legislation, Greece has adopted the overall target of protecting 30% of its marine area by 2030, of which 10% will be put under strict protection.

Through joint development of the Maritime Silk Road, China has actively cooperated with other maritime countries over marine protected areas. In 2016, China and **Cambodia** signed the *Memorandum of Understanding on Marine Cooperation*, and cooperated in the fields of marine observation and monitoring, marine environmental forecasting and conservation, and integrated coastal zone management. From 2019 to 2022, the two countries deepened cooperation in marine spatial planning, planning for coastal zone conservation and use, and building joint laboratories, and established Cambodia's first marine national park.

**Table 9.2 Area and coverage of marine protected areas in major coastal BRI countries**

| Country | Protected area (Square kilometers) | Coverage（%） | Country | Protected area (Square kilometers) | Coverage（%） |
|---|---|---|---|---|---|
| China | 48,126 | 5.48 | Bangladesh | 8,369 | 9.90 |

| | | | | | |
|---|---|---|---|---|---|
| Indonesia | 181,865 | 3.06 | Saudi Arabia | 2,140 | 0.97 |
| Thailand | 14,827 | 4.83 | United Arab Emirates | 6,281 | 11.48 |
| Malaysia | 25,099 | 5.56 | Greece | 22,326 | 4.52 |
| Vietnam | 3,630 | 0.56 | South Africa | 239,050 | 15.50 |
| Cambodia | 691 | 1.44 | Panama | 89,297 | 26.84 |
| Myanmar | 2,457 | 0.48 | Egypt | 11,716 | 4.95 |
| Sri Lanka | 399 | 0.07 | Kenya | 822 | 0.73 |
| Pakistan | 1,707 | 0.77 | Tanzania | 7,408 | 3.05 |

Note: Data is derived from World Database on Protected Areas (WDPA) as of May 2024.

### 1.5 Green shipping

In recent years, environmental pollution and carbon reduction of the shipping industry are closely followed by the international community. According to the research of the International Maritime Organization (IMO)[69], GHG emissions by the international shipping industry account for 3% of total global emissions. If no additional measures are taken to control emissions, it is predicted that by 2050, the carbon emissions of international shipping will increase by 2.5 times compared with the present level, which will bring challenges to the objectives of the *Paris Agreement*. The implementation of global regulations on sulfur limit (low sulfur fuel for ships), the designation of emission control areas (ECA) and the GHG strategy of IMO all put forward requirements for ship emission reduction. In 2003, the 23rd IMO Assembly adopted the draft of *IMO Policies and Practices Related to the Reduction of Greenhouse Gas Emissions from Ships*, and put forward three key measures, namely, limiting the effect of ship design and construction on GHG emissions, controlling the actual GHG emissions from ship operation, and establishing carbon market mechanisms. Green shipping has been added to the agenda. In 2023, the *2023 IMO Strategy on Reduction of GHG Emissions from Ships* was adopted at the 80th session of the IMO's Marine Environment Protection Committee (MEPC 80). The revised emission reduction strategy clearly defined the common goal of reaching net-zero GHG emissions for international shipping by or around 2050, promised the uptake of zero or near-zero GHG emission fuels by 2030, and introduced phased indicators for 2030 and 2040. The report "The Ocean as a Solution to Climate Change: Five

[69] https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/annex/ MEPC%2080/Annex%2015.pdf.

Opportunities for Action" published by the High Level Panel for a Sustainable Ocean Economy (The Ocean Panel) in 2019 showed that, through decarbonization of passenger and cargo shipping, the world is expected to reduce emissions by 1.8 billion tonnes of $CO_2$ equivalencies per annum by 2050.

Some countries along the Maritime Silk Road have issued a series of regulations or policies on green shipping, which have enjoyed some success in reducing shipping emissions [7]. In 2021, **China** published such documents as the *Decision of the Ministry of Transport on Amending the Measures for the Administration of Port and Shore-to-ship Power Supply*, the *Notice on Further Connecting Berthing Ships at Ports in the Yangtze River Economic Belt to Shore Power*, and the *Fourteenth Five-Year Plan of the Maritime System*, among others, and vigorously promoted the demonstration and use of green ships. In 2019, **Singapore** updated the Maritime Singapore Green Initiative (MSGI), and launched such important plans as Green Ship Programme (GSP), Green Port Programme (GPP), Green Energy Programme and Green Technology Programme (GEP & GTP) and Green Awareness Programme (GAP), which mainly encouraged the use of low-carbon fuel by reducing or exempting the annual tonnage tax and ship registration fee. **Saudi Arabia** signed a cooperation agreement with IMO in 2021, providing about USD 400,000 to fund IMO's Coordinated Actions to Reduce Emissions from Shipping (CARES) initiative, aiming at promoting blue economic growth in developing regions.

In addition to explicitly introducing green policies at the national level, countries with a higher Global Liner Shipping Connectivity Index (LSCI) along the Maritime Silk Road, such as **China, Singapore and Malaysia**, have also participated in or supported industry-led incentive plans for green shipping, including the Environmental Ship Index (ESI), the Clean Shipping Index (CSI), Greenhouse Gas Rating, green incentive plans, Zero-Emission Shipping and the *Clydebank Declaration*. At the same time, the top ten shipping companies in the world, such as Maersk, MSC, COSCO Shipping and CMA-CGM, are also actively involved in the development of clean energy, especially on decarbonization, zero-carbon energy application and development, low-carbon and emission reduction technology innovation and application, among other areas.

In addition to top-level design and policy formulation, many countries are also actively making efforts in innovative practices. In November, 2023, **Singapore** piloted the first fully-electric cargo ship with replaceable batteries, which can reduce

operating costs by as high as 50% compared with traditional ships, marking an important milestone in the decarbonization process of Singapore's maritime industry. The Maritime and Port Authority of Singapore (MPA) stipulates that, starting from 2030, all new port vessels operating in Singapore ports must be fully electric, or be able to use B100 biofuel, or compatible with net zero fuels, such as hydrogen. By 2050, all port vessels in Singapore must operate in a net-zero manner. In addition, as an international shipping center, MPA decided to establish the Singapore Maritime Energy Training Facility (METF) to enhance the abilities of global maritime technicians to use and treat clean marine fuels for ship operation. The rich solar, wind and heat energy on the **African** continent could make Africa a center of global maritime decarbonization. After IMO specified the goal of phasing out GHG emissions from international shipping, global shipping players are actively seeking suppliers of alternative shipping fuels, and African ports could become energy hubs of low-carbon shipping fuels in the future.

**Box 3 Green shipping corridors**

Green shipping corridor means establishing zero-emission routes between two or more ports, or creating a special maritime zone. It can improve fuel production and shipping-related infrastructure in the target area with the fastest speed and the highest efficiency, and is recognized by the international community as an effective mechanism to step up decarbonization of the shipping industry. In November 2021, 22 countries signed the *Clydebank Declaration* on the development of green shipping at the COP26 meeting, proposing that by 2025, at least six green shipping corridors should be established between two or more ports, their quantity and scale will be further expanded by 2030, and decarbonization of the shipping industry will be achieved by 2050. According to the *2023 Annual Progress Report on Green Shipping Corridors* issued by the Global Maritime Forum, the number of global green corridor initiatives has reached 44.

The Shanghai-Los Angeles Green Shipping Corridor is the first trans-Pacific green shipping corridor in the world. In 2023, the *Outline of the Implementation Plan for the Shanghai Port-Los Angeles Port Green Shipping Corridor* was issued, which proposed that from 2025, ships with zero or low carbon emission capacity throughout their lifecycle should be used in this corridor, while reducing carbon emissions of terminal operations. In the future, relevant parties will continue to promote

cooperation in the pilot application of new energy fuels for ships, such as green methanol, the use of shore-to-ship power supply and the construction of smart terminals, and promote demonstration programs for global cooperation on green, low-carbon and sustainable development of the shipping industry.

### 1.6 Green port

As important hubs of maritime trade channels, ports are an important part of better connectivity in BRI infrastructure, foundation for the development of global shipping, and key nodes for maritime connectivity and green development [8]. Port activities, such as berthing (mooring), may lead to oil leakage and air, noise and light pollution. Ship traffic is prone to cause underwater noise pollution; ships may attack giant marine animals; and ships may discharge ballast water containing aquatic invasive species when they move. The total GHG emissions from ships are large, and the large-scale offshore development, marine transportation and coastal storage of dangerous chemicals, such as oil products, also continuously fuel the risk of marine pollution.

In recent years, emission reduction rules for international shipping have become stricter, and the International Maritime Organization and business players at home and abroad have issued a number of policies and measures, thus the requirements for low-carbon management of international shipping have been continuously strengthened. The shipping companies have been subject to the expanded European Emissions Trading Scheme (EU ETS) since January 2024[70].

Major shipping countries along the Maritime Silk Road continued to develop green ports, and further invest to help ports use clean energy, conserve energy and reduce emissions, enhance management of green ports, and pursue scientific and technological innovations, and the efforts have paid off. Ports in China, Thailand, Singapore, Malaysia and Vietnam have been awarded the title of "Asia-Pacific Green Port" by the Green Port Award System (GPAS) developed by the APEC Port Services Network (APSN). **Thailand** plans to provide more renewable power for Laem Chabang deep seaport, and bases its daily operations on electric vehicles and machinery, making the port a demonstration base for green ports. If about 10% of the vehicles in the port are modified into electric trucks, the amount of diesel consumed

[70] The initial phase-in period for shipping industry under EU-ETS is from 2024 to 2026. The shipping company has to submit allowances for 40 % of its emissions for 2024, rising to 70% for 2025. From 2026 onwards, they must surrender allowances for 100% of their reported emissions.

can be reduced by 50 million liters per year, saving about THB 800 million as fuel costs and greatly reducing carbon emissions. In addition, starting from 2023, the solar demand of Laem Chabang deep seaport is expected to grow by an annual average of 11.1%, and it is estimated that it will invest about THB 600 million in the installation of solar energy equipment. The port of Laem Chabang in **Thailand** is connected with railway, highway and inland river transportation network. With China's unmanned vehicle technologies, it improves pacing efficiency, which supports rapid and green distribution between Thailand and its neighboring countries. Since 2023, **Vietnam** has started the pilot program on the model of green port in some seaports, and evaluated the effect of implementation. A roadmap for green port was issued, and Vietnam planned to formulate and publish national technical standards for green port during 2025-2030. After 2030, the "green port" standard will be enforced in the planning, investment, construction and operation of Vietnamese seaports.

The prosperity of the sea requires green and low-carbon development, and cooperation between green ports of China and the Maritime Silk Road countries is deepening. Many partner ports have sped up the development of green ports, aligned port and city planning and made ports cleaner. Piraeus port of Greece reduces energy consumption by optimizing fleet structure and opening new routes, and improves resource utilization by improving bridge crane technologies, thus reducing carbon emissions. At the same time, it also conducts pilot research on environmental monitoring to monitor the environmental impact of port operation and resolve it in time. Port of Mombasa in Kenya developed oil terminal projects to improve fuel treatment efficiency. It also planned a new planting area to replant a mangrove forest to make up for some mangroves transplanted under the project. Green development measures taken by these projects have achieved good environmental benefits during port construction and operation, and promoted the development of green ports.

**Box 4 Investment from China helps Colombo International Container Terminals in Sri Lanka to build "green terminals"**

Port of Colombo is one of the important intermediate ports for global navigation lines in Eurasia, the Pacific Ocean and the Indian Ocean. As the essential way to connect trade routes between Asia and Europe and an important transit hub in South Asia, the Colombo International Container Terminal (CICT) jointly developed by China and Sri Lanka has become one of the important nodes of the 21st Century

Maritime Silk Road. In 2011, China Merchants Port Holdings Company Limited invested in and built CICT, with an area of 58 hectares and a designed annual throughput of 2.4 million TEU, making it the only South Asian terminal that can handle 19,000 TEU ships. Since it started operations in July 2013, CICT business has grown rapidly. In 2022, CICT handled 3.215 million TEUs, an increase of 54.4 times compared with 2013.

As a Chinese-invested enterprise, CICT has continuously introduced advanced technologies, equipment and management expertise from domestic ports in China to build sustainable and environmentally-friendly terminals, which has been praised by the Sri Lankan Ports Authority. In November 2017, the terminal transformed the power source of all 40 gantry cranes and 40 container yards from oil to electricity, which made it the first green terminal in Sri Lanka and the largest in South Asia. After the gantry cranes are powered by mains electricity instead of diesel generator sets, it is estimated that USD 1.5 million of economic costs will be saved every year, the monthly fuel consumption will be reduced by at least 220,000 liters, and the total diesel consumption and direct $CO_2$ emission of gantry cranes will be reduced by 95%. In addition, this will also provide a healthier working environment for on-site operators and reduce noise and air pollution. In addition, when containers are lowered by the gantry crane, the gravitational potential energy will be converted into renewable electricity to power other equipment at the terminal, while the rest of electricity will be directly fed back into the local national grid for free.

### 1.7 Blue economy, such as marine fishery

According to OECD forecast, by 2030, the marine industry will make huge contribution to economic development and job creation, and the contribution of marine economy to global economic added value will double to USD 3 trillion, or about 2.5% of the global economic added value. Marine industry mainly includes marine mineral resources and offshore oil and gas industry, shipping, marine renewable energy and marine fishery.

As an indispensable pillar of the blue economy, marine fishery brings abundant food and nutrition supply to human society, and also provides basic livelihood for the vast coastal population. Research has pointed out that global marine capture fisheries (accounting for about 4% of global grain output) produces about 179 million tons of $CO_2$ equivalent as GHG every year, of which more than 70% come from fuel

combustion. In addition, the use of a specific fishing gear, such as bottom trawl, has created a large amount of GHG emissions through direct emissions from fishing boats and indirect interference with sediments that could store carbon on the seabed. Through appropriate fishery management measures, it is not only possible to reduce GHG from fuel consumption, feed production and other processes by transforming production methods, but could also improve sustainability and climate resilience of fisheries, and also develop fisheries as carbon sink to mitigate climate change.

Nearly 113 million people around the world depend on small-scale fisheries for their livelihood, with 97% in developing countries. Coastal overfishing is one of the biggest and most direct threats to our oceans and people who depend on them. According to FAO data, more than 35% of the world's fish stocks are overfished or overexploited. The *Agreement on Fisheries Subsidies* adopted by the World Trade Organization in June 2022 eliminates harmful subsidies, a key factor in the widespread depletion of the world's fish stocks, and effectively promoted sustainable development of marine fisheries. Maritime Silk Road countries have carried out a series of sustainable fishery management practices in the regional context. Vietnam has carried out innovative cooperation on fishery sustainable development at the community level. A locally elected "clam committee" consults the local government to agree fishery management strategies each year. Fishers also attend training workshops on environmental management to study latest methods of sustainable management. Each member of a cooperative is given a quota, detailing the number of clams they are allowed to harvest. In order to become MSC certified[71], an internationally recognized aquatic product certification, fishers had to adopt sustainable fishing methods to ensure that undersized clams will grow bigger, offering higher yield of clams and has led to a fivefold rise in wages for local fishers. Coastal fishery is the main source of fish production in Malaysia (82%). However, due to overfishing, habitat loss, pollution and climate change, coastal fish are currently facing serious threats, and fish supply in Malaysia has dropped by 90% since the 1970s. In the recent two years, Malaysia institutes have conducted research on biomonitoring of coastal fish species in mangroves using environmental DNA (eDNA)

[71] MSC certification is a supply chain certification by the Marine Stewardship Council for good management of marine fisheries and processed aquatic products, with sustainable fishing, reducing the impact of fisheries on marine ecosystems and effective fishery management as the main certification standards and principles.

metabarcoding. This innovative and non-invasive method could monitor fish species without traditional gears, which can support decision-making in fishing quota and ecosystem management so that more sustainable fishing methods will be adopted. In April 2024, Chile launched a groundbreaking Fisheries Improvement Project (FIP) with the support of WWF and Finance Earth. To address the challenges of unstable funds, lack of transparency and standards, high transaction costs and limited private sector participation, Chile introduced innovative financing mechanisms, encouraged private sector participation, and enabled over 140,000 coastal fishers to balance conservation and sustainable livelihood. China also promotes sustainable management of fishery resources during fishery cooperation with Maritime Silk Road countries. Since 2015, China and Laos have carried out 12 joint law enforcement actions for fishery administration, and such activities as proliferation of aquatic life resources and releasing fish fry into the Lancang-Mekong River Basin. They have released nearly 1.5 million indigenous fish in total, effectively conserving fishery resources and eco-environment along the Lancang-Mekong River.

**Box 5 China's innovative practice of fishery-solar hybrid projects**

Fishery-solar Hybrid Projects for PV Power Generation in Nantong City, Jiangsu Province[72]

Fishery-solar hybrid projects combine PV and aquaculture. This model sets up a PV power generation system above the aquaculture pond and raise fish or other aquaculture species in waters below the PV system. The advantages of fishery-solar hybrid projects include the following: Dual-purpose land use, improving economic value per unit land and land utilization rate, and alleviating the pressure on land use. Providing shade for fish ponds, reducing surface water temperature and evaporation. Inhibit photosynthesis of some phytoplankton, mitigating algae and bacteria, and improving water quality; and the economic value of PV power generation itself. The model of PV plus fishery presents clear advantages, and will pursue large-scale production, technical specialization and smart management in the future.

In recent years, Rudong County in Nantong City, Jiangsu Province, has developed a three-dimensional model of fishery-solar hybrid projects, with power

[72] https://www.gov.cn/xinwen/2023-02/17/content_5741939.htm#1.

generation above water and featured breeding underwater, which has enabled the water space to be fully utilized and pursued integrated and intensive development of ecological industries, including fishery farming and green power generation. At present, the county has developed fishery-solar hybrid projects with an area of more than 1,300 *mu*, which greatly improves land efficiency while providing clean energy.

## 2. Prospects for Promoting Sustainable BRI Marine Development

Mounting challenges brought by climate change and further development and exploitation of the ocean have aggravated global marine ecological security. Facing multiple issues, such as marine environmental pollution, ecological destruction and environmental risks, factors of instability and uncertainty are increasing in marine ecological environment. At the same time, the ocean is a systematic and complex whole, with all kinds of intertwining problems and extremely complicated internal relations. For example, according to the current forecast, global marine life may be reduced by 16%-25% due to climate change, and the sharp decline in biodiversity will also aggravate climate risks. However, integrated marine management based on ecosystems not only can solve a series of marine ecological problems in a coordinated manner, but can also bring considerable economic benefits. Research found that every dollar invested in major marine actions will generate at least five dollars in global benefits in the next 30 years. Specifically, investing USD 2-3.7 trillion globally across four key areas, namely, conserving and restoring mangrove habitats, scaling up offshore wind production, decarbonizing international shipping and increasing the production of sustainably sourced ocean-based proteins, would generate USD 8.2-22.8 trillion in total benefits from 2020 to 2050. At present, there have been a series of opportunities to meet the needs of marine sustainable development, and the most noteworthy ones are as follows:

### 2.1 Challenges

**(1) Serious regional marine environmental problems.**

The marine ecological environment of Maritime Silk Road countries is relatively fragile, while the demand for marine resources is increasing day by day, particularly with the rapid growth of population and economy. The over-exploitation of marine resources has brought tremendous pressure on marine ecological environment, with such outstanding issues as marine debris and microplastics, ocean acidification, ocean hypoxia and other emerging marine environmental problems [9]. Offshore pollution is

the main environmental challenge in recent decades. Although it seems that the ocean is so vast that it could digest any external input, the cumulative impact of various kinds of pollution has produced obvious effects on marine environment. The most challenging marine pollutants include: agricultural fertilizers, untreated wastewater, chemicals, invasive species and micro and large plastic waste. The relations between upstream pressure and downstream impact of rivers highlight the importance of land and sea coordinated management, and the source-to-sea approach for treatment is vital to address land-based activities and pollution. As the "Convention on Plastic Pollution" for the world is expected to be reached by the end of 2024, the treatment of global marine plastic pollution will be officially launched. However, chemicals pose a major threat to marine health: research shows that 75% of the Atlantic Ocean, 87% of the Mediterranean Sea and 96% of the Baltic Sea are polluted by synthetic chemicals and heavy metals[73].

**(2) Heavily damaged marine ecosystem.**

According to the IUCN Red List, at present, more than 8,000 marine species are assessed as Endangered or Critically Endangered. The world's coral reefs are rapidly deteriorating, seagrass beds are lost, and habitats and food sources of marine life are threatened. The destruction to marine ecosystems is largely due to the following factors: eutrophication of seawater caused by marine pollution, mass die-offs or even extinction of plankton and fish. Coastal projects have destroyed mangroves, wetlands and tidal flats, damaged coastal environment, and caused coastal zones in certain sea areas to lose their ecological functions, such as mitigating storm surges and purifying the environment, thus increasing the risk of natural disasters. Global fish stocks are currently facing the risk of unsustainable fishing, as overfishing damages marine biological communities and causes imbalance among species. The marine ecosystem of Maritime Silk Road countries faces many risks. For example, the regulation of IUU fishing in Southeast Asia tends to be relaxed, and overfishing may surge, which will bring greater pressure to seafood species that have already been harmed by habitat destruction, pollution and climate change. Another example is the Osa Peninsula in Costa Rica, dubbed "the most biologically intense place on earth". Due to El Niño, its water temperature has increased, causing great pressure to the survival of corals, resulting in coral bleaching for 80% of corals.

[73] https://zrzy.hebei.gov.cn/heb/gongk/gkml/kjxx/kpyd/10919681797599543296.html.

**(3)Intensifying risks associated with climate change.**

The mean annual global sea-surface temperature and annual global ocean heat content (OHC) for the upper 2000 meters in 2023 were the highest ever recorded by modern instruments. The ocean has continuously broken heat records in the recent five years, which became their warmest five years [10]. Marine climate issues, such as ocean deoxygenation, ocean acidification and coral bleaching threaten marine ecosystems. Ocean-related risks caused by climate change exert a far-reaching impact on human society. Take small island nations as an example. In the past 30 years, sea level was clearly on the rise for small island countries along the Maritime Silk Road, resulting in a significant increase in the frequency, scope and duration of coastal floods, intensified coastal erosion and seawater intrusion, and degradation of ecosystem functions for coral reefs, seagrass beds and mangroves, etc. These dampen the livability of small island countries, and even put some low-lying areas at the risk of relocation[74].

Despite its great potential for emission reduction, the shipping industry still faces many challenges in its green and low-carbon development, such as immature technologies and high costs and input. At present, only very few countries have included the shipping industry in their nationally determined contributions (NDCs), which shows that emission reduction for shipping has not received sufficient attention in most countries. As the BRI continuously deepens with steady progress, trade and sea freight volume of Maritime Silk Road countries are gradually increasing. Their demand for shipping will continue to rise, gradually raising pressure from carbon emissions. Green and low-carbon shipping development is a long-term, complex and systematic project, which still faces many challenges. Although the IMO has formulated global targets and measures for emission reduction, specific targets still vary across countries and their development path of green shipping remains unbalanced. At the same time, such issues as immature technologies on new energy for ships, the need to upgrade support for global operations, such as port and shipping facilities, and the high costs and input of transforming to energy-saving and emission-reduction technologies, have also increased difficulty and pressure for BRI countries to reduce emissions for shipping.

[74] The report of *Sea Level Rise in Small Island Countries under Climate Change* (2023).

**(4)Bilateral and multilateral cooperation mechanisms of marine ecological environment governance need to be improved.**

At present, some countries along the Maritime Silk Road are relatively weak in their governance capacity for marine ecological environment, so it is urgent to build capacity for such regions in local context. Most of cooperation in marine eco-environmental governance among Maritime Silk Road countries mainly focuses on meetings, exchanges, experience sharing, mutual visits, among others, without regular bilateral and multilateral cooperation mechanisms. In particular, there are relatively few specific action plans or substantive cooperation projects, and lacks effective demonstration projects that can be replicated and rolled out or common regional cooperation mechanisms and plans. For the content of cooperation, more technical cooperation, such as monitoring and investigation, has been conducted, with fewer exchanges at the policy level, such as on the implementation of international conventions and environmental laws.

**(5)Lacking stable financial guarantee for all-round cooperation.**

Although the world's oceans are facing "multi-faceted threats", SDG 14 (Life below water) is still among the least funded SDGs. The United Nations calls on all stakeholders to invest in a sustainable marine economy to provide food, renewable energy and livelihoods. The governance of marine ecological environment by Maritime Silk Road countries lacks stable and sufficient cooperation projects and financial support. At present, governments need to increase financial support for marine biodiversity conservation and plastic waste treatment, and introduce more related research topics and projects under multilateral and bilateral mechanisms and platforms. They also need to expand investment and financing channels, attract more green financial resources to support ocean conservation projects, and improve capacity for financial support.

**2.2 Trends and opportunities**

**(1) Global marine environmental governance is in a period of opportunity towards profound changes in governance objectives, rules, models and systems.**

At present, in view of the difficult circumstance for global marine eco-environment, the international community has a particularly strong demand for improving and innovating the global governance system for marine environment. The UN Decade of Ocean Science for Sustainable Development (2021-2030) (“the Ocean Decade”) has put forward seven visions of building a clean, healthy and resilient, productive, predicted, safe, accessible, inspiring and engaging ocean, supporting

countries in carrying out a series of research plans and projects, promoting inter-disciplinary, multi-disciplinary and cross-cutting innovation, and providing transformative solutions for sustainable marine development. Rich in marine resources, with active innovative industries and huge economic development potential, Maritime Silk Road countries play an increasingly important role in global marine governance. At present, the international community is actively cleaning up marine plastic waste. The *Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction* (the "BBNJ Agreement") was adopted and opened for signature. A series of policies and institutional innovations have provided a window and good opportunities for Maritime Silk Road countries to participate in relevant affairs and global marine eco-environment governance.

**(2) The potential of the ocean in providing climate change response is gradually unleashed.**

In global warming mitigation, the ocean plays important roles as a dominant reservoir for the storage of heat and a carbon sink. The increase in carbon sequestration by the global ocean per year can offset one-third of the annual traffic emissions. At present, the amount of anthropogenic carbon dioxide absorbed by the ocean only accounts for 15% of its maximum capacity, and there is still 85% of potential to be tapped, especially in the deep ocean. During the UN Climate Conference COP28, ocean issues made important headway within the first-ever "Global Stocktake of the Paris Agreement", illustrating the consensus by the international community of the need to consider the ocean when acting on climate change, and strengthen ocean action based on the best available ocean science. Many marine economic activities could provide climate solutions, for example, ocean transportation can replace diesel oil and bunker oil with low- and zero-carbon fuels (such as hydrogen, ammonia and some biofuels). The ocean can provide sustainable "blue food" for human society, and the current food system, such as emission-intensive agriculture, fishery and processed food, accounts for one-third of global emissions. The adoption of marine renewable energy may provide one tenth of the emission reduction required to limiting global warming to 1.5 °C. These solutions provide a win-win opportunity to address the climate crisis and promote economic development for BRI countries.

**(3) Policy and technological innovations in marine activities, such as green shipping, are making steadily progress.**

Shipping freight accounts for more than 80% of the global freight volume, while its total carbon emission is only 6.1% of the transportation industry. In terms of energy consumption per unit, shipping is the greenest and most economical mode of transportation. In the context of energy conservation and emission reduction, green shipping is embracing development opportunities, such as technological transformation and innovation, development of new shipping infrastructure and improved energy efficiency. IMO is also steadily promoting green development policies of global shipping through short-term and mid-to-long-term measures, directly or helping to reduce GHGs. Global green shipping policies are becoming increasingly stricter, thus the global shipping sector is under mounting pressure for transformation, and the shipping industry is also taking actions to turn crisis into opportunities. Energy-saving and environmental protection technologies for ship, especially clean fuel technologies, are gradually showing great market potential. In addition, since January 1, 2024, the shipping companies have been subject to the expanded European Emissions Trading Scheme (EU ETS), covering 100% of emissions from vessels at berth in EU ports, and 50% of emissions from voyages which start or end at EU ports. The initial phase-in period for shipping industry under EU-ETS is from 2024 to 2026, thus it is urgent for other countries to develop green shipping, which is bound to set off a wave of technological innovation.

**(4) International conventions and initiatives provide cooperation platforms and frameworks for maritime connectivity.**

BRI provides a platform for dialogue and exchanges for Maritime Silk Road countries to actively participate in regional governance of marine eco-environment, and also provides great room for cooperation among countries in project cooperation, technical and personnel exchanges. International conventions, such as the *United Nations Convention on the Law of the Sea* and the *Agreement for the Implementation of its Provisions*, the *United Nations Framework Convention on Climate Change* and its *Paris Agreement*, have provided cooperation frameworks for countries in marine biodiversity conservation and climate change, among other areas, and helped countries along the Maritime Silk Road improve their readiness and capabilities to govern marine eco-environment.

**(5) The Maritime Silk Road countries have good foundation and great readiness for cooperation in key areas.**

Some countries along the Maritime Silk Road have built up a good foundation

for cooperation in specific areas of marine environmental protection, such as marine biodiversity conservation, marine plastic pollution control, marine anoxia and acidification, polar environment and climate change, and are constantly seeking cooperation in policy measures, project cooperation, academic exchanges, publicity and education.

## 3. Recommendations for BRI marine sustainable development

In October 2023, the *BRI Blue Cooperation Initiative* was published at the 3rd Belt and Road Forum for International Cooperation, laying out a road map for BRI maritime cooperation. On marine plastic waste, marine biodiversity conservation, marine response to climate change, marine protected areas, green shipping, green ports, marine fisheries, among other areas, countries and regional institutions can carry out pragmatic cooperation in infrastructure development, scientific and technological cooperation, personnel exchange and training, implementation of international conventions and standard development, practice the concept of a maritime community with a shared future, promote BRI marine protection, and establish and improve regular BRI regional cooperation mechanisms on marine eco-environment governance, and build a clean, healthy, resilient and sustainable ocean.

### 3.1 Improve platforms and mechanisms of marine cooperation and promote sustainable marine development.

Promote integrated marine management based on ecosystems, cooperate with Maritime Silk Road countries on top-level design, regulations, standards and other institutions of marine eco-environment protection, roll out experience and practices of marine protection and utilization of marine resources in China, and better align policies on marine sustainable development. Relying on multilateral cooperation platforms, such as the BRI International Green Development Coalition (BRIGC), a blue partnership will be built, and vigorous efforts will be made to implement cooperation mechanisms, such as those on China-ASEAN and China-Africa environmental cooperation, build a diversified cooperation network joined by governments, enterprises, think tanks, social organizations and the public, improve the international cooperation mechanism for marine eco-environment governance along the Maritime Silk Road, pool efforts of various stakeholders, and promote research, practice and publicity of marine sustainable development. Based on the BRI

eco-environmental big data service platform, basic data platforms on marine eco-environment will be established in key areas, providing regional public goods and sharing marine eco-environmental information and technologies. With regional environmental cooperation mechanisms as the main support, a number of demonstration bases for regional marine eco-environment governance and port shipping will be developed for technical training, personnel training, academic exchanges and other events, providing technical platforms and paths for the region to jointly address marine eco-environment problems. A mechanism for marine eco-environment conservation and restoration and joint prevention and control for pollution will be explored through cooperation, which will improve early warning capability for ecosystems, step up coastline restoration, carry out marine ecosystem conservation, create a greener marine eco-environment, and promote marine sustainable development.

**3.2 Cooperate to promote the treatment of marine plastic waste and marine environment restoration.**

Many countries along the Maritime Silk Road are plagued by plastic pollution. In order to treat marine plastic waste in a coordinated way, it is suggested to deepen cooperation and exchange in marine plastic waste prevention and control under the framework of BRI cooperation, and jointly carry out research on monitoring methodologies for microplastics. A joint survey with ASEAN countries of the distribution of microplastics in waters surrounding the South China Sea could be conducted, with exchanges between China and ASEAN on policies and measures for prevention and control of marine plastic waste. The establishment of plastic waste management partnership in Maritime Silk Road countries will be explored to build a multi-partner governance model joined by government, market and the public, and deepen the cooperation of Maritime Silk Road countries in regional marine plastic waste management. Research institutions in China and its partner countries will be encouraged to jointly establish regional training and research centers for marine plastic waste and microplastics, coordinate regional monitoring methods for marine microplastics, and organize regional workshops on monitoring and evaluation technologies of microplastics to substantially improve regional monitoring and survey capabilities for marine waste. Innovative practices from China's Blue Cycle marine plastic waste treatment model could be popularized to jointly attain the goal of clean ocean, so as to pave the way for better use of marine resources.

### 3.3 Strengthen marine biodiversity conservation and vitalize marine ecosystems.

Many hotspots of marine biodiversity and areas of serious biodiversity loss are located in Maritime Silk Road countries. It is necessary to jointly develop marine biodiversity monitoring and protection networks and strengthen cooperation on early warning for marine ecosystems, in order to achieve the 30 by 30 target in the *Kunming-Montreal Global Biodiversity Framework*, and ultimately protect marine ecosystems and enhance their wellbeing. Our recommendations are: Build bilateral and multilateral cooperation mechanisms for marine biodiversity conservation, and gradually improve the capacity and proficiency of BRI countries in marine biodiversity conservation policies and planning. Promote exchanges and cooperation between China and Maritime Silk Road countries in establishing marine protected areas, implementing sustainable fishery management measures and restoring important habitats, to protect fragile habitats and species and reduce extra pressure on marine ecosystems. On protecting typical marine ecosystems, developing protected areas and other fields, cross-regional major scientific research and joint scientific expeditions will be conducted with Maritime Silk Road countries to strengthen capacity building of cross-border joint research on biodiversity conservation. Carry out joint survey of ecosystems and typical organisms and technical exchanges on conservation of healthy ecosystems, provide public goods for remote sensing and monitoring for ecological environment of mangrove, seagrass bed and coral reef bleaching, and exchange ideas and experience related to marine ecological management. Improve the capacity of Maritime Silk Road countries for the implementation of the *Convention on Biological Diversity* (CBD), and actively follow work related to the description of ecologically or biologically significant marine areas (EBSAs) under the CBD framework.

### 3.4 Cooperate on marine response to climate change and unleash the potential of marine climate regulation.

Ocean provides a series of potential solutions for ocean-based climate mitigation, which can help achieve carbon neutrality, including cultivating carbon-efficient blue-carbon ecosystems, developing marine renewable energy, reducing carbon footprint of marine activities, such as shipping, providing sustainable fisheries with low-carbon marine proteins and micronutrients, and marine carbon capture, utilization and storage (CCUS). At present, the international community has achieved initial

results from research on marine renewable energies, such as tidal energy, wave energy, temperature-difference energy, offshore wind power, hydrogen produced from seawater, among others. On building carbon sink, CCUS technology has also made breakthrough apart from conserving blue carbon ecosystems. In order to give full play to the great potential of Maritime Silk Road countries in marine carbon reduction, this report has the following recommendations. First, give full play to the roles of blue carbon ecosystems, such as mangroves, coastal salt marshes, seagrass beds and large algae, and unleash their potential in carbon sequestration and storage. The South China Sea is the region with the largest wealth of blue carbon in the world, and the area of mangroves in Indonesia, Malaysia and other countries rank among the top in the world. China and Maritime Silk Road countries have great potential for cooperation on blue carbon, thus they can actively plan blue carbon international cooperation projects, such as building carbon sink with coastal wetlands, mangroves, and ecosystem-based fishery farming. Second, speed up the development of a marine industrial system to reduce carbon and increase carbon sink, and develop low-carbon industries, such as clean shipbuilding, new marine energy system and sustainable fisheries. Third, strengthen research on nature-based solutions, jointly build marine observation networks for acidification, improve forecasting and early warning abilities of marine acidification, and protect and restore coastal habitats, such as mangroves and seagrass beds, to reduce the impact of marine acidification. Strengthen monitoring, early warning and risk assessment, and strengthen natural-based resilient coastal protection. Fourth, promote international cooperation in marine response to climate change, enhance assistance to countries with climate fragility, such as small island nations, and promote pragmatic cooperation in a wide range of areas, such as marine spatial planning, blue economy, and disaster prevention and mitigation. Strengthen cooperation to improve implementation capacity for UNFCCC, and encourage countries to include climate solutions, such as shipping emission reduction and blue carbon, in their next round of NDCs. Establish database platforms for marine responses to climate change, strengthen international cooperation and exchanges, and share and exchange technical specifications, data, information products and practical cases, among others.

**3.5 Accelerate the development of green ports and shipping and reduce the ecological and environmental impact of marine activities.**

Ports and shipping industry are the lifeblood of global trade, and also the key

areas for climate change response and GHG reduction. Take the international integrated logistics platform of "Silk Road Maritime network" founded by China as an example. By the end of March 2024, the 100 routes named after the "Silk Road Maritime network" had reached 7 ports in 43 countries and regions, occupying a prominent place in global shipping. In order to promote practices of green port and shipping in Maritime Silk Road countries, and reduce the impact of shipping-related industries and infrastructure on marine eco-environment, this report has the following recommendations: On one hand, relying on the existing green port demonstration projects, such as Piraeus Port in Greece, Mombasa Port in Kenya and Colombo Port in Sri Lanka, cooperation on BRI green development for ports should be strengthened. Through such practices as increasing the share of clean energy in ports, strengthening R&D and application of low-carbon technologies for shore-to-ship power supply at ports, promoting a multimodal transport network composed of highways, railways and waterways, and encouraging intelligent management of ship-shore coordination, more green ports will be built towards coordinated ship-shore carbon reduction. On the other hand, it is necessary to accelerate low-carbon development of green shipping, explore the feasibility of zero-emission shipping, carry out research and pilot programs on green shipping corridors with relevant countries (such as Singapore), build a system of BRI green standards for international shipping, including a framework monitoring, reporting, verifying and sharing relevant data of GHG emission reduction plans for international shipping, promote technical cooperation and joint research on zero-carbon alternative fuels, and develop mechanisms such as shipping emission reduction incentives, to promote technological innovation and industrial development of low-carbon shipbuilding.

**3.6 Establish a sustainable marine economic system to enhance the well-being of coastal areas.**

Marine economy refers to economic activities related to the ocean and coastal zone. At present, the global marine economy is valued at USD 2.5 trillion per year [11], similar to the size of the seventh largest economy in the world in 2021. Marine fisheries of Maritime Silk Road countries are very developed, and the fishery output of Indonesia, Vietnam, Bangladesh, Thailand and other countries ranks high in the world. It is recommended to actively roll out the practical experience of sustainable fishery production in China, promote the establishment of a regional marine system for sustainable aquatic products, introduce fishing quotas, promote responsible fishing

techniques and use alternative fishing gears that can reduce by-catch to address overfishing and minimize the harm to non-target species. By protecting mangroves and wetlands according to local conditions, a natural coastal buffer zone could be established, which helps to enhance disaster resistance of coastal areas and promote the development of coastal tourism and eco-industries, effectively enhancing the well-being of coastal areas. In addition to fisheries, the development of marine energy also brings new opportunities for the development of blue economy. Offshore wind power, PV, tidal energy and wave energy have gradually become new trends. For example, the coastal areas of Southeast Asia are densely populated, with concentrated load demand and huge offshore wind energy resources. Advanced technologies from China could be leveraged to develop offshore wind power projects and make good use of rich marine resources.

**3.7 Promote the innovation of green financial instruments and stimulate the potential of blue carbon ecosystems to address climate change.**

The potential of the ocean in addressing global challenges, such as climate change, needs to be further developed, and it is very important to strengthen financial support for the blue economy. The 9th Our Ocean Conference received commitments worth USD 11.3 billion from countries to protect the global ocean, but this still might seem like a drop in the bucket for the huge funding gap of ocean protection. SDG 14 is among the least funded SDGs, with a funding gap as large as USD 150 billion per year. In order to better mobilize social capital for sustainable marine industries, this report has the following recommendations: First, establish blue financial frameworks and systems, analyze the potential of demand and supply for ecological financing in Maritime Silk Road countries on marine plastic waste, marine biodiversity, marine response to climate change, marine protected areas, among others. Evaluate existing environmental strategies, green financial practices and effects of financial support, and expand investment and financing channels for regional marine eco-environment governance. Second, with the help of China's experience in exploring and establishing standard systems and trading mechanisms for blue carbon, efforts will be made to explore blue carbon trading markets, green shipping carbon markets, and the implementation of mangrove projects as carbon sink in Maritime Silk Road countries, in order to incorporate blue carbon into key areas of international cooperation in climate change response, strengthen relevant technical exchanges, and build carbon sinks with blue carbon.

## References


[1]. Stöfen-O, A., Naji, A., Brooks, A. L., Jambeck, J. R., & Khan, F. R. (2022). Marine plastic debris in the Arabian/Persian Gulf: Challenges, opportunities and recommendations from a transdisciplinary perspective. Marine Policy, 136, 104909.

[2]. Li Daoji. Reducing marine plastic waste to protect the marine environment [J]. Democracy & Science, 2020, (01):32-34.

[3]. Li Dan, Li Lingyu. Theory and practice of building a BRI community of ecosystems with a shared future [J]. Journal of Xiamen University (Philosophy and Social Sciences Edition) .2020, (3).

[4]. Tries B. Razak, Lisa Boström-Einarsson, Cut Aja Gita Alisa, Rindah Talitha Vida, Timothy A.C. Lamont. J. (2022). Coral reef restoration in Indonesia: A review of policies and projects. Marine Policy, 137, 104940. https://doi.org/10.1016/j.marpol.2021.104940.

[5]. Hu, N., Bourdeau, P. E., Harlos, C., Liu, Y., & Hollander, J. (2022). Meta-analysis reveals variance in tolerance to climate change across marine trophic levels. Science of the Total Environment, 827, 154244.

[6]. Zeng, X., Chen, M., Zeng, C., Cheng, S., Wang, Z., Liu, S., & Cao, L. (2022). Assessing the management effectiveness of China's marine protected areas: Challenges and recommendations. Ocean & Coastal Management, 224, 106172.

[7]. Nguyen, H. P., Nguyen, P. Q. P., & Nguyen, T. P. (2022). Green Port Strategies in Developed Coastal Countries as Useful Lessons for the Path of Sustainable Development: A case study in Vietnam. International Journal of Renewable Energy Development, 11(4), 950-962.

[8]. Chang, Y. (2023). New Political Economy Strategy of China--Belt and Road Initiative. Journal of Politics and Strategy, 1(1), 1-17.

[9]. Turschwell, M. P., Brown, C. J., Pearson, R. M., & Connolly, R. M. (2020). China's belt and road initiative: Conservation opportunities for threatened marine species and habitats. Marine Policy, 112, 103791.

[10]. Cheng, L. J., J. Abraham, K. E. Trenberth, T. Boyer, M. E. Mann, J. Zhu, F. Wang, F. J. Yu, R. Locarnini, J. Fasullo, F. Zheng, Y. L. Li, B. Zhang, L. Y. Wan, X. R. Chen, D. K. Wang, L. C. Feng, X. Z. Song, Y. L. Liu, F. Reseghetti, S. Simoncelli, V. Gouretski, G. Chen, A. Mishonov, J. Reagan, K. Von Schuckmann, Y. Y. Pan, Z. T. Tan, Y. J. Zhu, W. X. Wei, G. C. Li, Q. P. Ren, L. J. Cao, and Y. Y. Lu, 2024: New record ocean temperatures and related climate indicators in 2023. Adv. Atmos. Sci., https://doi.org/10.1007/s00376-024-3378-5.

[11]. UNCTAD. 2021. Advancing the potential of sustainable ocean-based economies: trade trends, market drivers and market access. https://unctad.org/system/files/official-document/ditctedinf2021d2_en.pdf

# Chapter 10 Sustainable Transportation

Transportation, as the backbone that supports mobility, is a vital sector in the Belt and Road Initiative (BRI). As of January 2023, China has signed over 200 BRI cooperation agreements with 151 countries and 32 international organizations[1], with a significant portion focused on transportation infrastructure and connectivity. Connectivity between China and BRI countries in transportation infrastructure has steadily increased. According to the *China-Europe Railway Express Development Report (2021)*, the number of China-Europe freight trains surged from 1,702 in 2016 to 15,183 in 2021, reflecting an average annual growth rate of 55%. With 82 routes in operation, China-Europe freight trains now reach 200 cities in 24 countries in Europe alone[2].

Many countries prioritize transportation infrastructure to stimulate economic growth, connect domestic and international markets, and boost investment competitiveness. According to the *Belt and Road Infrastructure Development Index Report (2024)* released by the China International Contractors Association (CHINCA), transportation infrastructure remains the most in-demand sector within the BRI. As the concept of "small and beautiful" BRI infrastructure projects gains traction, individual transportation projects in BRI countries are becoming smaller in scale, while the overall value of contracts awarded continues to rise. Medium- and small-sized transportation projects that require less initial investment and shorter construction cycles while delivering stronger connectivity and reduced risks, along with branch lines and stations closely integrated with local communities and social development, are expected to become the priority areas in future transportation infrastructure initiatives across BRI countries.

Moreover, the transportation sector is also crucial in addressing environmental impacts and climate change. According to the United Nations Environment Programme's report *Mapping Environmental Risks and Socio-Economic Benefits of Planned Transport Infrastructure: A Global Picture*, launched during the second phase of COP15 to the *Convention on Biological Diversity* in 2022, large-scale transport infrastructure projects currently underway or planned in 137 countries cross over approximately 60,000 km of the world's protected areas or Key Biodiversity Areas. Additionally, the transportation sector is a major contributor to energy consumption and greenhouse gas emissions. Data from the International Energy

Agency (IEA) shows that transportation is the second-largest carbon-emitting sector globally, accounting for 25% of carbon emissions and is thus a significant driver of global climate change. Despite the significant challenges of decarbonization, there have been encouraging advancements in technology and manufacturing. These developments have enhanced the economic viability of low-carbon technologies, reduced the costs of electric vehicles, renewable fuels, and alternative propulsion systems, and significantly lowered the "green premium". By 2030, most low-carbon technologies are expected to be economically viable on a global scale. The rapid decline in costs for low-carbon light land transportation (which accounts for the majority of emissions) over the past decade suggests that economically competitive transportation solutions are on the horizon.

China has consistently prioritized green transportation as a key area in advancing the Green Silk Road. In April 2019, at the Second Belt and Road Forum for International Cooperation, Chinese President Xi Jinping emphasized that the BRI "aims to promote green development", and encouraged countries to "launch green infrastructure projects, make green investment and provide green financing to protect the Earth which we all call home." In April 2021, at the Leaders Summit on Climate, China pledged to adopt a series of measures in green infrastructure, green energy, green transportation, and green finance to bring enduring benefits to the people of all BRI countries. In October 2021, at the Second UN Global Sustainable Transport Conference, China reiterated its commitment to promoting high-quality development of the BRI and enhancing infrastructure connectivity with other countries. In October 2023, China proposed eight actions for the high-quality development of the BRI, one of which is the creation of a multidimensional BRI connectivity network. This includes speeding up the high-quality development of China-Europe Railway Express, participating in the trans-Caspian international transport corridor, and building a new logistics corridor across the Eurasian continent linked by direct railway and road transportation. China is also actively integrating ports, shipping and trading services under the "Silk Road Maritime," and accelerating the building of the New International Land-Sea Trade Corridor and the Air Silk Road.

## 1. Green Transportation Under the BRI: Current Trends

### 1.1 Carbon Emissions in the Transportation Sector

According to UN's report *Sustainable Transport, Sustainable Development*[3],

transport is responsible for around a quarter of direct $CO_2$ emissions from fossil fuel combustion in 2018 (see Figure 10.1). Data from the International Energy Agency (IEA) further shows that in 2023, at the sector level, transport experienced the most pronounced growth in emissions, surging by nearly 240 Mt globally compared to 2022. Transport emissions grew at an annual average rate of 1.7% from 1990 to 2022, faster than any other end-use sector except for industry (which also grew at around 1.7%). To get on track with the Net Zero Emissions (NZE) by 2050 Scenario, $CO_2$ emissions from the transport sector must fall by more than 3% per year to 2030. These facts demonstrate that strong regulations and fiscal incentives, as well as considerable investment in infrastructure to enable low- and zero-emission vehicle operations, will be needed to achieve emissions reductions in this sector.

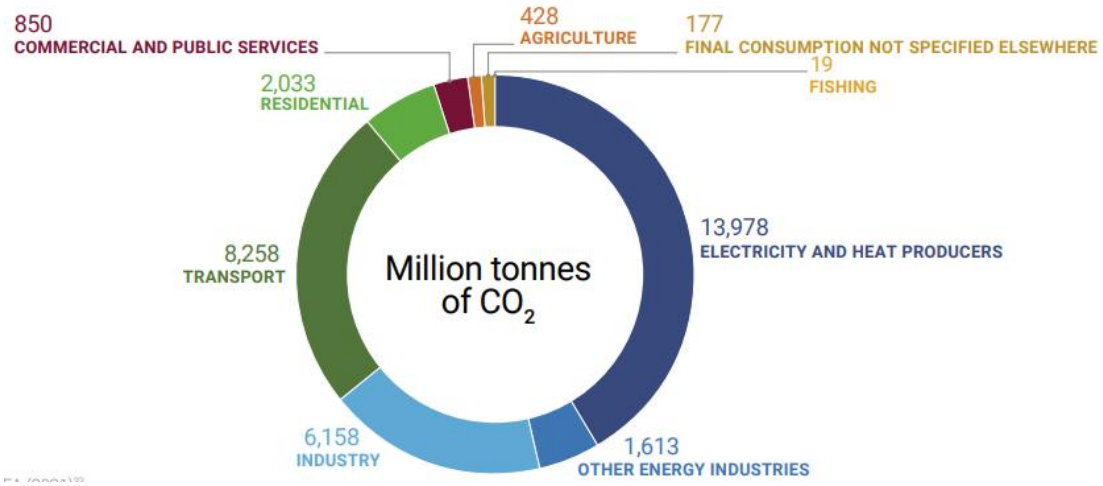


**Figure 10.1 CO2 emissions by sector in 2018 (unit: million tons)**

According to the IEA, road transport generates the highest carbon emissions within the transportation sector, followed by shipping and aviation, while rail transport produces the least. This indicates that road transport is the primary contributor to emissions in the sector. Encouraging a shift from road to rail or water transport, or adopting high-capacity rail systems, could substantially reduce $CO_2$ emissions in transportation.

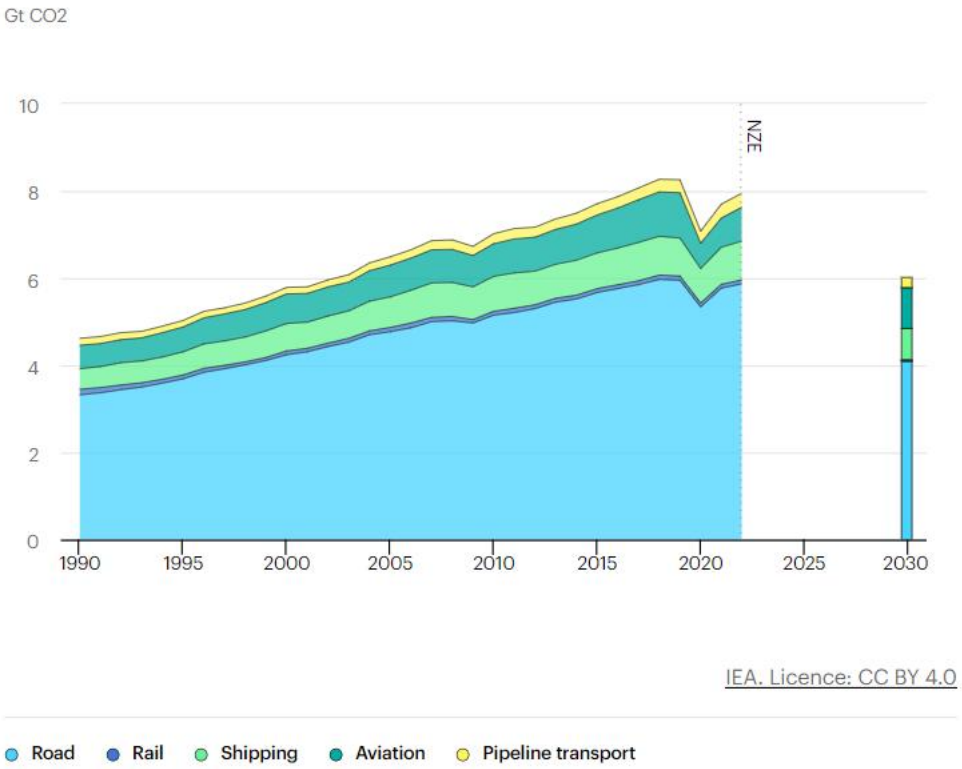


**Figure 10.2 CO2 emissions by different modes of transport globally (1990-2022)**

Between 2010 and 2019, Asia saw a 41% rise in $CO_2$ emissions, making it the fastest-growing region globally, followed by Africa with a 27% increase. In both regions, rapid urbanization and industrialization are expected to drive higher transportation demand and associated carbon emissions. With the majority of BRI countries located in these areas, there is an urgent need to accelerate green, low-carbon transitions in the transportation sector.

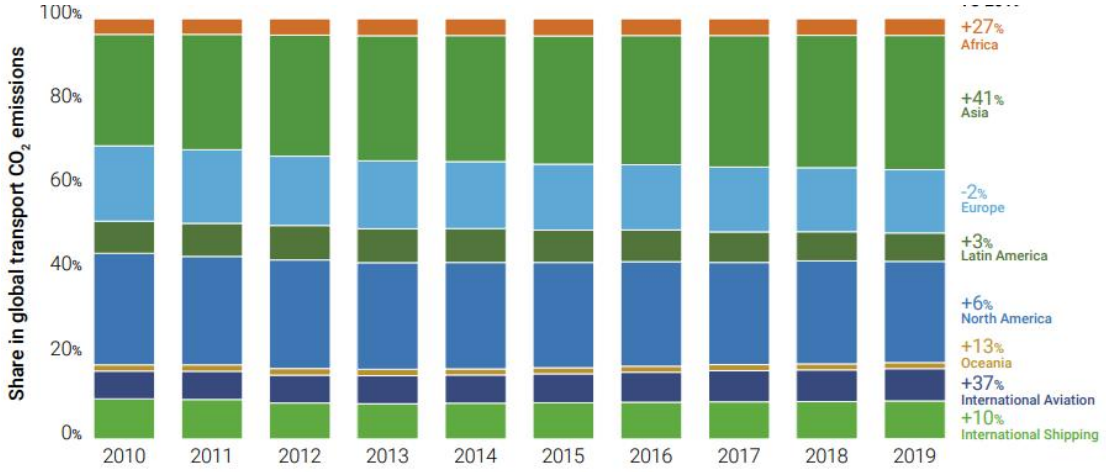


**Figure 10.3 Growth of $CO_2$ emissions by region (2010-2019)**

Figure 10.4 shows the greenhouse gas emissions from the transportation sector in G20 countries. In North American and European economies, transportation emissions

account for more than a quarter of total emissions. In both the UK and the U.S., transportation is the largest source of emissions, while in the EU and Saudi Arabia, it ranks the second.

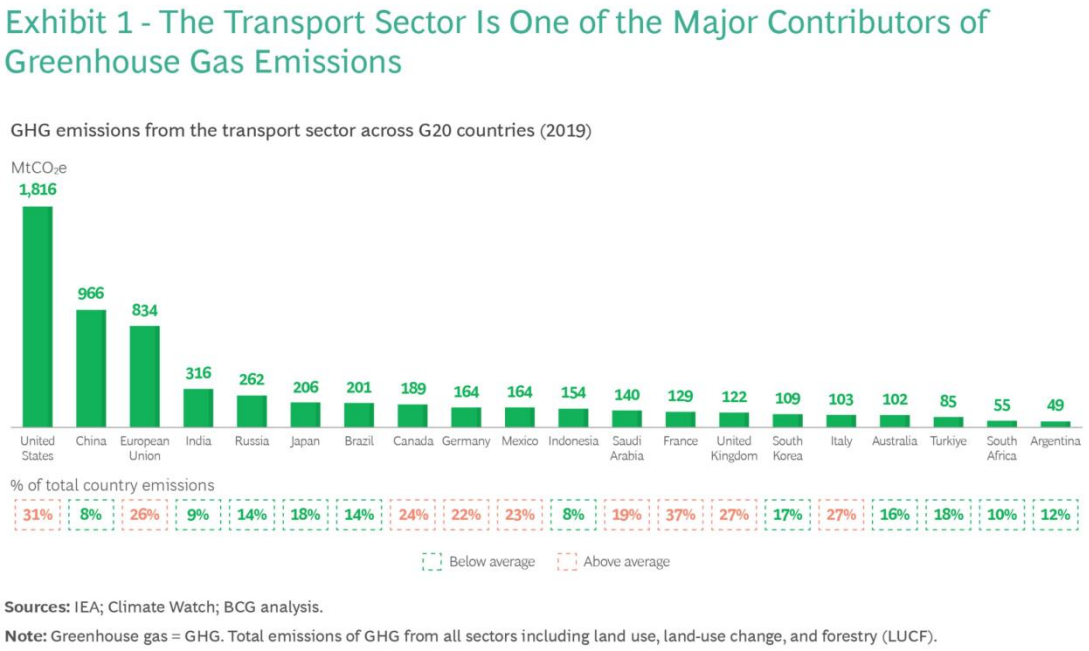


**Figure 10.4 GHG emissions from the transportation sector in G20 countries (2019)**

According to the International Transport Forum, some 98% of NDCs mention transport and 83% include green and low-carbon transport measures[4]. However, only 33% of NDCs set $CO_2$ reduction targets for the transport sector. To meaningfully reduce emissions and limit global temperature rise, these numbers need to change quickly and be coupled with decisive and efficient implementation. This is especially pressing because, despite progressive NDC revisions by some countries, the world is poised to use 86% of its carbon budget by 2030[5].

### 1.2 Green Transportation Policies and Practices Under the BRI

#### (1) Green Transportation Policies

Enhanced prevention and management of environmental risks is at the core of green transportation. It also serves as a crucial safeguard for the long-term and sustainable development of the Belt and Road Initiative (BRI). Since 2013, the Chinese government has issued numerous policy documents to strengthen the environmental management of BRI projects, which has led to continuous improvements in green transportation and risk management for the environmental impacts of transportation infrastructure under the BRI.

In 2017, the former Ministry of Environmental Protection, the Ministry of Foreign Affairs, the National Development and Reform Commission and the Ministry of Commerce jointly issued the *Guidance on Promoting Green Belt and Road.* One of the key tasks outlined in the *Guidance* is advancing green infrastructure development and ensuring the protection of ecological and environmental quality. This includes setting environmental standards and regulations for infrastructure projects, boosting ecological protection services and support for major BRI infrastructure projects, and promoting energy-efficient, environmentally friendly practices across sectors such as green transportation, green buildings, and clean energy.

In 2021, the Ministry of Commerce and the Ministry of Ecology and Environment jointly released the *Green Development Guidelines for Overseas Investment and Cooperation.* Among the ten key tasks outlined in the *Guidelines* are compliance with international green standards and the construction of green infrastructure. The *Guidelines* also encourage enterprises to adopt high standards in the planning and design of overseas infrastructure projects, properly manage relationships with local communities, the environment and ecosystems, and formulate feasible environmental protection measures.

In 2022, the Ministry of Ecology and Environment and the Ministry of Commerce jointly issued the *Guidelines for Ecological Environmental Protection of Foreign Investment Cooperation and Construction Projects*, which requires enterprises to follow principles of green, low-carbon, and sustainable development when implementing transportation infrastructure projects. Companies are advised to make thoughtful decisions in route planning and site selection to minimize disruption to nature reserves and key wildlife habitats. When avoidance is not possible, measures such as eco-friendly animal passages or the construction of wildlife corridors may be adopted to mitigate or compensate for the impacts.

In the same year, the National Development and Reform Commission, along with the Ministry of Foreign Affairs, the Ministry of Ecology and Environment, and the Ministry of Commerce, jointly issued the *Opinions on Jointly Promoting Green Development of the Belt and Road,* which has made specific plans to promote green development in key sectors, including green infrastructure, green energy, green transportation, and green finance. It also emphasizes the need to strengthen international cooperation in green transportation, support green transportation development in BRI countries, and promote China's smart transportation solutions in

areas such as low-carbon international shipping and aviation, as well as energy-efficient, low-carbon vehicles powered by clean and renewable energy. Furthermore, it encourages enterprises to participate in overseas railway electrification projects, boost the long-term viability and growth of the China-Europe Railway Express, and foster the development of multimodal transport and green logistics systems.

**(2) Green Transportation Practice**

In recent years, China has continuously enhanced the green development of its BRI transportation infrastructure projects. It has mitigated the impact of linear transportation projects on biodiversity by strengthening environmental management of overseas projects and encouraging the adoption of internationally recognized standards. Moreover, ecological and environmental considerations are now integrated into the entire project lifecycle, from planning and construction to operation. These initiatives have fostered a balanced approach to economic growth, poverty alleviation, and ecological protection in BRI countries.

**Infrastructure Construction**

The connectivity of transportation infrastructure—including railways, highways, ports, and airports—is a key aspect of BRI cooperation. Through collaborative efforts with BRI countries, China has made significant progress in promoting the green construction of transportation infrastructure and yielded fruitful results.

1) Railways

Railways are a key sector of BRI infrastructure development that attracts much attention. With China's expertise in railway technology and construction, cooperation on railway projects between China and BRI countries and regions has continuously expanded. Green development concepts are integrated into the entire process of construction and operation in BRI projects, ensuring that project execution aligns with environmental protection goals. Railway construction plans and greening initiatives are tailored to local conditions, incorporating innovative, eco-friendly techniques that minimize resource waste and protect biodiversity along the routes. These efforts aim to reduce environmental impact and create green railways that foster ecological harmony and coexistence.

The **Mombasa-Nairobi Railway** connects Kenya's capital, Nairobi, with East Africa's largest port, Mombasa. Built by China according to its Class I railway line standards, the project implemented detailed planning and scientific management to

minimize surface impact, protect riverbanks, and reduce the use of farmland and forests. It also prioritized soil and water conservation, noise control, and the prevention of water, air, and solid waste pollution. Wildlife corridors were established for animals such as zebras, and mangrove restoration projects were implemented[6]. To reduce the impact on local species, a total of 14 large wildlife passages and 79 bridges had been set up along the entire railway in consideration of the living habits and migration paths of wild animals.

In building the **Ankara-Istanbul High-Speed Railway Project** in Turkey, resources waste was reduced by optimizing the original grounding system. It created a regional "railway corridor", to make a long-distance and low-carbon travel possible. Different construction plans were carried out according to local terrain conditions, to create a "green corridor" with less project interference and more protection of cultural heritage.

The **China-Laos Railway** reflects a strong commitment to low-carbon, environmentally friendly development. From route planning to construction, extensive research has been conducted to assess potential environmental impacts and ensure that the railway blends harmoniously with nature. Vegetation was planted along the route to reduce soil erosion and accelerate ecological recovery, while wildlife migration routes were carefully avoided to minimize disruption to ecosystems. The railway's power supply infrastructure was also designed to preserve animal migration paths in order to support biodiversity. Moreover, the project integrated local ethnic culture and heritage with green transportation concepts. As one of the most eco-friendly transportation modes, the railway reduces reliance on long-distance buses and promotes low-carbon travel.

Figure 10.5 Greening works for China-Laos Railway

2) Highways

The **Pakistan PKM Motorway Project** (Sukkur-Multan Section) is a major north-south transportation artery in Pakistan. The PKM project is seated in an area of the temperate continental climate, with small precipitation and low humidity, of which 120 kilometers were of saline-alkali soils. Green plants are therefore hard to survive here. In conducting greening at roadsides, interchanges and building areas, it got rid of the difficulties in the scarcity of saplings and grass seeds resources, poor soil quality, and wide range of pest control. Along the artery, a total of 335,800 saplings and 5.53 million square meters of lawns were settled, making a greening area of 576,500 square meters. Other green practices in the project include using green and eco-friendly asphalt, optimizing concrete mix ratios to enhance setting performance, and creating green corridors for animal migration. These corridors were built in areas with open views, flat terrain, and suitable soil conditions, taking into account the local reliance on irrigation in agriculture, the living habits and migration routes of wild animals.

Figure 10.6 PKM Panorama

The **Cambodia Phnom Penh-Sihanoukville Expressway Project** connects the capital city Phnom Penh to Sihanouk port, the largest seaport in the country. It is the first-ever expressway in Cambodia. The Project has set a new benchmark for local infrastructure with its environmental protection philosophy. An ecological protection task force was established to enhance site construction management. All production and cleaning water must be treated through three stages of sedimentation before discharge. Earthworks operations were optimized to control dust. Site construction work used low-noise, low-vibration machinery, while noise and vibration reduction measures were taken. To protect vegetation and wildlife habitats, the project avoided conservation areas as much as possible and followed the concept of “restoration while

construction" to minimize environmental impact. To reduce traffic noise pollution, sound barriers and sound-reducing forests were built for 44 sound-sensitive areas along the route. Given the presence of numerous wild animals near sections of the expressway that traverse nature reserves, a 21-km-long barrier was erected to prevent them from entering and getting hurt from the project construction area. The project also built wildlife passages.

The **Montenegro North-South Expressway Project** is Montenegro's first expressway. It links the southern city of Bar with the northern city of Boljare. The project employs an eco-friendly design philosophy and technical solutions of closed drainage systems which separates the polluted road water from the clean surface water, so that the polluted water can be collected and treated before discharge. This approach reduces the impact of surface water on local water resources and the environment, ensuring compliance with EU wastewater discharge standards (EN858)[6].

3) Bridges and Tunnels

Bridges and tunnels are crucial to the BRI's connectivity initiatives, particularly in mountainous and coastal areas. These infrastructure projects offer accessible routes to cross the once insurmountable natural barriers, making it possible for us to overcome challenging terrains like mountains and seas.

During the construction of the **Pulau Muara Besar Bridge in Brunei**, the project team overcame challenges posed by climate, terrain, geology, and marine construction by employing innovative and optimized engineering techniques. These efforts not only conserved resources but also enhanced transportation efficiency. In addition, environmental protection measures such as vegetation protection barriers, transplantation, and soil preservation were implemented to protect the island's surrounding vegetation and create a green corridor.

**The Pelješac Bridge Project** is not only the largest infrastructure project undertaken by China in Croatia, but also the first major project funded by the EU and implemented in EU's territories adopting EU standards. The project team utilized GPS and other information systems, high-tech environmental equipment, and third-party professional firms to recycle and dispose waste and wastewater generated during construction. The project strictly followed garbage classification protocols with regular professional treatments to minimize human-induced pollution. Noise reduction measures tailored to the local fishing and tourism industries were taken to reduce impacts on marine life and preserve biodiversity. Comprehensive control

measures were implemented across the sea area, land-based processing sites, office spaces, and living quarters, ensuring full coverage of green construction and environmental management. As a result, the project team has achieved the goal of "zero accidents, zero defects, zero pollution, and zero infections." The project also collaborated with 65 global equipment and material suppliers from countries such as Croatia, Germany, and Spain. From bidding through to execution, the project strictly followed green and environmental principles, local regulations, and high-quality construction standards.

In the **Karnaphuli River Tunnel Project in Bangladesh**, a standardized, eco-friendly project site was set up to effectively manage domestic wastewater, save energy and protect the environment. At the beginning of the project, a comprehensive testing system was implemented to study green concrete mix proportions, in order to reduce natural resource and energy consumption while minimizing waste and the risk of secondary pollution caused by repair or removal. The project also innovated construction techniques and developed energy-efficient, environmentally friendly equipment to manage slurry overflow in the tunnel, accelerating construction speed while delivering green economic benefits for the enterprise.

4) Port Projects

According to statistics from the United Nations Conference on Trade and Development, 80% of global goods trade is carried out by sea. The diversified opportunities brought by the BRI have resulted in extensive cross-border transportation, positioning ports as critical nodes and carriers along the "21st Century Maritime Silk Road." In recent years, China has been actively involved in the construction of numerous international ports in BRI countries, enhancing maritime connectivity and deepening port cooperation. These efforts have led to continued improvements in port infrastructure and operations, driving economic growth and facilitating unimpeded global trade.

Port projects are intrinsically linked to the shipping industry. Each year, marine transport produces greenhouse gas emissions totaling about 1 billion tons of $CO_2$ equivalent globally, accounting for around 3% of man-made $CO_2$ emissions. These emissions are expected to more than double in the coming years in a business-as-usual scenario, posing a significant challenge to meeting the temperature targets set by the *Paris Agreement*. Port activities such as docking can bring oil spills, along with air, noise and light pollution. Ship traffic may produce underwater noise, potentially harm

marine life, and release ballast water with invasive species. Furthermore, high levels of greenhouse gas emissions from ships, extensive marine development and transport, as well as the coastal storage of hazardous chemicals, may increase marine pollution risks.

Sustainable development is essential for the prosperity of coastal areas. Many ports along the route are accelerating their transition to green ports, better integrating with port city planning, and enhancing environmental cleanliness. For example, the **Port of Piraeus** reduced energy consumption by adjusting fleet structure and creating new shipping routes, while improving resource utilization and lowering carbon emissions through advanced bridge crane technology. Environmental monitoring and research have been conducted to assess and address the impact of port operations on the environment. Similarly, the **Port of Mombasa** enhanced the efficiency of fuel treatment by building an oil terminal. It also compensated for mangrove loss by planning new planting areas for mangrove forests. These green initiatives have significantly improved environmental outcomes in port construction and operations and facilitated the transition to green ports. **The Colombo Port of Sri Lanka** completed the "oil-to-electricity" transformation of 40 gantry cranes and 40 container yards in November 2017, making it the first green terminal in Sri Lanka and the largest one in South Asia. "Oil-to-electricity" transformations can reduce the cost of the enterprise by about US $1.45 million per year and lower the diesel consumption of the gantry crane and the total direct carbon dioxide emissions by 95%. By reducing noise pollution and air pollution, the project provides a healthier working environment for the operators on-site.

**Electric Vehicles**

In 2023, China became the world's largest car exporter, with 4.91 million vehicles shipped overseas, representing a 57.9% increase year on year[7]. Among the export destinations, BRI countries held a significant share. As the BRI progresses and the quality, technology, and service of Chinese automotive products continue to improve, Chinese automotive companies are are expanding rapidly in BRI countries by establishing new factories. In Southeast Asia, countries like Indonesia and Thailand offer abundant labor resources and improved business environments, which creates favorable conditions for companies such as Dongfeng, Chery, SAIC, and Great Wall Motors. As a result, cost-effective models from these brands have gained greater acceptance in the local markets. In Hungary, a robust automotive industry

chain and a growing power battery sector have attracted investments from new energy vehicle companies like BYD and NIO. In Argentina, new energy vehicles, especially electric buses, have become a prioritized area for development for the local government due to their benefits in addressing climate change and reducing air pollution.

According to data from the General Administration of Customs[8], from January to August 2023, China exported 1.08 million electric passenger vehicles, a 92% increase year-over-year, with export values reaching 179.9 billion yuan, up by 129%. Among various export products, electric passenger vehicles saw some of the highest increases in both volume and value.

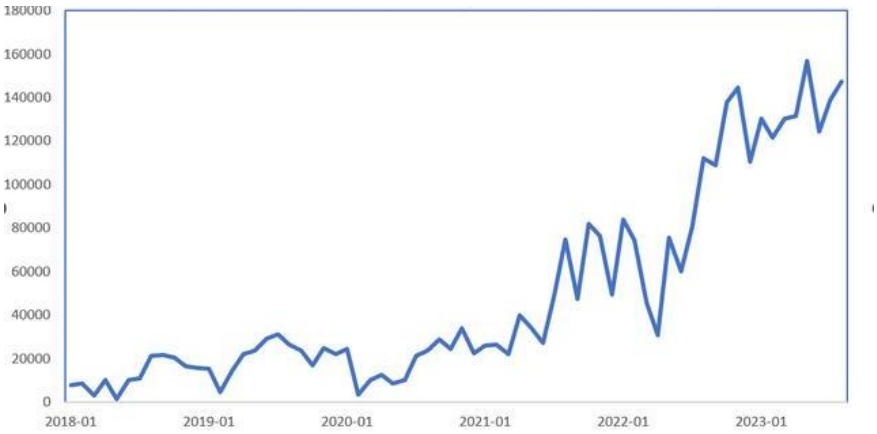


Figure 10.7 China's electric passenger vehicle exports (2018-2023)

Source: General Administration of Customs

In recent years, China's new energy vehicle (NEV) industry has made significant strides in industry standards, industry alliances, corporate deployments, and technological research and development. As one of the "Three New Treasures," NEVs, with their advantageous industry layout, innovative technology, and green philosophy, have become a key driver for accelerating green and low-carbon transformation in BRI countries. From Latin America to Europe, and from Asia to Africa, a growing number of Chinese NEV projects are being launched, supporting BRI countries in building smart, green public transportation systems and fostering sustainable, low-carbon lifestyles. In 2017, BYD's first electric bus factory in Europe began production in **Hungary**, with an annual output of about 400 zero-emission electric buses, bringing both economic and environmental benefits to the public transportation system. By the end of 2022, BYD had delivered 435 pure electric buses to **Chile**, representing over 60% of the country's electric bus market and contributing

to Chile's goal of transitioning to a 100% electric bus fleet by 2040.

### 1.3 Green Transportation Policies and Practices in BRI Countries

#### (1) Green Transportation Policies in BRI Countries

**Global Policy**

Amid global efforts for low-carbon transformation and carbon constraints, the majority of BRI countries have submitted updated Nationally Determined Contributions (NDCs) and developed national climate strategies along with sector-specific policies in transportation, energy, and construction. By August 2024, 172 parties had updated their NDCs, reinforcing their commitments to emissions reductions. The transportation sector, as a major energy consumer, is pivotal in the journey toward carbon neutrality across regions. The UN's report *Sustainable Transport, Sustainable Development* highlights road transport as a key area for reducing greenhouse gas emissions. Strategies to cut emissions include improving energy efficiency (e.g., fuel efficiency standards), advancing electrification (e.g., establishing charging infrastructure and ending the sale of new fossil fuel vehicles by 2030), and enhancing transportation efficiency (e.g., expanding public transit and railway networks). Nevertheless, in terms of the breakdown of carbon emissions within the transport sector, developed countries tend to have higher emissions compared to developing countries. This indicates that as developing nations grow economically, their share of energy consumption and carbon emissions from their transportation sectors is expected to rise. However, reducing emissions in this sector presents significant challenges, with progress lagging behind that of other sectors by more than a decade[9].

**National Policy**

To boost economic growth, connect domestic and international markets, and improve investment competitiveness, BRI countries are prioritizing the development of transportation infrastructure while setting clear goals for the green and low-carbon transformation of the sector. **Thailand**, for instance, aims to cut greenhouse gas emissions by 30% by 2030 (using 2005 as the base year) and introduced a carbon emissions-based vehicle taxation policy in 2016 to promote the use of low-carbon vehicles. The country's *Master Plan for Sustainable Transport and Climate Change Mitigation (2013-2030)* focuses on shifting more passenger and freight transport from road to rail, increasing transportation electrification, and supporting the development of battery charging technologies.

**Indonesia** has developed its *Long-Term Strategy for Low Carbon and Climate Resilience 2050* (Indonesia LTS-LCCR 2050) with the goal of achieving carbon neutrality by 2060. In its updated NDC submitted in September 2022, the country increased its GHG emission reduction target from 29% to 31.89%. Indonesia also issued a presidential regulation in 2019 which provides directives to accelerate the adoption of Battery Electric Vehicles (BEVs) for road transport, aiming for 15 million EVs by 2030. The country is also promoting natural gas-powered buses and using biofuels or natural gas as alternatives to traditional fuels to reduce fossil fuel based carbon emissions.

**Kazakhstan** is the largest greenhouse gas emitter in Central Asia. The country has its transportation sector as the fastest-growing source of emissions. Its green transportation efforts focus on clean transport equipment and reduced urban traffic emissions. In 2018, Kazakhstan approved the *Action Plan to Expand the Use of Natural Gas as a Motor Fuel (2019-2022)*, with plans to build 100 new gas stations and manufacture 12,000 natural gas buses and specialized equipment. The plan also includes converting buses and railway locomotives to run on natural gas or liquefied gas and building gas stations to support the decarbonization of the transportation sector. In 2023, Kazakhstan introduced the *Concept of Development of Transport and Logistic Capacity of the Republic of Kazakhstan till 2030*, which calls for the development of various transportation systems, including railways, roads, waterways, aviation, and logistics, while advancing continental transport corridors across the North-South and East-West routes[10].

**Egypt** officially launched a vehicle renewal program in 2021 aiming to convert 150,000 conventional vehicles to operate on natural gas within three years, alongside the construction of 366 new natural gas stations nationwide. Egypt is also developing urban transportation and advocating for green travel. It has already completed its first electrified light rail system connecting Cairo, the New Administrative Capital, and the Tenth of Ramadan City. In 2022, the World Bank approved a 400 million USD development financing agreement to support the shift towards low-carbon transportation along the Alexandria–the 6th of October City–Greater Cairo Area (GCA) railway corridor.

**Saudi Arabia** introduced its National Transport and Logistics Strategy (NTLS) in 2021. The strategy aims at enhancing sustainability, reducing fuel consumption by 25%, and adopting cutting-edge global mobility technologies for smart transportation

solutions to overcome challenges in the transport sector. The kingdom aims to have 30% of vehicles in Riyadh to be electric by 2030. In the fourth quarter of 2021, Saudi Arabia ranked among the top 50 globally in vehicle electrification for the first time. It plans to build a "car-free, road-free" city which adopts zero-emission vehicles, which would include the world's first sustainable, seamlessly connected mobility system powered entirely by 100% renewable energy sources[12]. The country also plans to use its abundant renewable energy resources to produce green hydrogen, a truly zero-carbon fuel, to introduce hydrogen fuel vehicle manufacturers, and to actively promote hydrogen as a low-carbon transportation fuel. The hydrogen energy plant being built in NEOM city may become the world's largest green hydrogen production facility.

**South Africa**'s Rail Modernization Programme has been underway for over 20 years. The country is now formulating long-term planning to revitalize its rail system and upgrade the railway system across the country in the next 20 years. In 2022, South Africa introduced a Hydrogen Society Roadmap to leverage its renewable energy resources, stimulate demand for green hydrogen, and promote decarbonization in heavy transport sectors.

**(2)Green Transportation Practices in BRI Countries**

**Accelerating the Adoption of Green and Low-Carbon Transport Equipment**

Promoting clean energy and low-emission transport equipment for green mobility is a key strategy for BRI countries to advance green transportation. **China** has been accelerating the application of new and clean energy. By the end of June 2023, China had 16.2 million new energy vehicles on the roads and over 73% of railways were electrified, with more than 1 million new energy vehicles deployed for urban logistics. Meanwhile, 74.9% of China's railroads were electrified, with fully operational auxiliary power unit (APU) replacement facilities for aircrafts and a fleet of 691 LNG vessels. Belgrade, the capital of **Serbia**, introduced buses equipped with Cursor 9 engines that are compliant with Euro VI standards, with a nitrogen oxide conversion efficiency of 95%. In June 2020, the government of **Greece** announced a 100-million-euro national scheme "Go Electric" to subsidize extensively the purchase of electric vehicles, including electric cars, e-scooters and e-bicycles by consumers and companies. The subsidies cover 20% of the purchase price, up to a maximum of 6,000 euros. In late March 2021, **South Africa** issued its NDC draft, prioritizing green transport such as electric and hybrid vehicles in its emission reduction efforts

between 2031 and 2040. Santiago, the capital of **Chile**, is on track to fully electrify its bus fleet by 2035 through a project that focuses on clean electric buses. This project is based on small-scale pilots, emphasizing robust charging infrastructure and smart equipment, innovative financing models, and using fiscal incentives to encourage clean electric vehicle projects. In addition, countries such as **Costa Rica, Pakistan, Laos,** and **Nepal** are actively promoting the use of pure electric buses, showing a strong preference for Chinese EV brands.

**Fostering Synergy Between Smart Transportation and Green Transportation**

By adopting information technology and building smart transportation, the operational efficiency of transportation systems is enhanced, leading to reduced pollutants and carbon emissions and enhanced synergy between green and smart transportation development. **China** is driving the deep integration of new technologies such as big data and artificial intelligence into the transportation industry, vigorously developing smart transportation, and promoting innovations in modes, business formats, products, and services. Efforts are being made to advance smart transportation services, exploring the "mobility-as-a-service" model, and achieving comprehensive integration of data resources, operational scheduling, ticketing, integrated payments, information services, and supervisory management across various transportation modes including urban public transit, taxis, and shared mobility. The public transportation system in **Singapore** utilizes big data technology across motor vehicles, subways, buses, and taxis. To help passengers and drivers plan routes in advance and avoid traffic congestion, the Land Transport Authority of Singapore has introduced the MyTransPort mobile app, which offers real-time route planning services. In **Malaysia**, the Malaysia Digital Economy Corporation (MDEC) and the Kuala Lumpur City Hall (DBKL) have jointly announced the introduction of Alibaba Cloud's Malaysia City Brain initiative. This initiative will be extensively used for traffic management, urban planning, environmental protection, weather forecasting, public safety, and smart tourism. Artificial intelligence technology is mainly applied in the smart transportation field to alleviate traffic congestion in Kuala Lumpur through measures such as dynamic traffic light adjustments, traffic accident detection, and priority for emergency vehicles, while also offering comprehensive recommendations for managing emergencies and traffic diversion. The Phu Quoc Island in **Vietnam** has implemented free 4G wireless internet coverage and installed a

smart transportation system. In Hanoi, smart transportation measures include electronic tickets, smart tolling, and smart parking. **Botswana** has also launched the construction of a smart transportation system, with the first phase aiming to assist the Botswana Police Service in achieving comprehensive tracking and scheduling of police vehicles, providing multi-dimensional reports on vehicle data and driver behavior to ensure the safe and efficient execution of police work. In Karachi, **Pakistan**, the Green Line BRT System has adopted new energy buses and integrated a comprehensive suite of smart bus equipment. Utilizing the BRT modern bus operation model and smart operation scheduling, it offers citizens a green, efficient, intelligent, and comfortable travel experience. In **Ecuador**, a smart road safety platform has been developed to enhance road safety management, revolutionizing its traditional practices. This platform supports vehicle management services for various bus companies and national departments, allowing authorized entities to track vehicles, access operational information, and monitor violations such as speeding to regulate the operation of taxis and buses.

**Promoting Green and Low-Carbon Travel**

Developing public transportation and encouraging green travel options, like cycling and walking, can help reduce motor vehicle pollution and carbon emissions while embracing a "slow life". **China** advocates the concept of green travel. It aims to raise public awareness and participation in eco-friendly transportation, boost green growth and cultivate green lifestyles. The *Green Travel Action Plan (2019-2022)* outlines efforts to create a safe, comfortable and seamlessly connected slow-moving traffic network in cities, increase investment in non-motorized vehicle lanes and pedestrian paths, and improve the environmental management of these systems to foster a green travel environment. In **Malaysia**, hybrid meter-gauge EMU developed by the East Coast Rail Link was put into operation. The EMU, equipped with smart maintenance and monitoring systems, supercapacitors, and big data remote diagnostics, has significantly improved the convenience and comfort of local travel. The government of **Singapore** has introduced policies to support the development of public transportation, encouraging more people to make it their preferred travel choice. The government covers construction costs, reduces wait times, and enhances bus service quality. By regulating fares based on total travel distance, passengers enjoy greater flexibility and convenience in selecting optimal routes, while high-capacity rail corridors provide efficient transit services. Jakarta, **Indonesia**, has launched

"Car-Free Day" events. Major roads are closed to motor vehicles on Sunday mornings, allowing people to jog, walk, bike, or enjoy street performances. Similarly, Ulaanbaatar, **Mongolia**, organizes "Car-Free Day" to promote green travel, encouraging citizens to cycle or walk when possible, reduce car use, and opt for low-emission or environmentally friendly vehicles for a cleaner, healthier lifestyle.

## 2. Green Transportation Under the BRI: Development Prospects

### 2.1 Emerging Trends and Opportunities for the Development of Green Transportation Under the BRI

#### (1) Climate-Resilient Transportation Infrastructure as a Key Trend

A study published in *Nature Communications* in June 2019 indicates that about 27% of global road and railway assets is at risk from at least one type of natural disaster, with around 7.5% exposed to 100-year flood risks. Road and railway networks are most vulnerable to surface flooding, followed by tropical cyclones, river floods, and earthquakes. Climate change will exacerbate the impact of natural disasters on transportation infrastructure, as potential increases in temperature and precipitation will shorten the lifespan of roads and significantly increase maintenance and repair costs[13]. Given that transportation infrastructure in developing countries is still in its early stages, climate-adaptive infrastructure will become a global consensus and trend in future projects, whether building or upgrading roads, railways, and ports, or in South-South cooperation. Countries will pay greater attention to the green attributes and climate resilience of transportation projects under the Belt and Road Initiative.

#### (2) Greater Awareness on the Impact of Linear Transportation Projects on Biodiversity

From the transportation development strategies released by BRI countries and China's commitment to high-quality BRI cooperation, it is evident that in the context of post-pandemic economic recovery, cross-border and cross-regional road and rail networks will further expand to boost trade and economic growth. However, this will inevitably impact animal habitats and ecosystems. BRI countries, especially in regions like Southeast Asia, are rich in biodiversity with fragile ecosystems. As global biodiversity conservation requirements increase, countries will strive to balance transportation infrastructure development with biodiversity protection by implementing stronger measures in transportation planning, site selection, impact assessments, environmental management, and restoration.

**(3) Rapid Expansion of Zero-Emission Vehicles**

At the COP26 in November 2021, six multinational automakers (BYD, Ford, General Motors, Jaguar Land Rover, Mercedes-Benz, and Volvo) signed the *COP26 Declaration on Accelerating the Transition to 100% Zero-Emission Cars and Vans*. They pledged to achieve 100% zero-emission car sales in leading markets by 2035 and globally by 2040. These six companies accounted for about one-quarter of global vehicle sales in 2019. Additionally, 19 countries committed themselves to establishing green shipping corridors between two or more ports, and major freight companies like Amazon, IKEA, Michelin, and Unilever announced plans to only purchase zero-carbon freight vehicles from 2040 onwards[14]. It is expected that the future will see explosive growth in new energy vehicles. The electrification of transport, including passenger cars, vans, and two- and three-wheel vehicles, is expected to surge, while traditional fuels will give way to low-carbon alternatives such as hydrogen and natural gas. The decarbonization of key components, including batteries and vehicle materials (e.g., zero-carbon steel) throughout their entire life cycle will soon be prioritized as a key area of international competition in the new energy vehicle industry.

**(4) Increased Emphasis on Technological Support**

With the rapid advancement of technology, BRI countries are actively promoting the development of smart transportation, with a growing consensus on the pivotal role of technology in supporting sustainable transport. This is evident in several areas: first, technology is driving the transformation and upgrading of the transportation sector, resulting in larger, more specialized and standardized transport equipment, which significantly improves energy efficiency; second, new materials, technologies, and processes are being rapidly adopted, while innovative models like “Internet + Transportation” are gaining widespread traction, greatly enhancing transportation efficiency and management; third, technology is spurring the growth of emerging strategic industries, with online monitoring systems, intelligent control systems, smart scheduling systems, big data, the Internet of Things (IoT), blockchain, and cloud computing being widely applied across the transportation sector. In the future, green, circular, and low-carbon technologies will be deeply integrated with smart transportation systems.

### 2.2 Challenges for the Development of Green Transportation Under the BRI

**(1) Continuous Increase in GHG Emissions**

The International Transport Workers’ Federation (ITF) forecasts in *ITF*

*Transport Outlook 2021*[15] that global transport activity will more than double by 2050, and traffic emissions will rise by 16% compared to 2015. Any currently expected emissions reductions from our commitments to decarbonize transport will be more than offset by the increased demand for transport. This necessitates more targeted actions to reduce unnecessary travel, shift to more sustainable transportation modes, improve energy efficiency, and rapidly expand the use of electric vehicles and low-carbon fuels. Research[9] indicates that carbon reduction in transportation is particularly challenging in BRI regions due to the high share of emissions from international aviation and maritime transport. By 2050, approximately 40% of carbon emissions are projected to come from these sectors.

**(2) Growing Costs and Funding Gaps**

Achieving low-carbon development in the transportation sector requires enhanced ecological protection for transportation infrastructure and significant reduction of pollution emissions. However, this often translates into increased transportation costs, which poses a long-term challenge for many developing countries. The World Bank estimates that by 2030, global transportation infrastructure investment needs to increase by approximately $417 billion annually to meet the targets set by the *Paris Agreement*. Securing financial resources, establishing green investment funds, and leveraging international partnerships are crucial to obtaining the initial capital required for transitioning to low-carbon alternatives. It is also essential to create an environment conducive to private sector investment and innovative financing mechanisms. United Nations data shows that the majority of private funds are directed toward renewable energy generation, with only 15% allocated to low-carbon transportation.

**(3) Biodiversity Threats from Linear Transportation Infrastructure**

The ecological environment in BRI regions is both sensitive and fragile, with rich biodiversity and complex landforms and geographical conditions. Ecological protection during infrastructure development poses significant challenges. Many BRI projects involve long-distance linear transportation infrastructure that intersects with ecologically sensitive areas. The construction of such infrastructure leads to growing ecological impacts including habitat degradation and fragmentation, environmental pollution, habitat isolation, and the introduction of invasive species, which has affected at least 15%-20% of global land areas. Addressing the impact of project construction on local ecosystems and biodiversity, while balancing regional economic

development with environmental protection, has become a pressing concern for BRI countries.

**(4) Optimization of Transportation Structure is Still in Its Early Phases**

Reducing emissions in the transportation sector demands both technological innovation in vehicles and swift optimization of transportation structures and modes. In BRI countries, carbon emissions in the transportation sectors have long grown at a rate higher than the global average, largely due to the heavy reliance on road transport. The potential of low-carbon alternatives, such as rail and waterborne transport, remains under-utilized. Increasing the use of intermodal transport, such as shifting from road to rail or waterborne modes, is crucial for addressing these challenges.

**(5) Slow Progress in the Adoption of New Energy Vehicles in Developing Countries**

The World Bank's 2022 report, *The Economics of E-Mobility for Passenger Transportation*[16], reveals that while electric vehicles are broadly adopted in major markets like China, the United States and Europe, progress is slow in other regions, particularly developing countries. In some developing nations, fossil fuels remain the primary energy source for vehicles. The lack of charging infrastructure, outdated battery technology, and insufficient clean fuel options further impede the shift to electric transportation. It is crucial for these countries to create green transportation strategies that are tailored to their unique needs and conditions.

## 3. Green Transportation Under the BRI: Development Recommendations

### 3.1 Incorporating Climate and Environmental Goals into Green Transportation Planning

China should actively engage with BRI countries on developing long-term transportation strategies and supporting their national emissions reduction targets for the transportation sector in their NDCs based on their own ecological protection and climate change goals. Meanwhile, development plans across related industries should be aligned to formulate a comprehensive top-level strategy for green and low-carbon progress in the transportation sector. This includes integrating land use planning, advancing high-capacity public transport options such as rail and buses, enhancing fuel efficiency, and expanding infrastructure like charging stations. Effective coordination is needed across transportation, environmental protection, land use, and

energy sectors, as well as within various transportation subsystems. Given that the decarbonization of transportation is closely linked to the energy sector—since many low-carbon technologies like electric and hydrogen vehicles depend on electricity—it is crucial to ensure a reliable and affordable power supply while coordinating the decarbonization efforts across both transportation and energy sectors.

Currently, most countries view the transportation sector as a key area for emission reductions. As transportation is a prioritized area and a pillar industry for BRI cooperation, it is advisable to refine mid-to long-term green transportation strategies under the green BRI framework, and establish a multi-tiered green transportation planning system that includes different categories and modes. This process should be guided by each country's specific environmental and climate sustainability goals, addressing needs for economic growth, social development and sustainable transport, while coordinating goals such as industrial development, poverty alleviation, land resource development, trade facilitation, and sustainable development.

### 3.2 Developing Green and Intelligent Transportation Infrastructure

Advancing green infrastructure is crucial for the recovery of countries along the route. China should leverage its experience in green infrastructure, collaborate with BRI countries on green design, green construction, and low-carbon operation, sharing technology and concepts to help them build more green transportation infrastructure. Green development principles should be incorporated throughout the entire lifecycle of transportation infrastructure projects, from planning, design, construction, to operation and maintenance. We should also draw on international best practices and adopt energy-efficient, low-carbon technologies to minimize environmental damage and reduce pollutants and carbon emissions. It is also crucial to support green infrastructure development with green finance, strengthen institutional frameworks, and boost investment and financing from both public and private sectors.

Special attention should be given to biodiversity protection. When designing BRI transportation projects, it is important to take into account landscape connectivity and protection of endemic or endangered species. The environmental impacts of these projects can be eliminated or mitigated by creating corridors, migration passages, or avoiding critical biodiversity areas. In the process of construction, we should invest more in ecological infrastructure, such as ecological corridors and biodiversity monitoring points, to support long-term impact assessments. It is also essential to use

tools from international financial institutions and organizations to assess regional biodiversity risks and enhance cross-border environmental risk management.

### 3.3 Strengthening Collaboration on Green Transportation Development

Communication and collaboration between China and BRI countries on green transportation development should be enhanced. For infrastructure projects, Chinese companies should ensure that their construction in host countries minimizes environmental impact and adheres to local laws and standards. While promoting Chinese green transportation practices and technologies, it is important to make necessary adjustments to increase the adoption of these technologies and standards. Joint research and application of new energy transportation equipment are also crucial. China can supply essential products, services, and solutions to BRI countries in need. In addition, in the capacity building for the development of green transportation, including policy development, technology research, and standard setting, platforms like the BRI International Green Development Coalition (BRIGC) can facilitate exchanges and information sharing, particularly regarding data on protected areas and nature reserves.

### 3.4 Promoting New Energy Vehicle Cooperation Based on Local Conditions

In the face of global issues like energy shortages, climate anomalies, and environmental pollution, major economies are prioritizing the development of new energy vehicles (NEVs) as a strategic response. The development of the NEV market is picking up pace. The data released by the International Energy Agency (IEA) shows that in 2020, although the global automobile market sales declined due to the impact of the epidemic, the NEV market still maintained a strong momentum of development. Market sales grew to 3.125 million units, with a year-on-year increase of 41%, but still accounted for less than 5% of the global automobile market sales. In 2021, global NEV market sales grew to 6.6 million units, nearly doubled year-on-year, accounting for about 10% of the automotive market sales. This indicates a strong and growing market for new energy vehicles worldwide.

The development of electric vehicles requires solutions tailored to the needs of different markets. China has been engaged in successful collaborations with BRI countries on NEVs and can expand these partnerships from vehicle sales to other aspects of the NEV supply chain, such as batteries and charging stations. China is also exploring the establishment of local manufacturing facilities to enhance the development of NEVs and create green jobs in BRI countries. For example, the

development of two- and three-wheeled electric vehicles is prioritized in regions such as Southeast Asia and Africa; in some rapidly expanding African cities, Bus Rapid Transit (BRT) is one of the effective ways to reduce carbon emissions and alleviate air pollution.

### 3.5 Optimizing Transportation Structure and Promoting Multimodal Transport

Since the second half of 2020, disruptions in global logistics supply chains have become evident. To improve supply chain resilience and enhance global freight infrastructure, there will be more investment in multimodal transport infrastructure to support integrated global transport networks. Governments are committed to enhancing multimodal transport infrastructure by investing in smart port facilities to boost efficiency, developing land ports to alleviate pressure on sea ports, expanding railway and road connections, deepening waterways for larger vessels, and building additional container terminals and berths. Many BRI countries are rapidly advancing infrastructure development, with urgent needs to optimize existing transport structures. Strengthening connectivity between China and BRI countries and establishing a comprehensive multimodal transport network will be crucial for aligning transport standards and promoting integration across industrial chains, supply chains, and value chains in multimodal transportation.

## References


[1] Zhao Changqing. Ten Years of Eurasian Continental Transportation Connectivity: Achievements and Potential in the Eurasian Economy[J]. Journal of Eurasian Economy. 2023(03):1-12

[2] Ministry of Transport of China. *China Sustainable Transportation Development Report*[R]. Beijing. 2021

[3] United Nations. *Sustainable Transport, Sustainable Development* [R]. https://www.un.org/zh/node/154155

[4] International Transport Forum. How Serious Are Countries About Decarbonising Transport? [EB/OL], [2024-02-13].

[5] UNFCCC. *NDC Synthesis Report*[R]. October 2022.

[6] *BRI Case Study Report on Green Transport (2021)*[R]. BRIGC Website: http://www.brigc.net/zcyj/bgxz/

[7] China Association of Automobile Manufacturers. Chinese Automobile Brands Are Rising Rapidly with Outstanding Performance Data. China News. https://baijiahao.baidu.com/s?id=1798675228228682537&wfr=spider&for=pc

[8] General Administration of Customs. The official website. http://search.customs.gov.cn/search/pcRender?pageId=f5261418ddc74f03b27e3590c531102b

[9] Li, Danyang & Chen, Wenying. Global Transportation Energy Transition Paths Under Carbon Neutrality Targets[J]. *Climate Change Research*, 2023, 19(02):203-212.

[10] Bakhishew Daniyar. Research on the Kazakhstan's New Economic Policy—The Bright Road Plan [D]. Beijing, 2018.
[11] Egypt Actively Promotes Green Growth Strategy. *People's Daily*. http://world.people.com.cn/n1/2021/0531/c1002-32117361.html
[12] Liu, Chen & Ma, Luanyu. Research on Saudi Arabia's New Energy Policies [J]. *Journal of Changchun Normal University*, 2021, 3: 63-68
[13] Oxford University, World Bank, European Commission, etc. A Global Multi-Hazard Risk Analysis of Road and Railway Infrastructure Assets.
[14] Ending Fuel Vehicles by 2040, Six Automakers Sign COP26 Declaration. Tencent News. https://new.qq.com/rain/a/20211112A09W5F00
[15] *ITF Transport Outlook (2021)*. International Transport Workers Federation, 2021.
[16] World Bank. The Economics of E-Mobility for Passenger Transportation [R]. 2022.

# Chapter 11 Green Silk Road and Energy Transition

Against the compound impacts of climate crisis and energy crisis, the issue of energy transition should become a priority for global economic development. China's "Belt and Road" initiative not only brings opportunities for economic cooperation and development to countries along the route, but also promotes a wide range of transition practices in the energy sector. According to the World Bank, by the end of 2022, the population of the 44 Belt and Road countries studied in this report will reach 2.15 billion, accounting for 26.9% of the global total. Among them, Nigeria, Egypt and Ethiopia in Africa have a population of more than 100 million; Indonesia, Pakistan and Bangladesh in Asia have a population of more than 100 million; and Greece in Europe and Chile and Ecuador in the Americas have a population of more than 10 million. According to the International Energy Agency (IEA)[75], the number of energy policies in 44 countries varies significantly (Figure 11.1): countries that have introduced relatively a larger number of energy policies include South Africa (75), Indonesia (57), Greece (25), and Chile (55), while some other countries have not yet introduced any specific energy transition policies.

[75] IEA, "Policy", https://www.iea.org/search/policies?q=policy

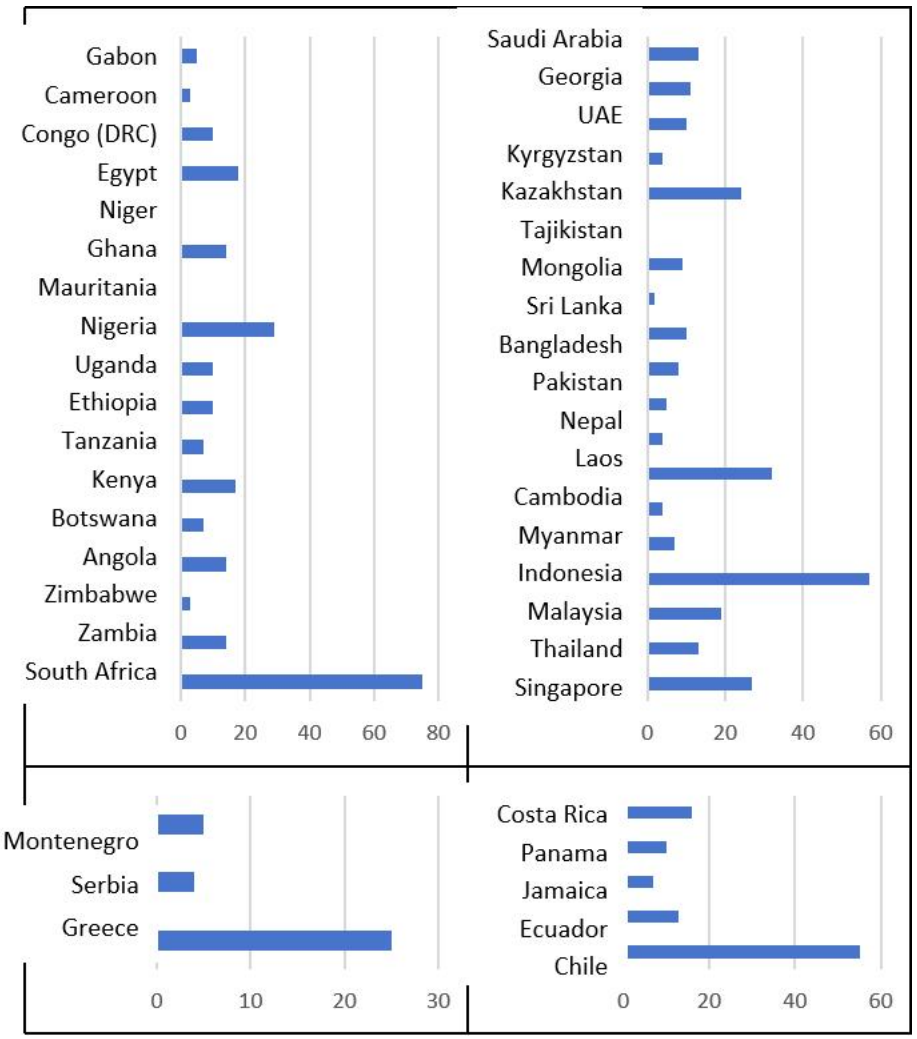


Figure 11.1 Number of Energy Policies in BRI Countries

# 1. Current Status of the Green and Low-Carbon Energy Transition in the 'Belt and Road' Countries

## 1.1 Africa

### (1) Policy Planning

According to the IEA Policy[76] Library, 17 African countries have formulated 122 energy-related policies, covering electrification, key minerals, tariff design, methane emission reduction, renewable energy, energy efficiency, energy access, carbon capture and sequestration, and just transition. However, policies on topics such as technology R&D and innovation and the mining industry are still lacking. Renewable energy policies mainly cover PV/solar, wind, hydro, and biomass. Policies related to PV/solar and hydropower are mentioned most frequently, indicating that renewable energy development in Africa is dominated by PV/solar and hydropower,

[76] IEA, "World Energy Outlook 2023", https://www.iea.org/reports/world-energy-outlook-2023

followed by wind and, to a lesser extent, biomass.

In 2005, Nigeria issued a "Renewable Energy Master Plan", which was updated in 2021. The plan aims to increase the share of renewable electricity in Nigeria from 13% in 2015 to 23% in 2025 and 36% in 2030. The main driver for this growth target is the diversification of the country's electricity mix to include installed capacity targets for hydropower, solar PV, wind, biomass, and solar thermal technologies: the plan proposes 2,000 megawatts (MW) of small hydropower capacity by 2025, 500 MW for solar PV, and a significant increase from 50 MW in 2015 to 400 MW in 2025 for biomass. In 2011, Kenya released the "Least Cost Power Development Plan 2011-2031", considering geothermal as the choice of energy to meet Kenya's growing energy needs with the lowest cost. The cumulative installed geothermal capacity target for during this period is 5.5 GW. Additionally, wind and hydroelectric plants are expected to account for 9% and 5% of total electricity demand, respectively by 2031. In the past two years, energy transition policies have seen exponential growth in various countries. In 2022, South Africa unveiled a national hydrogen energy development roadmap, with plans to build a hydrogen production and export base called "Hydrogen Valley" across Mokopane, Johannesburg, and Durban, to form a complete hydrogen ecosystem. Mozambique released an energy transition strategy, planning to become a leader in hydrogen production in Southern Africa by 2030. Djibouti also expressed its willingness in making a green hydrogen development strategy and roadmap to advance hydrogen development. The aim is to not only provide clean fuel for ships passing through the Bab-el-Mandeb Straits but also achieve a large volume of export, thus realizing sustainable and inclusive economic development of the economy. In 2023, Egypt established the National Green Hydrogen Committee and launched the National Green Hydrogen Strategy which aims to increase the share of renewable energy generation to 42% by 2035.

**(2) Status of energy development**

The African continent is endowed with abundant energy resources, including oil, natural gas, coal and hydroelectric resources. However, due to historical reasons and different levels of national development, there are huge differences in energy use among African countries. Some countries still use traditional energy sources, such as coal and wood, as their main source of energy, with wasteful use of energy resources and environmental problems becoming increasingly prominent. At the same time, due to the low level of energy infrastructure development in African countries, the ageing

of power facilities and the insufficient supply of electricity have led to inefficient energy consumption.

Currently, more than 40% of people in Africa do not have access to electricity and 70% do not have access to clean cooking. By 2030, Africa will be home to one-fifth of the world's population, and providing access to modern energy for all while meeting growing energy demand will remain a major concern for African governments at that time.

**Access to electricity**: African countries' access to electricity is at a relatively low level globally, with its overall average steadily increasing from 53% in 2017 to 60% in 2021, but there are still large variations between countries. As of 2021, the lowest access rate, Niger, is only 19%. The highest, Egypt, reaches 100%. Those reaching above 80% are Gabon (92%), South Africa (89%), and Ghana (86%), with all other countries below 80%.

**Carbon dioxide emissions**: the level of carbon emissions per capita in Africa declines somewhat between 2016 and 2020, but varies considerably between countries. By 2020, South Africa has the highest at 6.7 tonnes per capita, while Congo, Uganda and Niger have less than 0.1 tonnes.

**Proportion of renewable energy**: the share of renewable power generation in African countries has steadily increased from 2.3% in 2011 to 5.3% in 2015. in 2015, Kenya's share of renewable power generation was close to 50%, with all other countries below 10%, while Ghana and Botswana are severely underexploited in terms of renewable energy.

**(3) Challenges**

**Electricity Shortage**

Since the population with no access to electricity peaked in 2013, the pandemic ourbreak in 2019, and the following energy crises, debt problems and political instability have virtually eroded the progress Africa has made in reducing the number of unelectrified people. Currently, about 600 million people in Africa do not have access to electricity, accounting for about 80% of the global population without access to electricity.

**Debt crisis**

The Covid-19 and the ensuing energy crisis have led to a debt crisis and a

deterioration in Africa's economic outlook. Energy investment has remained low, leading to slow progress in expanding electricity and clean cooking in sub-Saharan Africa.

**Policy and regulatory barriers**

Significant policy and regulatory barriers have hindered their entry into African power markets. While multiple African countries have placed energy at the top of their national development agendas, many institutional, regulatory and fiscal challenges continue to severely undercut the efforts for and adoption of domestic renewable energy options.

**Vertical integration of power utilities**

Vertical integration of electricity utilities has also limited competition and private sector participation in electricity markets. A single utility, usually owned by the state, is responsible for generating, transmitting, and distributing electricity. In some cases, state ownership means that tariffs and subsidies are controlled by the goverment, making it challenging for private sector investors to compete on price or make a profit. Current electricity market structures result in poor integration in electricity trading across the continent. The key to addressing these challenges is political will and partnership.

**Lack of policy coherence**

Governments currently have introduced competing priorities that they must fulfil. With limited resources to support this delivery, the focus tends to be on areas that are considered to be a higher priority than renewable energy. In this conrtext, fragmented political will and a lack of policy coherence in terms of coverage and duration became the reality in most areas. In the case of energy, this has resulted in limited access to renewable energy in Africa.

**1.2 Asia**

**(1) Policy planning**

IEA Policy Database shows that 19 Asian countries have a total of 102 energy-related policies covering electrification, technology development and innovation, methane emission reduction, renewable energy, energy efficiency, energy access, carbon capture, utilisation and sequestration, and people-centred transformation. Among them, 57 are on renewable energy, 15 on energy efficiency and 10 on electrification.

Regarding renewable energy policies, they mainly cover PV/solar energy, wind

energy, hydro energy, and biomass energy.The total number of statistical policies in the IEA policy library is 259, of which 102 are energy-related, involving renewable energy 57 times. In order of magnitude, they are PV/solar energy 35 times, water energy (hydropower) 31 times, biomass energy 18 times, and wind energy (wind power) 17 times. This indicates that renewable energy development in Asia is dominated by PV/solar and hydroelectric energy, with a more balanced emphasis on biomass and wind energy. Development plans of Asian countries mainly focus on renewable energy, power grids, and electric vehicles. **Myanmar's** "Energy Master Plan" proposes an energy production mix of 57% hydropower, 30% coal, 8% natural gas and 5% solar and wind by 2030. **Georgia's** 2021 release of its "Ten-Year Network Development Plan, 2021-2031" proposes to strengthen the national transmission system infrastructure by 2031, with 18 projects identified to strengthen the domestic transmission system and cross-border transmission lines. **Singapore's** updated "EV Roadmap 2021" proposes to phase out internal combustion engine vehicles by 2040, and to promote the use of electric vehicles in Singapore through vehicle taxation and incentives, deployment of electric vehicle charging piles, and improved regulations and standards.

**(2) Status Quo of Energy Development**

There is a large gap among Asian countries. The Middle East has a GDP per capita that is on average 80% higher than that of emerging markets and developing economies, while its per capita energy demand is more than double that of the latter. Southeast Asia relies heavily on coal for power generation. In recent years, Indonesia and Vietnam have joined the Equitable Energy Transition Partnership (JETP), through which both countries expect better access to international financing to accelerate the transition from unabated coal-fired power generation and ultimately reduce carbon emissions. In Vietnam, the latest power development plan seeks to reshape its energy system, including reducing the use of coal and expanding the use of low-emission hydrogen and ammonia in the power sector.

**Access to electricity:** the overall 2017-2021 average of access to electricity in 19 Asian countries increases from 95% in 2017 to 97% in 2021. By 2021, Myanmar, with the lowest access rate, is at 72%, while all others are above 80%, with most countries reaching 100%.

**Carbon dioxide emissions:** the average of 2016-2020 carbon dioxide emissions for 19 Asian countries declines slightly from 2016 to 2020, with large variations

between countries. By 2020, the highest is 20.3 tonnes per capita in the UAE and no more than 0.5 tonnes per capita in Nepal and Bangladesh.

**Renewable energy share:** the average value of renewable energy generation as a share of total electricity generation in 19 Asian countries increased steadily from 1% in 2012 to 1.7% in 2015. By 2015, the highest was 5.9% in Thailand, with all other countries below 5% and the lowest 0.2% in Nepal and the UAE. The overall level of renewable energy generation in the region is low.

**(3) Challenges**

**High proportion of coal-fired generation in Southeast Asia**

Southeast Asia is home to nearly 9% of the world's population and accounts for 6% of global GDP. Since 2000, the overall GDP of Southeast Asian countries has nearly tripled, outpacing global GDP growth over the same period. As a result, the region's energy demand has also grown faster than the global average, and this is set to continue. As a result of its continued reliance on fossil fuels, Southeast Asia has also seen the largest absolute increase in CO2 emissions in the world.

**Large investment gap in clean energy**

Southeast Asia has become a global manufacturing centre for clean energy technologies, with Vietnam and Indonesia joining the ranks of exporters of equipment such as solar PV modules. Overall, the region's clean energy investment needs are approaching $30 billion in 2022 and are expected to more than double by the end of this decade.

**Lack of flexibility in grid**

The current power system in Southeast Asia is dominated by fossil fuel generation technologies. In many cases, generation is provided under strict arrangements of fuel supply contracts. Renewable energy sources will provide an increasing share of power generation, and it is critical to maintain grid reliability, flexibility and security in order to integrate the growing share of variable renewable power against the backdrop of growing electricity demand.

**Overdependence on oil exports in West Asia**

Half of the world's top ten oil producers are in West Asia-Saudi Arabia, Iraq, the United Arab Emirates, Iran, and Kuwait.In 2022, the Middle East produced 31 million barrels of oil per day (bpd), nearly three-quarters of which was exported, accounting for more than four-tenths of global oil exports. The region is also a major producer of

natural gas, accounting for three of the world's top ten gas producers.

**Large energy consumption by desalination in West Asia**

West Asia has one of the lowest per capita freshwater reserves in the world. Climate change is likely to further limit water availability in the future. With growing populations and easy access to seawater, desalination is increasingly being used to address water scarcity. The growing demand for desalination will drive the share of desalination in total energy consumption higher.

### 1.3 Europe

**(1)Policy Planning**

The EU's major policy initiatives include "The European Green Deal" and the "Fit for 55' Package", "The EU Recovery Plan" , "REPower EU", "The Net Zero Industry Act", and "Techonology Screening Standards", etc. According to the IEA Policy Library, the three European countries studied in the report have a total of 35 energy-related policies, covering Electrification, technology R&D and innovation, methane emission reduction, renewable energy, energy efficiency, energy access (energy access/energy scarcity), etc., with the themes of carbon capture and storage and people-centred transformation missing. The largest number of themes are renewable energy 16, energy efficiency 9, and electrification 4. Renewable energy policies mainly cover PV/solar energy, wind energy, hydro energy, and biomass energy. there are a total of 34 policies counted in the IEA Policy Library, of which 27 are energy-related and involve renewable energy 16 times. In order of magnitude, they are water energy (hydropower) 8 times, PV/solar energy 7 times, biomass energy 3 times, wind energy (wind power) 3 times. This indicates that European renewable energy development is dominated by hydro and PV/solar energy and, with a more balanced emphasis on biomass and wind energy.

European development plans mainly include support for technology research and development, strengthen financial support. **Greece** released "The National Recovery and Resilience Plan/Green Transition" in 2021, proposing investment and reform measures for green transition. Under the National Recovery Plan, Greece and the European Commission signed a funding agreement to provide financial support worth €17.8 billion, also known as the 'Greece 2.0' framework. The agreement covers €13.5bn and will also bring in €12.7bn in loans. The Greek government plans to double total domestic energy R&D spending to 0.13% of GDP over the 2017-2030 period, up from 0.06% in 2017.

**(2)Status Quo of Energy Development in Europe**

**Access to electricity:** all 3 European countries reach an average of 100% access to electricity in 2017-2021.

**CO2 emissions:** average CO2 emissions per capita in 2016-2020 in 3 European countries reduced from 5.4 tonnes in 2016 to 5.2 tonnes in 2020.

**Renewable energy share:** the level of renewable energy generation in Serbia and Greece in 2011-2015 differed considerably, with Greece steadily increasing from 7% in 2011 to 16.9% in 2015, while Serbia increased from 0 in 2011 to 0.1% in 2015.

**(3)Challenges**

**Restrictions in R&D programmes**

Most of the R&D funding in the Greek energy sector comes from EU institutional grants, reducing the influence of the Greek government and potentially posing challenges to the implementation of smart specialisation strategies. Recently, the Greek government has taken steps to support the private sector and start-ups to drive the growth of energy R&D spending in Greece. Ongoing monitoring of expenditures on energy R&D, disaggregated by source, sector and recipient country, should be a key means of ensuring that the country develops innovative processes and allocates resources appropriately. However, Greece has not submitted energy-related R&D data to the IEA since 2011.

**High proportion of fossil fuels**

Low-carbon energy sources account for only 38.38% of Serbia's energy consumption[77], compared to 60.97% for fossil fuels, with coal combustion being the most serious at 59.57%. Hydroelectricity dominates the low-carbon energy mix with 34.93%. Wind energy, although with a relatively small share of 2.73%, is still an important part of the energy mix in Serbia. Fossil fuels, on the other hand, are mainly natural gas and coal, of which the use of natural gas is relatively small, only 1.4%.

**1.4 America**

**(1)Policy Planning**

IEA data show that five American countries have a total of 89 energy-related policies, including 48 renewable energy policies, mainly covering PV/solar, wind, hydroelectric, and biomass. 2021 **Chile's** "National Electricmobility Strategy" sets out a series of measures to transition to electric vehicles, with a plan that, by 2035,

[77] Low-Carbon Power,"Electricity in Serbia in 2023/2024", https://lowcarbonpower.org/zh/region/%E5%A1%9E%E5%B0%94%E7%BB%B4%E4%BA%9A

light- and medium-duty vehicles, public transport, and major mobile machines (including extraction trucks and heavy mining machinery) to have 100% EV sales. From 2035, only electric vehicles will be allowed to be sold. In 2017, **Ecuador** published the "National Plan for Energy Efficiency 2016-2035", which sets out cross-sectoral plans for energy efficiency, transport, industry, housing, production, power generation, and policies for all energy-consuming sectors. In 2015, **Panama** published the "Panama: Energy Plan 2015-2050", which stipulates that 15% of Panama's generating capacity will come from renewable energy sources by 2030 and 50% by 2050. Argentina, Brazil, Chile, Colombia, Ecuador, Uruguay and Venezuela have imposed import bans on second-hand vehicles, 11 countries have adopted LDV Euro 4 emission standards or imposed 4–5-year old limits on second-hand vehicles, and 4 countries have adopted LDV Euro 3 emission standards or imposed 6-8 year old limits. Some countries have adopted stricter measures, e.g. Chile and Colombia have adopted Euro 6 emission standards (current EU pollutant standards), Peru has done the same from 1 January 2024, and Argentina and Brazil have opted for similar Euro 6 standards.

**(2)Status Quo of Energy Development**

Among many indicators, Latin America and the Caribbean stands out for its extraordinary endowment of natural resources (both fossil fuels and renewable energy) and its history of policy development that has produced one of the world's cleanest electricity sectors[78]. Sixteen of the region's 33 countries have committed to net-zero emissions by mid-century or earlier, and most have proposed updated and increasingly ambitious climate targets linked to the 2015 Paris climate agreement.

**Access to electricity:** the average of access to electricity in five Americas countries increased from 98% in 2017 to 99% in 2021. By 2021, only Panama is at 95%, with all other countries reaching 100%.

**Carbon dioxide emissions:** the average value of carbon dioxide emissions per capita in the 5 Americas countries for 2016-2020 decreases from 2.8 tonnes in 2016 to 2.4 tonnes in 2020, with little variation between countries.

**Renewable energy share**: the 2011-2015 average of renewable energy generation as a share of total electricity generation for the five Americas countries increased steadily from 6.6% in 2011 to 10% in 2015, with large variations between

[78] IEA, "Latin America Energy Outlook 2023", https://www.iea.org/reports/latin-america-energy-outlook-2023

countries. By 2015, Costa Rica had the highest at 24.4% and Chile at 11.9%, while the other countries were below 10%, with Ecuador having the lowest at 2.1%.

**(3)Challenges**

**Lack of policies and regulations**

The electrification of global transport and the expansion of power grids is spawning a surge in demand for key minerals such as copper, lithium, rare earth elements and graphite. The region's abundance of mineral resources puts it in a strong position to expand production to meet the demands of the global clean energy transition, with additional potential to move up the value chain into refining and processing. Reaping these benefits will require a clear strategic vision, strong public policies and broad partnerships among Governments and other stakeholders. Countries in the region need to design and implement policies and regulations that attract significant investment, ensure sustainability, and achieve a just and equitable transition.

**Electricity shortages in certain areas**

3% of the population of Latin America and the Caribbean has no access to electricity. Nearly three-quarters of them are concentrated in rural areas and in countries that have made little progress in the last decade, with more than 1.5 million people not connected to the grid even in large countries such as Brazil and Mexico, which have more than 99% access to electricity. Poor communities continue to be disproportionately affected, not only by lack of access but also by unreliable connections. Reliable and affordable access to electricity remains key to other important social agendas and requires greater national efforts.

**Lack of clean cooking**

Nearly 75 million people in Latin America and the Caribbean do not have access to clean cooking, about 11% of the region's population. Residents without access to energy rely mainly on solid biomass such as firewood and charcoal, and some households still use coal and, to a lesser extent, paraffin. Soaring energy prices and rising inflation have exacerbated local government concerns about energy affordability and made it more difficult for people to switch to modern cooking fuels.

**High energy prices**

The average household expenditure on household energy use in Latin America and the Caribbean stays between 3 and 10% of monthly income. Low-income households spend a significantly higher percentage of their income on energy

compared to higher income groups and are highly vulnerable to price shocks. The above challenges tend to be concentrated in remote areas or informal settlements, with about one fifth of the population living in the areas concerned. In this context, a faster transition to cleaner energy could help reduce the challenge of removing fossil fuel subsidies.

**Lack of flexibility in power system**

The need for flexibility in the electricity system in Latin America and the Caribbean is set to increase significantly as wind and solar PV (PV) power generation increase their share of electricity generation in a number of countries. By 2050, the demand for flexibility in LAC is projected to reach nearly five times the 2021 level in the Asia-Pacific region. In most cases, flexibility needs can be technically met through the use of dispatchable units, expansion of domestic transmission, new energy storage, and demand response measures without resorting to cross-border trade or regional electricity integration, although higher levels of cross-border trade have the potential to meet these needs at lower costs.

## 2. Outlook for Green Silk Road and Energy Transitions

As can be seen from the renewable energy generation capacity of the countries published in the World Energy Statistics Yearbook[79], from 2012 to 2022, the countries with higher average annual growth rates in renewable energy generation capacity include Kazakhstan (107.7%), Viet Nam (76.5%), the United Arab Emirates (UAE) (75.2%) and Pakistan (53.9%), which is much higher than the global average value of 12.6%. Their domestic renewable energy policies have effectively contributed to the growth of their renewable energy power generation industries.The fastest growth in 2022 is 55.2% in Singapore, 32.1% in Pakistan, 22.4% in Vietnam, 22.2% in Indonesia, and 18.6% in Chile, suggesting that the faster development of renewable energy in these countries in recent years may be related to the faster economic growth in their countries. Among them, Indonesia has the highest installed energy capacity.

**Table 11.1 Renewable Energy Generation by Country**

[79] KPMG, “Statistical Review of World Energy”, https://kpmg.com/cn/zh/home/campaigns/2023/10/statistical-review-of-world-energy-2023.html

| Region | Country | Renewable energy power generation (AJ) | Average annual growth rate (%) | | Share of renewable energy power generation (%) |
|---|---|---|---|---|---|
| | | 2022 | 2022 | 2012-2022 | 2022 |
| Africa | South Africa | 0.15 | 2.50% | 38.20% | 0.40% |
| | Egypt | 0.1 | 3.10% | 18.00% | 0.20% |
| Asia | Singapore | — | 55.20% | 9.20% | — |
| | Thailand | 0.23 | 0.20% | 14.80% | 0.60% |
| | Malaysia | — | 5.00% | 8.40% | 0.10% |
| | Indonesia | 0.39 | 22.20% | 15.60% | 1.00% |
| | Vietnam | 0.33 | 22.40% | 76.50% | 0.80% |
| | Kazakhstan | — | 24.70% | 107.70% | 0.10% |
| | Pakistan | 0.06 | 32.10% | 53.90% | 0.20% |
| | Bangladesh | — | 11.30% | 20.60% | — |
| | Sri Lanka | — | 8.20% | 23.80% | — |
| | UAE | 0.07 | 11.00% | 75.20% | 0.20% |
| | Saudi Arabia | — | 0.30% | 41.00% | — |
| Europe | Greece | 0.18 | 13.70% | 11.90% | 0.40% |
| Africa | Chili | 0.29 | 18.60% | 15.00% | 0.70% |
| | Ecuador | — | 5.10% | 4.70% | — |
| Global Average | | | 13.00% | 12.60% | |

### 2.1 Africa

In view of the data analysis in the status quo section, Africa's power supply is still seriously insufficient, and efforts should be made to improve the level of domestic power supply in the short term; the renewable energy policy is more composite, which indicates that most countries in Africa are still exploring energy transformation paths suitable for themselves, and the medium and long term need to adjust the country's energy supply strategy according to local conditions. Overall, Africa's bioenergy supply will increase by about 35% by 2030 compared to 2020,

mainly related to the cultivation of short-rotation woody crops. The use of organic waste to provide bioenergy does not require the exclusive use of land, thus avoiding any impact on biodiversity and any potential conflict with food production and minimising the impact on soil health. By 2050, bioenergy supply will be two-thirds higher than in 2020, outpacing growth in total energy supply. The following analyses the short-, medium- and long-term development trends in different regions of Africa.

**(1)North Africa**

Egypt enjoys a high rate of access to electricity, but a low share of renewable energy and a high density of renewable energy-related policies.

**Short-term policies**

In 2023, with financial support from the European Bank for Reconstruction and Development (EBRD), the Red Sea Wind Energy Project completed project financing and will contribute to Egypt's green transformation[80]. The $100 million EBRD loan was launched in 2023 for the construction of a 500 MW onshore wind farm in the Gulf of Suez area.

**Mid- to long-term policies**

In 2016, Egypt released its" Sustainable Development Strategy: Egypt Vision 2030", which was then updated in 2022, which constructs a unified long-term political, economic and social vision for Egypt's energy transition and sets an energy transition target of reducing GHG emissions from the energy sector (including oil and gas) by 10% by 2030 compared to 2016 levels.

North Africa will become a net exporter of clean energy and fossil fuels and a major exporter of piped gas and renewable energy to Europe. The region is rich in wind and energy potential, and Egypt and Morocco have invested heavily in renewable infrastructure, thereby reducing their dependence on fossil fuels. With major gas and renewable energy export-led projects under consideration and construction, North Africa has emerged as a global hotspot for gas and renewable energy, becoming the largest viable energy supplier to the EU. North Africa aims to promote and accelerate the deployment of renewable energy and the management of gas resources to make the region a viable source of global energy security. Only Egypt in the region has progressive plans to accelerate renewable energy deployment.

**(2)East Africa**

[80] IEA, "Red Sea Wind Energy - Green Egypt", https://www.iea.org/policies/17266-red-sea-wind-energy-green-egypt?s=1

Kenya, Tanzania, Ethiopia, and Uganda have less than 100% access to electricity in their respective countries, with a high proportion of renewable energy in Kenya and a low proportion of renewable energy in the other countries.

**Short-term policies**

Kenya's latest energy policy release, Electricity Tariff Reduction 2022, provides dedicated financial assistance to the majority-owned national utility, "Kenya Power and Lighting Company (KPLC)". The financial support will be passed on to household consumers through tariff regulation and is expected to boost energy consumption. Uganda's most recent policy, the "2021-2025 Sustainable Energy Response Plan (SERP) for Refugees and Host Communities in Uganda", aims to help address the predominant reliance on the use of inefficient cookers for cooking using biomass and provide access to sustainable alternative cooking fuels and technologies.

**Mid- to long-term policies**

Currently, the main source of electricity in East Africa is hydroelectricity, but by 2035, with the economic benefits of domestic natural gas and exports, half of the electricity could come from natural gas generation and Uganda has the opportunity to become a crude oil exporter[81]. Increased LNG exports could reduce energy poverty and provide 57% of Tanzania's electricity.2024 In May, Shell, ExxonMobil and the Tanzanian government agreed on a framework for the development of 10 million tonnes per annum of LNG, which is expected to reach a Final Investment Decision (FID) in 2025 and begin operations in 2031.2025, Shell, ExxonMobil and the Tanzanian government have also agreed on a framework for the development of a 10 million tonnes per annum LNG plant. In addition, with an annual population growth rate of 2.5%, 70% of the population under the age of 30 and the region's high-potential human capital and hydrocarbon resources, East Africa offers a significant market opportunity for international investment.

**(3)West Africa**

**Short-term policies**

In 2021, Nigeria released its "Sustainable Economic Development Plan (SEDP)", approving $5.9 billion in June 2020 to stimulate and diversify the economy, retain and create jobs, and provide greater protection for the poor. The plan is structured around 10 key projects, two of which are directly related to the energy sector, including the

[81] PWC, "Africa energy review 2023", https://www.strategyand.pwc.com/a1/en/insights/africa-energy-review.html

installation of solar home systems, a commitment of $619 million to the Solar Home Systems Project, which will help up to 5 million households install solar home systems, serving about 25 million Nigerians who are currently not connected to the national grid.

**Mid- to long-term policies**

The West African energy sector continues to be a significant net exporter of oil and gas. Nigeria will continue to be a major oil exporter in the region. West Africa has the potential to become a much larger gas producing region, reaching 6% of global production by 2035. Further monetisation of domestic gas will see Senegal and Mauritania become global players in the LNG export market. Currently, 92% of West Africa's renewable energy is generated by hydroelectricity. Since 2019, only Senegal, Mali, Togo and Burkina Faso have seen an increase in renewable energy generation. West Africa is promoting and accelerating LNG exports to boost industrialisation and energy security. Natural gas can have a multiplier effect on job growth and help West Africa achieve higher industrialisation and 2.5% population growth.

The lack of natural gas infrastructure, monetisation of available gas and frequent power outages have hampered the region's development, and some parts of the domestic gas value chain can only work through private sector engagement with oil companies. Co-operation and partnerships between businesses and governments are necessary to enhance energy security and prosperity in the region. Natural gas-fired power generation in Mauritania, Ghana and Nigeria is set to expand further.

**(4)Central Africa**

**Short-term policies**

In 2022, Cameroon issued the "Cost of Gas and Transportation Fuel Subsidies", and in order to cushion domestic consumers from the impact of the global energy price crisis, the Cameroonian government is increasing funding for subsidies for petrol, diesel, paraffin, and domestic natural gas.

**Mid- to long-term policies**

In 2019, the Republic of Gabon issued "The Hydrocarbon Code" Law No. 002/2019, which stipulates that all hydrocarbon resources, basic infrastructure and information acquired or produced in petroleum operations are the exclusive property of the State. Therefore, oil and gas development can only be carried out with the proper authorisation. The law is expected to provide a long-term impetus to reduce methane emissions in Gabon.

Currently, 95% of renewable energy in Central Africa is hydropower. The additional electricity that may be generated by pumped storage could be used as a 'natural battery', a dispatchable energy storage to complement the development of renewable energy sources. At the same time, given the low level of electrification in the region, there is a need to monetise gas and even oil reserves to enable greater growth and industrialisation, rather than relying on hydro as the main source of electricity.

**(5)South Africa**

South Africa has high electricity consumption but a low share of renewable energy. Solar home systems now provide electricity to more than 8% of households in sub-Saharan Africa and will play an increasingly important role in providing primary electricity to African households in the current decade.

**Short-term policies**

In 2021, South Africa increased license threshold requirements for embedded electricity generation projects, which increased the licence threshold requirement for embedded generation projects from 1MW to 100MW, aiming to stimulate investment in new generation, with the remaining production to be re-injected into the national grid, and to drive the rapid development of embedded generation projects in the short term.

In order to minimise its reliance on coal resources, South Africa, together with the UK, the US and the EU, signed the "Just Energy Transition Partnership (JETP)" at the 26th United Nations Climate Change Conference (COP26) in 2021, targeting US$8.5bn to assist South Africa in phasing out coal-fired power plants between 2023 and 2027, and the government has committed to gradually moving away from coal-fired power plants by 2035, while the South African government has committed to The South African government has also committed to reducing its reliance on coal for power generation to 50% and below by 2035[82].

**Mid- to long-term policies**

Zambia's "The National Long Term Vision 2030 (Vision 2030)", released in 2006, is a long-term plan aimed at creating an enabling environment for sustainable socio-economic development. One of the energy conditions for achieving this goal is to achieve universal access to clean, reliable and affordable energy at the lowest

[82] Institute for International and Area of Studies, Tsinghua University, "South Africa's Dark Ages: When electricity became a national disaster", https://www.essra.org.cn/view-1000-5164.aspx

economic, socio-economic and environmental cost and to increase the use of renewable energy sources, reducing the share of wood fuels to 40% by 2030. Angola's "Regional Policy for Universal Access to Modern Energy 2014-2030" was published in 2014 with the goal of providing 54% of the region's population with access to modern energy.

With the decommissioning of coal, Southern Africa is set to become the new frontier of energy transition. Large oil and gas discoveries and favourable renewable energy potential have made the region a centre for oil and gas and green hydrogen production. The energy sector in Southern Africa can offer sustainable development opportunities to ensure energy security, economic growth, social inclusion and environmental stewardship. The combined development of natural gas and renewable energy will reduce the region's carbon footprint and minimise pollution while balancing environmental benefits. In addition, Southern Africa is endowed with abundant natural resources, including highly promising wind and solar energy, coal, minerals, and gas and oil reserves, which offer opportunities for the region to achieve energy self-sufficiency while transitioning to a cleaner future.

**(6)The BRI Solutions**

The African continent has unique natural conditions for the development of green hydrogen. North Africa, South America, the Middle East and Sub-Saharan Africa have the greatest potential for green hydrogen development globally, and the IEA forecasts that these four regions are expected to produce 45% of the world's hydrogen energy by 2050, with Africa's solar, wind and hydro energy reserves accounting for 40%, 32% and 12% of the world's energy, respectively.

Africa-China hydrogen energy cooperation has huge potential and broad prospects. China is actively involved in the development of hydrogen energy and other new energy industries in Africa. China Energy Construction Group (CECG) has signed memorandums of understanding with Egypt and Morocco on green hydrogen projects, proposing to build PV, wind power and 1.4 million tonnes per annum green ammonia projects in Morocco, and PV, wind power, 140,000 tonnes per annum electrolytic hydrogen, ammonia, and ancillary storage and processing facilities in Egypt. Africa has the resource endowment to develop hydrogen energy, but lacks technology and capital, and China will actively help Africa to realise energy transformation.

## 2.2 Asia

### (1)Southeast Asia

**Short-term policies**

Singapore's energy policy emphasizes the improvement of energy efficiency. In 2023, as part of Singapore's transition to an energy-saving nation, the country released the "Enhancements to Minimum Energy Performance Standards (MEPS)," aiming for all light bulbs sold in Singapore to be minimally as energy efficient as LED bulbs from 2023 onwards. This is expected to save households approximately $3.5 million in energy costs annually and will bolster energy efficiency in the short term. In 2023, Indonesia announced the "Increase in 2023 Electricity Access Enhancement Budget," which will be used for new electricity installations assistance, the construction of 12 solar/micro hydro power plants in underserved areas, and the installation of over 31,000 solar energy-based street lighting systems. It is expected that power supply will be improved in the short term.

**Mid-to long-term policies**

In 2023, Thailand launched the "Incentives for EVs' Battery Cells" program, allocating THB 24 billion to subsidize the production of battery cells for EVs. The subsidies intend to reduce the cost of production, aiming at cheaper prices for EVs in domestic markets, supporting Thailand's target of making 30% EV cars out of the total car production by 2030. In 2022, Cambodia introduced the "National Energy Efficiency Plan (NEEP)," which outlines a long-term energy transition strategy in the power sector, combining policy reforms and project investments. USD 77 million are invested over the 2022-24 period, under the support from the Asian Development Bank (ADB), the ASEAN Infrastructure Fund, the Climate Investment Fund and Green Climate Fund. In 2015, Vietnam released the "Renewable Energy Development Strategy 2016-2030 with outlook until 2050 (REDS)," with special focus on biomass, wind, and solar technologies. According to this strategy, Vietnam plans to promote onshore wind power until 2030 and assess offshore wind resources potential as an electricity solution post 2030. By 2030, renewable power generation should cover 10% of total generation (from less than 1%, excluding hydro, in 2014).

Total final consumption in Southeast Asiais is projected to rise significantly to 2030. Energy consumption for transport sees the largest increase among end-use sectors given increasing demand for mobility, especially for two/three-wheelers and panssanger cars. Policy and infrastructure support for the electrification of mobility is

limited, and oil retains its dominance in the transport sector in this scenario. In industry, energy consumption rises driven mainly by the regions growing light manufacturing sector as well as increased production of iron, steel and chemicals. In buildings, rising household incomes translate into higher appliance ownership and demand for cooling and consequently driving up energy demand.

**(2)West Asia**

**Short-term policies**

In 2022, “The U.S.-UAE Partnership for Accelerating Clean Energy (PACE)” marked a new bilateral partnership with a goal of deploying $100 billion and 100 GW of green energy by 2035. Focusing on funding 15 GW of clean and renewable energy, the two countries announced in January 2023 the first wave of public-private investments into PACE with an initial envelope of $20 billion. In recent years, Saudi Arabia has released renewable energy policies with great intensity. In 2021, it launched the “Green Initiative—Renewable Investments” and has kickstarted the building of solar capacity totaling nearly 3.7 GW.

**Mid-to long-term policies**

In 2017, the UAE launched “The National Plan for Climate Change of the United Arab Emirates, 2017-2050” which aimed to revise tariffs to reform subsidies for electricity and water, facilitate the creation of energy service companies, promote the development of green vehicles, establish a fuel economy standard, and develop waste to energy facilities to comprehensively improve the level of clean energy in UAE. In 2022, Saudi Arabia announced the “Egypt-Saudi Electricity Interconnection Project”. With the Project, Saudi Arabia aims to increase the share of natural gas and renewable energy sources in electricity production to about 50% by 2030, while Egypt targets 42% of electricity generation from renewables by 2035.

Strengthened climate commitments by countries around the world imply marked changes in revenue streams from oil and gas in the Middle East. Shrinking global oil demand in the APS substantially reduces export demand. To compensate, several countries in the region are actively pursuing diversification strategies that aim to open new industrial and export opportunities such as hydrogen production.

**(3)South Asia**

The shares of renewables in the energy mix are below 4% in Nepal, Pakistan, Bangladesh, and Sri Lanka.

**Short-term policies**

In 2016, Nepal introduced a renewable energy subsidy policy focused primarily on off-grid applications and provides subsidies for mini/micro hydropower, improved water mill, solar energy (home systems, mini-grids, grid connected), biogas, biomass energy, wind energy and wind-solar hybrids. In 2015, Pakistan launched the "Net Metering Policy for Solar PV and Wind Projects," allowing solar PV and wind generators under 1 MW of capacity to sell back produced electricity to the national grid. These policies are expected to continue promoting national renewable energy development in the short term.

**Mid-to long-term policies**

In 2015, Bangladesh released the "Energy Efficiency and Conservation Master Plan up to 2030," which includes Energy Management Program for large industrial energy consumers, energy efficiency building program based on the Bangladesh National Building Code (BNBC), and energy efficiency & conservation finance program for private companies. The Plan is expected to improve national energy efficiency in the long run.

**(4)Central Asia**

**Short-term policies**

In 2022, Kazakhstan promulgated the "National Methane Emissions Inventory and Reduction Programme" to accelerate the abatement of GHG emissions through the development of a National Methane Emissions Inventory and Reduction Programme. The European Bank for Reconstruction and Development (EBRD) already supports Kazakhstan's climate efforts through the "Fugitive Methane Emissions and Carbon Intensity Reduction Programme," which specifically targets natural gas infrastructure. The new programme will work to monitor and reduce methane emissions across a variety of sources, including: landfill, oil and natural gas systems, agricultural activities, coal mining, stationary and mobile combustion, wastewater treatment and some industrial processes. The EBRD will also assist the government in joining the Global Methane Pledge, which aims at reducing global methane emissions by 30% by 2030.

**Mid-to long-term policies**

In 2014, Kazakhstan released the "Fuel and Energy Development Concept 2030," which proposed that by 2030, the structure of installed capacity of generating sources will be 55% coal, 25% natural gas, and 20% renewable energy. Under this baseline

scenario, the estimated installed capacity of energy sources by 2030 will be 27,583 MW, and the available capacity will be 23,839 MW. The concept identifies a range of actions, including improving legislative mechanisms for attracting investments in the sectors of production and transmission of electric energy, forming a single authorised body responsible for policy in the areas of electricity and heat supply (including the approval of tariffs for regulated services), and ensuring transparency of the activities of the subjects of the electricity market and the system for setting tariffs for electricity and heat.

**(5)East Asia**

In 2015, Mongolia adopted the "State Policy on Energy for 2015-2030". The main objectives of the policy are to build the energy security of the country, assure sustainability of the energy sector development and create the basis for faster deployment of renewables in the future. The policy consists of two stages. The first stage is to be executed over 2015-2023 period of time with a focus to develop energy safety and backup power capacity, establish foundations for the development of renewable and improve legal environment for the renewable sector. The second stage corresponds to 2024-2030 period of time with goals to export secondary energy and to develop sustainable renewable energy sector. With this policy, Mongolia is to prioritize energy security in the short term while actively developing renewable energy in the long term.

**(6)The BRI Solutions**

China and Central Asian countries share inherent advantages and a solid foundation regarding energy cooperation. First, there are significant geographic advantages. The geographical proximity between China and Central Asia, which are connected by moutains and rivers, provides a natural advantage for the transportation of energy as the costs of it are significantly reduced because of logistics convenience. Second, there is a supply and demand balance. Central Asia is rich in oil, gas, coal, and a variety of minerals, making it a "treasure trove" of energy resources. Additionally, the region boasts substantial potential for renewable energy such as wind, solar, and hydropower. Meanwhile, China has strong energy consumption demand and a vast market as the largest importer of oil and gas in the world. Third, the policy foundation is solid. The BRI has received active responses and support from all five Central Asian countries. The concepts of building a community of shared interests and a community with a shared future for mankind are widely recognized by

regional countries and aligned with the development strategies of these countries. Those provide strong policy support for energy cooperation. By leveraging these favorable conditions, China and Central Asia can tackle the challenges of the new era together and maintain a sustained and productive energy cooperation.

### 2.3 Europe

**(1) Short-term policies**

In 2022, Greece passed its first "National Climate Law," which mandates minimal 55% of greenhouse gas emissions cut by 2030, 80% by 2040, and net zero emissions by 2050. The law also requires Greece to reduce its dependence on fossil fuels, including the phase-out of lignite-fired generation by 2028.

Additionally, Greece is implementing significant reforms to its wholesale electricity market mechanisms to spport full integration into the European common wholesale electricity market so as to ensure more competitive and efficient wholesale electricity trading.

**(2) Mid-to long-term policies**

In 2021, Greece joined the Global Methane Pledge led by the European Union and the United States. About 155 countries have joined the pledge, committing to work together to collectively reduce global anthropogenic methane emissions by at least 30 percent below 2020 levels by 2030. The participants further commit to take comprehensive domestic actions to achieve that target and to move towards the highest-tier IPCC good practice inventory methodologies to quantify methane emissions.

In 2020, Serbia and Montenegro joined the "EU Initiative for Coal Regions in Transition in the Western Balkans and Ukraine". At least 17 regions in Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, Serbia and Ukraine with significant coal mining activities and coal-based energy production are eligible to participate on a voluntary basis. The Initiative offers an open platform for region-wide multi-stakeholder dialogue to share experiences, knowledge and best practices on the transition, and region-to-region exchanges with EU counterparts.

In August 2022, Greece approved its first *Offshore Wind Law*, which aims for 2 gigawatts (GW) of offshore wind capacity by 2030, equivalent to 10% of its current electricity production. Prior to this, to address climate and energy issues, the Greek government had established the "2030 National Energy and Climate Plan," which sets out a detailed roadmap regarding the attainment of specific energy and climate

objectives by 2030 and simplifies the licensing procedure for renewable energy sources. The goal is for renewable energy consumption in Greece to reach 35% by 2030, with installed renewable energy capacity increasing from 8.62 GW to 25 GW, of which 70% will be used for domestic electricity production. Specifically, photovoltaic capacity will reach 7.7 GW, wind power 7 GW, hydropower 3.7 GW, biomass power 300 MW, and geothermal power 100 MW.

European BRI countries are influenced to varying degrees by EU green policies. In 2022, the EU paid over USD 300 billion for natural gas imports in 2022, a threefold increase compared to the average of the previous five years. This fed through to much higher end-user prices for both natural gas and electricity. In response to the energy crisis, the EU raised its clean energy ambitions, while placing energy security at the forefront of its transition plans. By 2030, demand for fossil fuels such as oil, gas, and coal is expected to decline significantly compared to 2022. In light of that, large legislative packages and a raft of national and EU-level incentives are in place to promote the electrification of the energy economy and the decarbonization of the power sector. By 2050, there will be a surge of electric cars on the road from around 6 million today to 200 million.

**(3) The BRI solutions**

As countries such as Greece, Serbia, and Montenegro have huge demand in electric vehicles and transition of coal-fired power generation, the BRI can provide solutions for these countries with China's advanced technologies.

In 2017, China and Montenegro signed the MOU on the cooperation under the BRI. Projects involving Chinese enterprises, such as the Možura wind farm and the ecological reconstruction of the thermal power plant in Pljevlja, have brought Montenegro up to the forefront of the development clean energy and the transition of traditional energy among Central and Eastern European countries, aiding its efforts to build an ecological nation.

In August 2018, China and Greek government signed the MOU on the cooperation under the BRI, making Greece the first developed European country to enter such agreement with China. CHN Energy, as the world's largest wind power company, is collaborating with Greece to explore a green future featuring new energy development and that cooperation will add a new chapter to the story of two ancient civilizations. As a comprehensive clean energy enterprise, Guohua Energy Investment Co.,Ltd. embeds "green" concepts into its development, and strives to be a participant,

contributor, and leader in international clean energy cooperation, while integrating the concepts of green and low-carbon development throughout the lifecycle of the Thrace project in Greece, from development to construction and operation.

In November 2023, in the capital of Serbia, Belgrade, PowerChina Resources Ltd. completed the equity transfer for the Vetrozelena wind farm project with European renewable energy developer CWP Europe (CWPE). That marks further cooperation between the two companies in the clean energy sector and injects new vitality into the sustainable development of Serbia.

### 2.4 America

The Americas include countries such as Chile, Ecuador, Jamaica, Panama, and Costa Rica, all of which have an electrification rate of over 90%. Notably, Costa Rica has a relatively high proportion of renewable energy, exceeding 20%.

**(1) Short-term policies**

In 2018, Costa Rica enacted the "Law 9518 - Incentives and Promotion for Electric Transport" to create the regulatory framework for the promotion of electric transport in the country and to strengthen public policies to encourage its use within the public sector and the general public.

In 2020, Jamaica released its "Integrated Resource Plan (IRP)," which aims to support 320 MW of solar or wind power; 120 MW of liquefied natural gas (LNG), and 74 MW of other renewable generation capacity (including hydro, waste to energy, and/or biomass energy) by 2025. By 2030, the goal is to have 30% of its energy generation from renewable sources, more than doubling the current share of 12%. By 2037, the IRP is expected to deliver investment of around USD 7.3 billion in the electricity sector and to provide a 1600 MW increase in energy capacity divided into: 1260 MW for solar or wind power, 330 MW for natural liquefied gas and 74MW for biomass or hydrogen based sources.

In 2021, Panama's Ministry of Energy allied with the Friedrich Ebert Foundation to create a virtual school focused on the clean energy transition, where young people can attend courses delivered by experts in the field of energy. Based on Sustainable Development Goal 7 "Affordable and clean energy for all", the objective is to educate and motivate young Panamanians who are about to enter the labor market, to work for a just, inclusive and equitable energy transition. The aim is to develop skills in different fields related to energy, such as geopolitics, policy and regulation, communication, innovation and leadership, and to strengthen awareness on gender

equity, sustainability and social transformation. It is expected that these measures will promote national clean energy transition in the short term.

In 2022, Chile launched the "My Electric Taxi Program," which plans to provide up to 8 million Chilean pesos in co-financing for the replacement of a basic cab or urban bus with an electric one in the Great Valparaiso, and the purchase and installation of an electric home charger for each of the beneficiaries of the program. That program is expected to increase the share of electric vehicles in Chile in the short term.

**(2) Mid-to long-term policies**

In 2010, Jamaica released the "National Energy Policy (2009-2030)," which represents the revision to the "Energy Policy Green Paper 2006-2020". In Jamaica's energy sector, there are three significant solar and wind energy projects, including the 20-megawatt (MW) Content Solar Ltd. solar energy electricity generation plant owned by WRB Energy Company; the Wigton windfarm with a 20.7 MW plant and an 18 MW extension facility, the largest wind energy facility in the English-speaking Caribbean; and Jamaica's largest photovoltaic power plant, the 51 MWp (megawatts-peak) Paradise Park solar farm. Renewable energy is a significant part of Jamaica's energy strategy, which aims to achieve 30 percent of electricity generation from renewables by 2030.

In 2017, Costa Rica issued the "Electricity Generation Expansion Plan 2016-2035," which summarizes the electricity development strategy at a national level for the next 20 years, taking into account the different technology options and the future demand. This Plan points out the main decisions to be made, which have to comply with economic and environmental criteria and with the national energy policies.

In 2021, Chile's "Energy Efficiency Law" mandated that every 5 years the Ministry of Energy shall prepare a National Plan for Energy Efficiency, and the first plan must establish a goal of reducing energy intensity for the country, at least 10% by 2030, compared to 2019. That law covers almost all areas of energy consumption, including transport, industry, mining, and residential, public, and commercial sectors, with a reduction of energy intensity by at least 10% by 2030 which represents an accumulated saving of USD 15.2 billion and a reduction of 28.6-million-ton CO2.

Panama prioritizes energy transition in addressing climate change. According to its "National Energy Plan 2015–2050," the country aims to ensure that 70% of

Panama's generation capacity will come from renewables. To this end, Panama has introduced specific policies for developing solar power, sustainable buildings, and green transport. Meanwhile, the National Strategy for Electric Mobility released in 2019 aims to electrify 10%-20% of private vehicles and 15%-35% of buses by 2030. In addition, Panama seeks to become the green hydrogen center of Central America with a plan of producing at least 500,000 tons of green hydrogen annually by 2030.

Furthermore, energy development in the Americas exhibits three main characteristics: First, hydrogen production is expected to grow rapidly. In Latin America and the Caribbean (LAC), energy demand is increasing faster than the global average. Low-emissions hydrogen displaces hydrogen from fossil fuels and finds new uses in hard-to-abate sectors such as long distance trucking, aviation, shipping and heavy industry, as well as in the power sector. Second, the supply of bioenergy is accelerating. In 2020, bioenergy supply in the LAC region reached 8 ej, accounting for approximately 15% of the global total. Third, energy efficiency is improving. From 2010 to 2016, Chile and Colombia successfully phased out incandescent bulbs, fulfilling their commitments to enhance energy efficiency. Additionally, several LAC countries have established MEPS for general service lights (GLS) and are actively promoting improved efficiency for industrial motors. The Super-Efficient Equipment and Appliance Deployment initiative (SEAD) is supported by both Chile and Colombia. For instance, Chile has lifted up the MEP motor standard from International Efficiency Class (IE)2 to IE4 (equivlent to G3 to G1).

**(3) The BRI solutions**

The Americas have a strong demand for electric vehicles and renewable energy, particularly biomass energy, presenting an opportunity for China to leverage its technological advantages and provide solutions. Cooperation in new energy has become a new highlight and driving force in China-Latin American relations. Latin American countries boast abundant renewable energy resources, and many see the development of new energy as a vital means to promote economic growth. China, leveraging its comprehensive industrial chain and extensive project implementation experience in the new energy business, has complementary advantages and significant potential when working with Latin America.

During the 2023 Pan American Games in Chile, green transportation was one of the highlights. Chinese-made double-decker electric buses were deployed to transport large numbers of locals to various sports venues in Santiago, injecting "green energy"

into that great sports event. Moreover, preparations are underway for Chile's first high-voltage direct current transmission line, co-built by China Southern Power Grid Co., Ltd (CSG). As the largest overseas greenfield investment grid project by CSG to date, the project which stretches approximately 1,350-kilometer will be a major outcome of the China-Chile collaboration under the BRI and support Chile's green development.

# 3. Recommendations on Promoting the Green and Low-Carbon Energy Transition for the BRI

## 3.1 Africa

### (1) Strengthening Energy and Power Investments

It requires a more than doubling of energy investment in this decade to meet the growing energy demand from African countries, realize universal access to modern energy and achieve energy and climate goals by 2030. Energy is fundamental for Africa's development and industrialization. Deploying sustainable energy not only provides reliable power and addresses climate change, but also fosters development and creates new job opportunities in the industry. With Africa's vast potential to play a pivotal role in the global energy transition, the transformation of its own energy sector is already well-positioned for growth. As the backbone of the power system, the grid is crucial for expanding renewable energy capacity. Strengthening transmission and distribution infrastructure is essential to advancing sustainable development goals and driving green industrialization across the continent.

### (2) Attracting International Financing

The investment required to meet Africa's growing energy demands far exceeds the funding provided by public sources such as governments and development partners, and this gap can only be bridged through private investment, loans, and public-private partnerships (PPP). Many projects in Africa need concessional finance to serve as demonstration projects or to attract private capital. An enabling environment entails better regulatory frameworks, innovative financing tools, modern procurement practices, and implementation mechanism to address the capacity gaps faced by governments across the continent. Therefore, it is essential to coordinate governments, institutions, business and society at national and regional levels around a shared energy vision by implementing collaborative financing and execution models to facilitate funding, reduce project risks, and alleviate the financing pressures faced

by African governments.

**(3) Designing Electricity Markets**

Effective electricity market design is crucial for overcoming local barriers that hamper private sector participation in Africa's power markets. The private sector can assist by sharing experiences and insights on challenges in local and other regions. Adopting PPP and other structures to engage the private sector can also facilitate government success in designing and implementing renewable energy policies and regulations. Acquiring land for renewable energy projects often poses a significant barrier, which calls for multi-level interventions. Governments can promote policies on alternative land uses, such as utilizing wasteland or agricultural land for photovoltaic projects, thereby expanding the area suitable for renewable energy installations. Project developers should engage with local communities early and continuously, discussing how projects can benefit them, which can expedite development efforts. Flagship initiatives like the Africa Single Electricity Market and the Continental Electric power system Master Plan represent ongoing pathways for Africa-Europe energy partnership aimed at improving the continent's electricity sector.

**(4) Reducing Fossil Fuel Subsidies**

Fossil fuel subsidies in Africa distort the market, particularly as indirect subsidies on the cost of public utility fuel supply create an artificial comparative advantage for fossil fuel power plants, obstructing renewable energy investment. Governments need to rebalance if not prioritize the resources for increasing renewable energy, such as redirecting subsidies to provide lower end-use electricity prices for the most vulnerable groups, which may help boost electricity uptake in Africa and incentivize the development of the renewable energy sector. By prioritizing and increasing the resources allocated to renewable energy, governments can make significant progress toward achieving a more sustainable energy system that benefits the economy, society, and the environment.

**(5) China's Contributions**

Given Africa's development potential in energy infrastructure and renewable energy, cooperation between China and Africa in the energy sector mainly includes two directions.

First, collaboration around the construction of electricity infrastructure to improve electricity access for the African population and support economic development. A significant number of people in Sub-Saharan Africa still lack access

to electricity, and the issue of providing electricity for livelihoods remains unresolved for a long time. In addition to low levels of electricity access, poor quality of power infrastructure, such as grid equipment, is also a major reason for supply difficulties. Moreover, insufficient grid capacity also hinders countries like Egypt and Ghana, which have surplus electricity, from exporting power or increasing supply to domestic demand centers. Technical incapacity and a lack of endogenous investment have severely restrained the construction of Africa's power infrastructure, which in turn inhibited electricity consumption and economic growth, creating an unfavorable situation where the electricity sector and economic development constrain each other.

Second, cooperation around clean energy industries such as wind and solar power. Africa's clean energy endowments and China's industrial chain advantages are a good complement to each other. Much of Africa is located in the tropics, benefiting from abundant sunshine and high solar radiation which make it one of the richest regions in solar resources globally. At the same time, the African plateau covers a vast area, and the mountainous regions and coastlines are consistently influenced by winds from both the ocean and the interior of the continent with abundant wind energy resources. However, due to a lack of funding and technology, Africa's clean energy remains underdeveloped. Over the years, China has accumulated profound technological experience in clean energy sectors such as wind and solar power, along with a relatively complete industrial chain and production capacity with cost and technological advantages. Through South-South cooperation and the BRI, collaboration in new energy between China and Africa can significantly leverage both sides' strengths and achieve a win-win. On one hand, renewable energy can alleviate the challenges of electricity supply in Africa and contribute to the green development of the continent's energy system. On the other hand, China's new energy companies can access oversea market and explore new growth points and development paths. This cooperation aligns with both sides' interests and contributes to global climate governance goals.

### 3.2 Asia

#### (1) Strengthening Partnership

In 2021, during The UN Climate Change Conference in Glasgow (COP26), developed economies launched the Just Energy Transition Partnership (JETP) aimed at establishing financing cooperation mechanisms for coal-dependent emerging market and developing economies. This initiative is committed to setting ambitious

emission reduction targets and ensure credible national transition pathways. The JETP framework includes multilateral development banks, national development banks, and private financing institutions, with the goal of providing diverse financing channels to mobilize additional resources through promoting international private investment.

**(2) Attracting Clean Energy Investments**

Emerging markets and developing economies may find it challenging to raise the funds necessary for achieving clean energy transition goals, as they often rely heavily on public investment from governments or state-owned enterprises. Due to relatively high borrowing costs, increasing investment requires diverse financing sources, with both domestic and international private financing available for playing a crucial role. Mobilizing these capitals involves international cooperation, engagement from international and development financial institutions, and reforms to domestic policies and regulatory frameworks that facilitate private investment.

**(3) Integrating Renewable Energy**

Clean energy transition will reshape electric power systems and enhance energy security. It is crucial to establish markets and mechanisms for renewable energy deployment, clean energy investments expansion, and coal-fired power generation limitation by 2030. Beyond 2030, integrating the growing capacities of wind and solar energy into electric power systems will become an increasingly important task.

**(4) Regional Grid Integration**

Integrating regional grid can enhance electricity security and facilitate the integration of renewable energy. Through regional integration, electricity demand can be balanced across a larger area while reducing the need for flexibility, mitigating variability, and allowing for greater peak load adjustments. By connecting systems that rely on wind and solar photovoltaic energy at different levels and portfolios, needs on flexibility can also be reduced. Regional integration can promote a greater reservoir of resources, including hydropower, fossil fuel capacity, and energy storage, thereby adding to existing flexibility. A better-integrated system can also mitigate disruption risks and improve the robustness of the system. To achieve regional integration requires increased investment in grid infrastructure to enable interconnections between countries.

**(5) China's Contributions**

Asia's countries have substantial potential in renewable energy and grid construction, presenting broad prospects for cooperation with China.

On one hand, China carries a notable advantage in renewable energy equipment.

As the world's largest producer of solar panels, wind turbines, batteries, and electric vehicles, China has extensive experience and immense potential in green and low-carbon cooperation with Asian countries. Chinese energy construction enterprises dominate both the domestic and global contracting markets. China's share in the international renewable energy market is also steadily mounting, positioning it as one of the major suppliers of solutions and advanced technologies of renewable energy in the world.

On the other hand, in terms of grid construction, China's energy companies have accumulated rich experience in construction investment, design, and equipment manufacturing. They have played an active role in the electricity infrastructure market in Southeast Asia through various means, including equity investment, financial support, engineering contracting, and equipment exports, and they have strong motivations and competitiveness regarding overseas investment and export. Hence, Chinese equipment, technology, and capital gradually enter foreign electricity markets. Chinese energy enterprises should expand their industrial advantages and enhance cooperation with Asian countries in grid construction based on energy infrastructure development.

### 3.3 Europe

#### (1) Strengthening Electricity and Gas Market Reforms

The government of Greece should strengthen efforts to reform the electricity and gas markets to ensure that consumers benefit from the advantages of efficient wholesale and retail markets. A mechanism should be established to coordinate electricity and gas infrastructure development plans to identify and address concerns on energy security, system stability, emissions reductions and stranded assets. It should also strengthen the expertise and capacity of the Regulatory Authority for Energy, as it will play a key role in the further opening of the electricity and gas markets, as well as monitoring market behavior, designing and implementing new support schemes, and protecting end-user interests while ensuring security of supply. It is essential to ensure transparent and stable legal and regulatory frameworks, which enable renewables and electricity infrastructure projects to be implemented within a reasonable time frame. Adjustments to taxes, market regulations, and financial support measures should be made so that energy prices drive behavior and investment towards a just energy transition, increase system flexibility and reduce the risk of stranded assets.

**(2) Adjusting the National Energy and Climate Plan**

The government of Greece should adjust the measures in the update of the National Energy and Climate Plan so they align with the National Climate Law and increase EU climate ambitions. It should reassess the need for investments in fossil fuel infrastructure, taking into account the risk of stranded assets and the need to direct limited capital to investments supporting the energy transition. To achieve the 2030 renewable energy targets and put the country on the path to net-zero emissions, Greece's renewable energy policy places a strong emphasis on increasing the generation of renewable energy, primarily from wind and solar photovoltaic sources, as well as the electrification of energy demand. This requires coordination across the government to ensure that policies driving the deployment of renewable generation are coherent with those supporting electrification of end uses.

**(3) Upgrading Public Energy R&D Programs**

The government of Greece should upgrade the existing inventory of public energy R&D projects and funding and publish this information on a transparent and regularly updated web portal. This information should be used to monitor spending and assess the achievement of the objectives of the National Research and Innovation Strategy. Data collection should be extended to private R&D activities (based on the OECD guidelines), and these data should be communicated to the IEA in a timely manner.

**(4) Enhancing Clean Energy Equipment Manufacturing Capacity**

The European Union's clean energy ambitions require a large quantity of raw materials, and it is currently highly dependent on imports. The European Union has sought to promote investment in domestic production as a way to increase the resilience of energy supply chains. While recognising the benefits of trade and the importance of international cooperation, the proposed EU Net Zero Industry Act (NZIA) would require the EU clean manufacturing capacity to reach at least 40% of deployment needs by 2030, while the proposed European Critical Raw Materials Act (CRMA) would require 10% of the EU annual consumption to be extracted in the region, and less than 65% of its annual consumption of each mineral to have been processed in a third country. Around 10% of the 40 GW of solar PV modules that were added in the European Union in 2022 were manufactured in the region. Therefore, the European Union should invest significantly more in manufacturing capacity, particularly solar PV.

**(5) China's Contributions**

Given the demand from European countries for electric vehicles and transition from coal-fired power generation, China should strengthen its cooperation with Central and Eastern Europe in the fields of electric vehicles and wind power equipment.

In 2023, the amount of China's greenfield investment projects in Europe surged to EUR 4.5 billion, primarily driven by several large projects in automotive industry. Those include investments by Chinese battery giants such as Contemporary Amperex Technology Co., Limited (CATL) and Automotive Energy Supply Corporation (AESC) in battery manufacturing plants in the UK, France, Germany, and Hungary. As China enters a phase of high-quality development, some Chinese enterprises are intensifying their adjustments in domestic industrial structures. These companies should seek to transition to higher level of the industrial chain by establishing new energy industry clusters abroad, optimizing industrial phases, and shifting investments in relatively low-value-added segments to target countries, thereby supporting the optimization and upgrading of their domestic operations.

### 3.4 America

**(1) People-Centered Transitions**

It is essential to work out how best to provide power to remote communities and informal settlements. Mini-grid and off-grid systems are now playing a larger part in providing access to remote communities around the world, helped by continued cost declines and technical improvements. In the LAC region, a number of notable mini-grid projects in the mining sector have fostered a local developer base that can be scaled up. Off-grid solutions can also play a role in regions that face significant risks of disruption as a result of climate change.

**(2) Energy Security and Regional Power Integration**

Power systems across Latin America and the Caribbean are set for a major shift from a base of hydropower and thermal power plants to one increasingly reliant on wind and solar photovoltaics. This will require new sources of flexibility and system operation changes to maintain electricity security. Deeper regional power integration in LAC is important in this context: it could enhance system reliability, reduce electricity costs and support expansion of renewables sources. Countries in the region have made varying degrees of progress toward regional power integration. For instance, interconnections were established between Brazil and Argentina, Colombia and Ecuador, Argentina and Uruguay, and Chile and Argentina, and various new

projects are being studied. The most notable example is the Itaipu plant at 14 GW – the third-largest hydropower plant in the world – being owned by Brazil and Paraguay. Nonetheless, cross-border electricity trade remains limited compared to other regions in the world.

**(3) Tapping into Energy Efficiency Potential**

First, employ digital solutions to enhance competitiveness, lower operational costs and accelerate the transition to clean energy. Second, impose stricter fuel efficiency standards, particularly for trucks, adopt alternative fuels and EVs and discourage the imports of older, less efficient second-hand car. Third, collaborate to establish minimum energy performance standards that apply across the region and deliver benefits by creating a larger market area. Finally, increase efficiency in non-energy-intensive industries. Non-energy-intensive industries (other industry), with most energy needs characterised by low and medium temperature heat for processing and motors, account for almost half of energy demand in the industry sector in LAC countries.

**(4) Developing Hydrogen Energy**

Hydrogen consumption in Latin America and the Caribbean today is concentrated in the five largest economies (Argentina, Brazil, Chile, Colombia and Mexico) and in Venezuela and Trinidad and Tobago. With its abundant renewable resources, the region has the potential to produce low emissions hydrogen at a lower cost than most other parts of the world. This hydrogen could be used to help decarbonise hard-to-abate sectors where there are few alternative technologies. Seizing this opportunity would support domestic decarbonisation efforts, enhance industrial competitiveness and create new jobs. It would also boost energy and food security, given that most LAC countries currently rely heavily on imports of ammonia and urea. LAC countries are starting to move forward in this area. Chile became the first country in the region to publish a national hydrogen strategy in 2020, followed by Colombia in 2021, Uruguay in 2022 and Argentina, Brazil, Costa Rica, Ecuador and Panama in 2023.

**(5) Developing Bioenergy**

Electricity systems in LAC are set to see large increases in flexibility needs to as wind and solar PV drastically increase their share of electricity generation. Different levels of renewables in the generation mix and differing resource endowments provide opportunities for increased multilateral trading, with countries that have an excess of renewables providing flexibility to those that need it. In most cases,

flexibility needs could technically be met without recourse to cross-border trading or regional power integration through the use of dispatchable units, the expansion of domestic transmission, new energy storage and demand-response measures, but higher levels of cross-border trade have the potential to meet these needs at lower costs.

**(6) China's Contributions**

Latin America has a huge market in green energy, and China should strengthen cooperation with Latin American countries in electric vehicles and renewable energy, including bioenergy, to support energy transition in the region.

To be specific, first, China and Latin America should continue to promote the implementation of more green energy projects such as solar PV power plants, hydropower plants, and bioenergy power plants. Second, China and Latin America should collaborate in technology R&D by sharing their rich experiences in electric vehicles and green energy technologies. By conducting joint research, they can tackle fundamental challenges in green energy development. Third, China and Latin America should ramp up the training and exchange of talents. In recent years, the number of students from Latin American countries studying in China has been on the rise. That serves as an important bridge for technological exchange between China and Latin America and provides a rich talent pool for deepening green energy cooperation. Additionally, China and Latin America should strengthen the exchange and sharing of policy experiences to improve green energy policies together[83]. The cooperation in green energy between China and Latin America will exemplify the South-South cooperation, step up sustainable development for both sides and inject more momentum into South-South collaboration.

[83] Tsinghua University's Institute for International and Area Studies, *Dark Age of South Africa—When Electrcity Supply Becomes a National Disaster*, https://www.essra.org.cn/view-1000-5164.aspx

# Chapter 12 Innovations in Green Technology

The global economy is now transitioning from a resource-dependent model to one driven by technology. Green and low-carbon technology innovation has become a critical tool to achieve "win-win" in economic growth, social progress, and environmental protection. It also plays a central role in the ongoing industrial revolution and global technological transformation. For example, many BRI countries are heavily impacted by climate change and urgently require technological capabilities to address it, which can be achieved through technology transfers from other nations. China's advancements in renewable energy and pollution control have significantly accelerated its green and low-carbon transition, offering replicable models for other countries. The expansive markets in BRI countries present new opportunities for the development of China's environmental protection industry.

From a developmental perspective, as many BRI countries face limitations in technology and human capital, their growth are often constrained by their resource endowments. Research indicates that energy consumption and $CO_2$ emissions per unit of GDP in BRI countries exceed the global average by more than 50%, while cement and steel usage, as well as emissions of ozone-depleting substances per unit of GDP, are more than twice the global average[84]. Some BRI countries rely heavily on high-carbon, fossil fuel-driven development models. However, in the context of global warming, the traditional path of "treatment after pollution" is unsustainable. As of 2021, the average GDP share from the primary sector in BRI countries was approximately 11.67%, significantly higher than the global average of 4.30%[85]. The large share of the primary industry leaves economic output and stability particularly susceptible to environmental degradation and the impacts of climate change.

In terms of ecological and environmental governance, BRI countries have diverse yet highly vulnerable ecosystems and limited governance capacities. According to the International Disaster Database[86], from 1995 to 2015, seven out of the ten countries most affected by climate-related disasters were along the Belt and Road, with their relative disaster losses more than double the global average. BRI

[84] Bao, Rui. Research on Ecological Cooperation and Its Pathways for Countries Along the Belt and Road[J]. *Journal of Harbin Institute of Technology(Social Sciences Edition)*, 2024, 26(01):136-142. DOI: 10.16822/j.cnki.hitskb.2024.01.016.

[85] Zhu, Kaiwei. Research on Low-Carbon Transition Pathways and Climate Cooperation Suggestions for Belt and Road Countries. 2023.

[86] https://www.emdat.be

countries face more frequent and severe meteorological disasters, and their fragile ecosystems make it even more challenging to respond. In addition, some BRI countries suffer from poor air quality, with average PM2.5 concentrations far exceeding the standards set by the World Health Organization, highlighting the urgent need to address air pollution and other environmental issues.

In this context, advancing green and low-carbon transitions and enhancing ecological and environmental governance are crucial for the sustainable development of BRI countries. Accelerating the spread and adoption of green technologies is particularly important. Globalization has led developed nations to shift energy-intensive, high-pollution industries to developing countries, which poses significant challenges for BRI nations in pursuing sustainable development. Issues such as inefficiency, fragmentation, and technological gaps are becoming more pronounced. Cooperation in technological innovation can offer strong support for green industry growth and environmental protection in BRI countries. By leveraging green and low-carbon technology partnerships, these nations gain greater opportunities for green development. To address this situation, China has proposed to align the BRI with the UN's 2030 Agenda for Sustainable Development and build a platform for cooperation and win-win outcomes for BRI countries by providing targeted green technology support, integrating production factors, and accelerating the formation of green supply chains. This initiative not only helps BRI countries achieve their green transition and ecological protection goals, but also significantly contributes to advancing global environmental agreements, including the vision for carbon neutrality in the *Paris Agreement*, the *Convention on Biological Diversity*, and the *United Nations Convention to Combat Desertification*. China, with a focus on mutual benefit, uses green technology as a bridge to support BRI countries in achieving green and sustainable development, which fully demonstrates its responsibility as a major global power.

At the same time, there are still many obstacles to the transfer and cooperation of green technologies between China and BRI countries. These challenges include the large number of countries involved, their extensive geographic distribution, and the substantial differences in resource endowments, energy structures, and consumption patterns. To advance the green and low-carbon transition in BRI nations and effectively address global environmental challenges, it is essential to conduct in-depth research, accurately identify, and scientifically assess the varied green technology

needs of different regions and countries, with collaborative efforts in green technology financing, management systems, capacity building, and intellectual property rights[87].

## 1. The Demand for Green Technology Innovations in BRI Countries

Understanding the green technology needs of BRI countries is a key starting point for boosting the green development in these countries and enhancing China's collaboration with them in green technology innovation. Countries vary in terms of economic, social, and ecological conditions, resulting in diverse needs for green technologies. Through a scientific assessment of these needs, China can more accurately align with the actual demands of its partners, and ensure that cooperation projects are consistent with their current development and future plans. Comprehensive evaluations of demand will enable China to prioritize areas for collaboration, optimize resource utilization, boost cooperation efficiency, and ensure that projects are scientifically planned and systematically executed, thus accelerating the promotion of cooperation projects and the transformation of cooperation outcomes, and ultimately facilitating the solid and in-depth development of long-term cooperative relations.

At present, many BRI countries remain in an energy-intensive phase of industrial development, with energy consumption and greenhouse gas emission levels exceeding the global average. Estimates suggest that if these countries meet the targets outlined in their initial Nationally Determined Contributions (NDCs), annual emissions could be reduced by 3.2 billion tons by 2030 and by 9 billion tons by 2050, contributing significantly to the global low-carbon transition. However, to achieve the *Paris Agreement*'s goal of limiting global temperature rise to 2°C, BRI countries and regions would need to cut emissions by an additional 8 billion tons by 2030 and about 25 billion tons by 2050 [88]. Under the global push for "carbon neutrality," BRI countries face tremendous pressure to transition to low-carbon economies, highlighting the urgent need for international low-carbon technology transfers.

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[87] DENLE A A， AZADI H， ARBIOL J. Global assessment of technological innovation for climate change adaptation and mitigation in developing world [ J ] . Journal of Environmental Management， 2015(July).

[88] Chai, Q., S. Fu & X. Wen. Scenario Study of Low-Carbon Energy Development for BRI Countries Based on the BRIAM Model [J]. *China Population, Resources and Environment*, 2020, 30(10):1-11.

Therefore, this chapter examines the demand for green technology innovation in BRI countries as they address climate change, with the goal of providing a basis for targeted technical assistance and capacity-building efforts.

This chapter systematically examines the Technology Needs Assessments (TNAs) submitted by various countries under the United Nations Framework Convention on Climate Change (UNFCCC). It compiles and organizes data on green technology demands across nations, assesses the technical needs of BRI countries in addressing climate change, and identifies and analyzes the distribution of prioritized technologies for mitigation and adaptation. This analysis serves as a valuable information base to support China in strengthening climate technology cooperation and facilitating technology transfer with BRI countries.

The UNFCCC's TNA mechanism was officially launched in 2001. By July 2024, 98 developing countries had conducted assessments to address climate change, with over 1,000 technology action plans (TAPs) seeking support. TNAs serve as an authoritative source of data on the technologies required by various sectors in developing countries to adapt to and mitigate climate change. TNAs also identify barriers to the development, transfer and uptake of these technologies and ways to address technology needs and barriers. Countries are increasingly using their TNAs and TAPs to inform the development and implementation of their Nationally Determined Contributions (NDCs) and long-term low greenhouse gas emission development strategies (LT-LEDS) under the *Paris Agreement*. For this chapter, 31 developing countries[89] from Africa, Asia, and South America were selected for evaluation based on data availability (see Table 12.1). By organizing each technical demand from the TNAs, and matching them with the Green Technology Patent Classification System developed by the China National Intellectual Property Administration, this report categorizes the green technology needs of BRI countries into 13 types[90] (see Table 12.2).

**Table 12.1 List of Assessed Countries**

| Region | Number of Countries | Assessed Countries |
|---|---|---|
| **Africa** | 12 | South Africa, Zambia, Zimbabwe, Kenya, Nigeria, |

[89] Among the 44 countries evaluated in this report, 31 have submitted TNAs.
[90] A comprehensive list of green technology categories is formed in this chapter based on the technologies mentioned in China's Green Technology Patent Classification System and the TNAs.

| | | |
|---|---|---|
| | | Egypt, Ethiopia, Mauritania, DR Congo, Ghana, Uganda, Botswana |
| **Asia** | 14 | Thailand, Indonesia, Cambodia, Vietnam, Laos, Nepal, Mongolia, Tajikistan, Kazakhstan, Pakistan, Kyrgyzstan, Bangladesh, Sri Lanka, Georgia |
| **America** | 5 | Chile, Ecuador, Jamaica, Panama, Costa Rica |

Table 12.2 Categories of Green Technology

| No. | Categories of Green Technology | No. | Categories of Green Technology |
|---|---|---|---|
| 1 | Biodiversity | 8 | Human Health |
| 2 | Energy | 9 | Coastal Zone Protection |
| 3 | Water Resources | 10 | Industrial Production |
| 4 | Solid Waste Management | 11 | Infrastructure Construction |
| 5 | Transportation | 12 | Natural Disasters |
| 6 | Green Agriculture/Forestry | 13 | Data and Models |
| 7 | Green Buildings | | |

Figure 12.1 illustrates the overall demand for different categories of green technologies in 31 countries. Statistics show that energy, green agriculture/forestry, water resources, transportation, and solid waste management are the top five categories of green technologies prioritized across these countries. Among them, green technologies for energy and agriculture/forestry are identified as priority needs by 62.5% of the countries, indicating that more than half of the countries have an urgent need for green technologies in these two sectors. This is followed by green technologies for water resources (prioritized by 50% of the assessed countries), transportation (prioritized by 27.5% of the assessed countries), and solid waste management (prioritized by 25% of the assessed countries).

The demand for green technologies in areas such as natural disasters, biodiversity, data and models, and infrastructure development is relatively lower, as these technologies are prioritized by only 5%, 5%, 2.5% and 2.5% of the assessed countries. This is mainly due to two factors: first, the environmental and development challenges faced by different countries vary, leading to differing degrees of prioritized technology needs in specific areas; second, these technology categories may have distinct geographic characteristics, with some countries having a more pressing need

for these technologies due to their unique geographic environments.

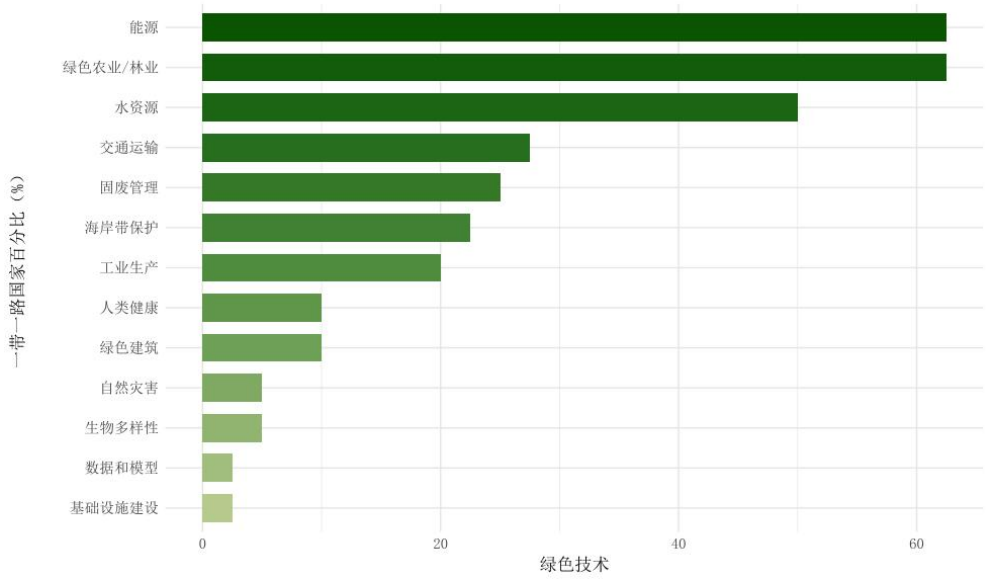


Figure 12.1 Prioritized technology needs in assessed BRI countries

**1.1 Africa**

Figure 12.2 shows that the prioritized technology needs in the 12 selected African countries vary significantly. Over half of these countries emphasize green technologies in agriculture and forestry (64.7%) and energy (58.8%). This reflects the heavy reliance of much of the African continent's economy on agricultural and forestry production, as well as the severe shortage of energy resources. The strong demand for green technologies in agriculture and forestry is driven by a focus on enhancing the sustainability of agricultural production, achieving environmentally friendly development, ensuring food security, and improving the quality of agricultural products[91]. Meanwhile, the huge demand for energy-related green technologies aims to meet the growing energy supply needs of these countries, reduce reliance on fossil fuels, accelerate the shift to cleaner, renewable energy forms, and contribute to climate change mitigation[92].

This is followed by demand for green technologies in the areas of water resources (35.3%), solid waste management (35.3%) and industrial production (23.5%). This underscores the priority African countries place on managing water resources, as many regions face severe challenges related to water scarcity and

[91] Corbeels M, Naudin K, Whitbread A M, et al. Limits of conservation agriculture to overcome low crop yields in sub-Saharan Africa[J]. Nature Food, 2020, 1(7): 47-454.

[92] Kline D, Vimmerstedt L, Benioff R. Clean energy technology transfer: A review of programs under the UNFCCC[J]. Mitigation and Adaptation Strategies for Global Change, 2004, 9: 1-35.

pollution[93]. The demand for solid waste management technologies stems from the waste disposal problems posed by increasing urbanization and industrialization. Advanced technologies and methods are needed to deal with waste, mitigate environmental pollution and reduce resource waste[94]. Technology needs in the area of industrial production, on the other hand, are aimed at reducing the negative environmental impacts of industrial activities, including reducing industrial emissions, improving energy efficiency and promoting cleaner production practices.

Moreover, some countries demonstrate unique green technology needs. The prioritization of green building technologies in South Africa and Uganda reflects their commitment to combating climate change and achieving sustainable development. Green building technologies can greatly reduce building energy consumption and greenhouse gas emissions, while also enhancing building comfort, health and livability. South Africa's prioritized technology needs in human health highlights the growing concerns over environmental pollution and public health challenges, which indicates a strong awareness of the impact of environmental issues on human health, and a proactive approach in seeking green technologies to improve environmental quality and protect public well-being. Egypt has prioritized coastline protection as a technology need because of the critical role of its extensive Mediterranean and Red Sea coastlines in economic development and ecosystem stability. By applying green technologies to coastline protection, Egypt can balance environmental conservation and economic development, enhance the coastal communities' resilience to natural disasters, preserve valuable cultural and historical heritage, and attract more international support and cooperation, thereby advancing its sustainable development goals[95].

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[93] Podgorski J, Kracht O, Araguas-Araguas L, et al. Groundwater vulnerability to pollution in Africa's Sahel region[J]. Nature Sustainability, 2024: 1-10.

[94] Güneralp B, Lwasa S, Masundire H, et al. Urbanization in Africa: challenges and opportunities for conservation[J]. Environmental research letters, 2017, 13(1): 015002.

[95] El-Asmar H M, Taha M M N. Monitoring coastal changes and assessing protection structures at the damietta promontory, nile delta, egypt, to secure sustainability in the context of climate changes[J]. Sustainability, 2022, 14(22): 15415.

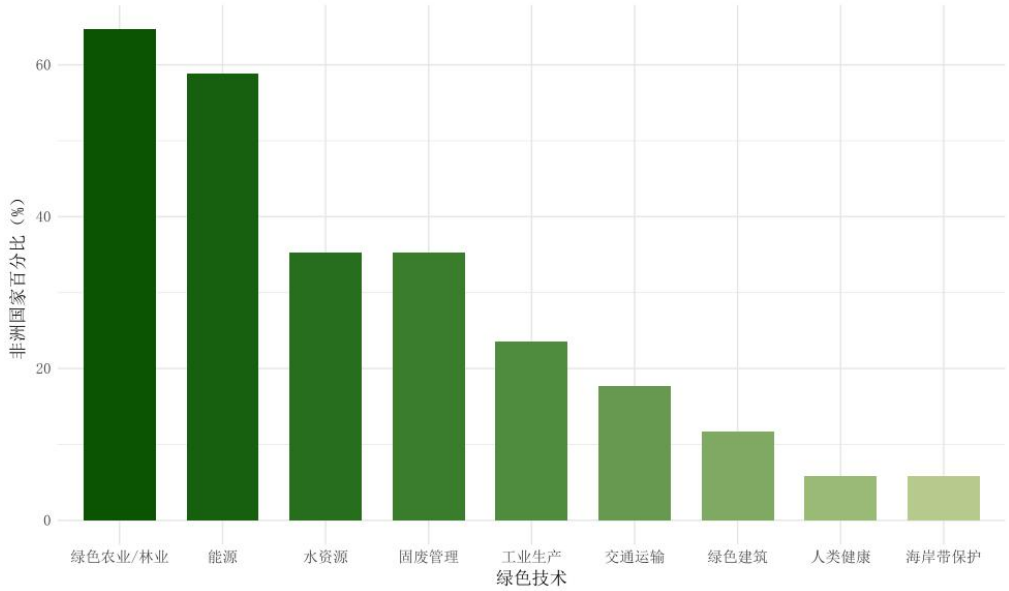


Figure 12.2 Prioritized technology needs in assessed BRI countries in African

### 1.2 Asia

The statistics in Figure 12.3 reveal that for the 14 selected Asian countries, the prioritized green technologies needs exhibit both commonalities and unique characteristics. Overall, more than half of the countries prioritize green technologies related to agriculture and forestry (66.7%), energy (61.1%), and water resources (61.1%). This reflects the region's high population density, intensive agricultural production, and critical issues related to energy shortages and pollution[96],[97]. At the same time, water resources for agricultural production and residential use face the twin challenges of scarcity and pollution.

Thirty-eight percent of the countries prioritize coastline protection, which is closely linked to the diverse coastline and island features in Asia. The region's extensive coastlines, large river deltas, and rich coral reef resources are accompanied by severe coastal vegetation degradation. These characteristics make island nations particularly vulnerable to rising sea levels, extreme weather events such as marine storms, and scarcity of freshwater resources[98]. Therefore, green technologies related to coastal zone protection are essential for maintaining the livelihoods of local

[96] Jat M L, Chakraborty D, Ladha J K, et al. Conservation agriculture for sustainable intensification in South Asia[J]. Nature Sustainability, 2020, 3(4): 336-343.

[97] Rehman A, Batool Z, Ma H, et al. Climate change and food security in South Asia: the importance of renewable energy and agricultural credit[J]. Humanities and Social Sciences Communications, 2024, 11(1): 1-11.

[98] Richards D R, Friess D A. Rates and drivers of mangrove deforestation in Southeast Asia, 2000–2012[J]. Proceedings of the National Academy of Sciences, 2016, 113(2): 344-349.

populations and protecting fragile ecosystems.

Green technologies related to transportation, solid waste management, and human health are prioritized by 27.8%, 16.7%, and 16.7% of the countries, respectively. This reflects the growing prominence of traffic congestion due to accelerating urbanization in Asia, as well as increasing attention to solid waste management issues arising from dense urban populations. The impact of environmental pollution on human health has become a top concern for these countries[99],[100].

In addition, some countries have unique green technology needs. For instance, Sri Lanka prioritizes green technologies related to biodiversity due to its rich species resources, diverse ecosystems, high proportion of endemic species, and biodiversity hotspots. However, agricultural expansion, illegal logging, human activities and climate change pose serious threats to Sri Lanka's biodiversity[101]. By introducing advanced biodiversity conservation techniques, Sri Lanka could monitor and manage its natural resources more effectively, protect rare species and promote the restoration and sustainability of ecosystems.

Thailand has prioritized green technologies related to data and modeling, focusing on hardware infrastructure, database management, and software technologies. The goal is to provide affected sectors with powerful tools and integrated systems for reliable assessments and strategic planning to achieve sustainable development goals. It is worth mentioning that digital economy and artificial intelligence technologies offer significant potential for innovation and application in green technology[102]. Through the use of big data analysis and artificial intelligence technology, it is possible to more accurately predict environmental changes, optimize resource allocation, enhance environmental protection, and drive the green transformation of various industries. For instance, AI can be used to monitor key environmental indicators such as air quality, water quality, and forest coverage, providing real-time

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[99] Strokal M, Bai Z, Franssen W, et al. Urbanization: an increasing source of multiple pollutants to rivers in the 21st century[J]. npj Urban sustainability, 2021, 1(1): 1-13.

[100] Azimi M N, Rahman M M. Unveiling the health consequences of air pollution in the world's most polluted nations[J]. Scientific Reports, 2024, 14(1): 9856.

[101] Sanjeewani N, Samarasinghe D, Jayasinghe H, et al. Variation of floristic diversity, community composition, endemism, and conservation status of tree species in tropical rainforests of Sri Lanka across a wide altitudinal gradient[J]. Scientific Reports, 2024, 14(1): 2090.

[102] Liu, Q., Y. Ma & S. Xu. Has the Development of the Digital Economy Improved China's Green Economic Efficiency? [J]. *China Population, Resources and Environment*, 2022, 32(3): 72-85.

data and early warning services to better protect the ecological environment, reduce pollution emissions, and promote sustainable development.

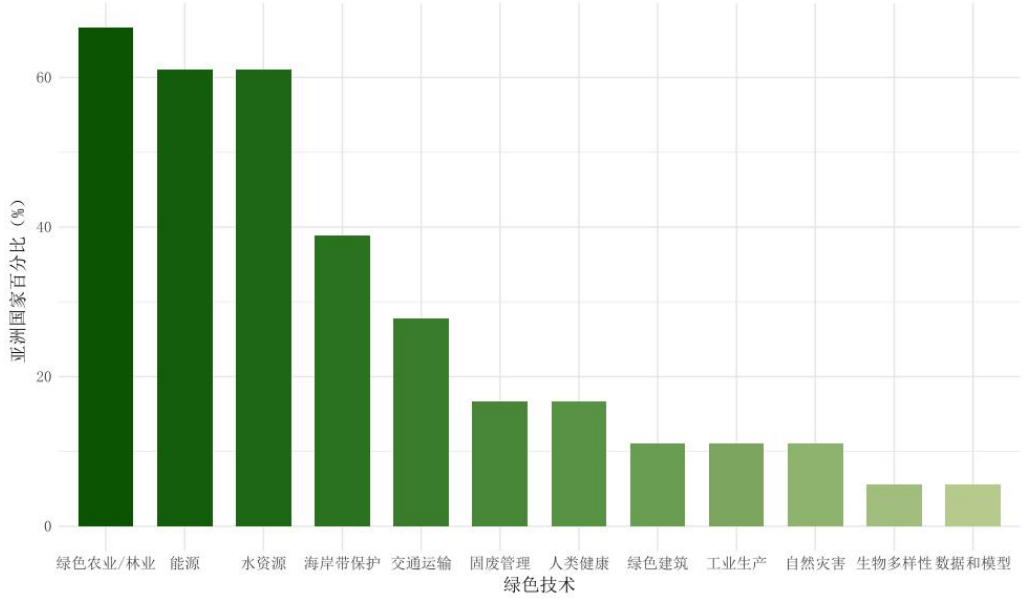


Figure 12.3 Prioritized technology needs in assessed BRI countries in Asia

**1.3 The Americas**

As illustrated in Figure 12.4, the prioritized green technology needs in the five selected countries across the Americas are consistent with the general characteristics of the countries as a whole while also exhibiting unique features due to their distinct geographical locations. Firstly, 80% of the countries have prioritized energy-related green technologies, reflecting the region's multiple challenges and opportunities in addressing energy needs, protecting the environment, and achieving sustainable development. Key areas of focus include renewable energy development, biomass energy utilization, energy efficiency enhancements, and the promotion of distributed energy systems. In addition, 60% of the countries have prioritized green technologies related to water resources and transportation. These technologies aim to tackle challenges in the management of water resources, alleviate traffic congestions, and reduce energy dependence and GHG emissions, while supporting regional integration and economic growth. The adoption of these green technologies will play a critical role in achieving the dual goals of environmental protection and sustainable development, in order to enhance the resilience of South American nations against economic and ecological risks.

Secondly, 40% of the countries have prioritized green technologies related to sustainable agriculture and forestry in order to enhance environmental protection,

address climate change, foster economic and social development, and improve resource management and environmental quality. These technologies not only contribute to the preservation of the Amazon rainforest and biodiversity but also improve agricultural productivity and sustainability, increase climate resilience, boost rural economies, reduce poverty and pollution, and help achieve comprehensive sustainable development goals[103]. Similarly, 40% of the countries have prioritized green technologies in industrial production to advance environmental protection, mitigate climate change, enhance economic competitiveness, improve social welfare, and elevate public health and quality of life. These technologies also help countries meet increasingly stringent regulations and international standards. The adoption of green industrial technologies will reduce pollution and resource consumption, foster innovation and industrial upgrading, create jobs, and enhance workforce skills, supporting the sustainable industrialization of South American nations[104].

Besides, several countries have identified specific green technology priorities tailored to their unique needs. Ecuador, for instance, has prioritized biodiversity-related green technologies to protect its rich ecosystems, support environmental conservation, promote sustainable development, and foster ecotourism and sustainable agriculture. The adoption of these technologies will strengthen Ecuador's ecological and economic resilience, ensuring the long-term sustainability of its valuable natural resources[105]. Costa Rica has prioritized green technologies on solid waste management and infrastructure construction to tackle challenges such as environmental protection, pollution control, resource recycling, climate change adaptation, sustainable urban planning, and water resource management[106]. These technologies will improve environmental quality and resource efficiency while delivering economic and social benefits, providing jobs and improving living standards for its population[107]. As an island nation, Jamaica has prioritized green

[103] Knoke T, Hanley N, Roman-Cuesta R M, et al. Trends in tropical forest loss and the social value of emission reductions[J]. Nature Sustainability, 2023, 6(11): 1373-1384.

[104] Uglietti C, Gabrielli P, Cooke C A, et al. Widespread pollution of the South American atmosphere predates the industrial revolution by 240 y[J]. Proceedings of the National Academy of Sciences, 2015, 112(8): 2349-2354.

[105] Müller J, Mitesser O, Schaefer H M, et al. Soundscapes and deep learning enable tracking biodiversity recovery in tropical forests[J]. Nature communications, 2023, 14(1): 6191.

[106] Abarca-Guerrero L, Maas G, Van Twillert H. Barriers and motivations for construction waste reduction practices in Costa Rica[J]. Resources, 2017, 6(4): 69.

[107] Margallo M, Ziegler-Rodriguez K, Vázquez-Rowe I, et al. Enhancing waste management strategies in Latin America under a holistic environmental assessment perspective: A review for policy support[J]. Science of the Total Environment, 2019, 689: 1255-1275.

technologies for coastal protection. With its economy and social well-being closely tied to marine resources, Jamaica's coastline is under significant threat from rising sea levels, hurricanes, coastal erosion, and human activities[108]. Strengthening coastal protection is essential for safeguarding Jamaica's environment and ensuring its economic stability[109],[110].

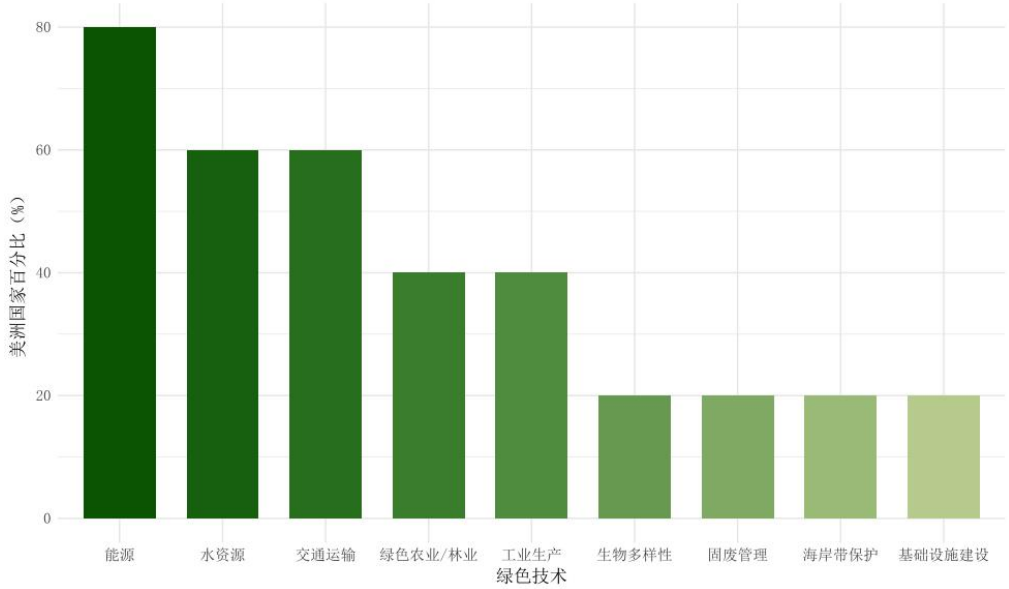


Figure 12.4 Prioritized technology needs in assessed BRI countries in America

## 2. Current Landscape and Opportunities for BRI Cooperation in Green Technology Innovations

### 2.1 Existing Cooperation Meets Technological Needs

Since the inception of the BRI, China has been committed to fostering an international consensus centered on green development, facilitating the adoption of green technologies within a multilateral cooperation framework, and promoting multidisciplinary and in-depth cooperation in green technology innovations. These efforts primarily focus on the following three areas:

**Enhancing green technology R&D capacity.** China has collaborated with BRI countries to bolster the technological support for the development of the Green Silk Road by establishing mechanisms such as the Belt and Road Science, Technology and

[108] Peduzzi P, Velegrakis A, Chatenoux B, et al. Assessment of the role of nearshore marine ecosystems to mitigate beach erosion: The case of Negril (Jamaica)[J]. Environments, 2022, 9(5): 62.

[109] Chan C, Armitage D, Alexander S M, et al. Examining linkages between ecosystem services and social wellbeing to improve governance for coastal conservation in Jamaica[J]. Ecosystem Services, 2019, 39: 100997.

[110] Lee S, Hall G, Trench C. The role of Nature-based Solutions in disaster resilience in coastal Jamaica: current and potential applications for 'building back better'[J]. Disasters, 2022, 46: S78-S100.

Innovation Cooperation Action Plan, setting up joint laboratories and funding collaborative research on green technology. China also launched demonstration projects on green technology and supported joint research projects with Pakistan in related fields including disaster prevention and mitigation, climate hydrology, resource management, and sustainable development, driving the green growth of the China-Pakistan Economic Corridor with technology. In partnership with countries such as the Philippines, Malaysia, and South Africa, China offered technical R&D assistance to local enterprises in these countries for implementing carbon reduction strategies. Additionally, China has collaborated with countries such as Myanmar, Mongolia and Sudan to promote the green transformation of local industries through innovations in wet type copper smelting technologies, palm oil extraction processes, and biodegradable plastics derived from palm residues. These cooperative efforts, aligned with the unique resource and energy features of each country, have achieved huge breakthroughs in green technology and enhanced the R&D capacities of BRI countries.

**Boosting green technology exchange and transfer.** Efforts have been made to establish environmental technology exchange and transfer bases, innovate cooperation models for environmental technology exchange, and facilitate the transfer of environmental technologies. The Belt and Road Environmental Technology Exchange and Transfer Center (Shenzhen) has been launched, which creates a comprehensive system that spans the entire chain from incubation to investment, collaboration, and commercialization. The Center operates under a business model that features joint development, joint operation and shared benefits, with its business covering over 60 BRI countries. Fifteen joint innovation centers for green industries have been established, involving areas such as energy conservation, hydrogen energy, and safe, energy-efficient lighting. These initiatives have successfully transferred photovoltaic power generation and storage technologies, wastewater treatment plant management expertise, and electric two-wheeler technologies to countries including Thailand, Bangladesh, Indonesia, and Kenya, and have introduced photovoltaic water pumping systems to Laos. Through these initiatives, Chinese technologies and services are implemented in BRI nations. China has also advanced the construction of green technology exchange bases such as the China-ASEAN Demonstration Base for Environmental Technology and Industry Cooperation (Yixing) (Wuzhou) and the SCO Ecological and Environmental Protection Innovation Base (Shanghai),

leveraging the agglomeration effect of the environmental protection industry to accelerate the deployment of green technologies in BRI countries.

**Facilitating the sharing of innovative green technologies.** China has collected nearly 1,000 green development technologies suitable for transfer to BRI countries, covering areas such as air pollution control, water pollution control, soil pollution remediation, solid waste management, and environmental monitoring, and has shared these technologies with BRI countries. Models for sustainable development in technology transfer, joint laboratory construction, and training of technical personnel have been established based on the specific needs and features of different countries and regions. International joint laboratories have been established, including the China-Myanmar-Mongolia-Congo Green Mineral Resources Joint Laboratory, the China-Thailand-Malaysia Renewable Energy Joint Laboratory, the China-Saudi Arabia-Pakistan Petroleum Joint Center, and the China-Egypt-Sudan Green Technology Joint Laboratory. By leveraging cross-border technology transfer centers, the transfer and implementation of green and advanced technologies have been strengthened, enhancing the intrinsic green development capacities of BRI countries and fueling innovative progress for low-carbon, circular, and sustainable development. Moreover, a Belt and Road green technology reserve has been established, featuring nearly 40 exemplary cases with valuable insights and potential for broader application, which are being actively promoted among BRI countries to facilitate the sharing of green achievements. Furthermore, China has signed intergovernmental science and technology cooperation agreements with more than 80 BRI countries and is actively promoting the development of the Alliance of International Science Organizations (ANSO) under the BRI, which now includes 58 member institutions [111].

### 2.2 Energy Technologies as a Key Driver

As analyzed in the previous section, the energy sector is identified by the vast majority of countries as one of the key areas for technologies to achieve green development, with a wide-ranging demand. In December 2023, at the COP28 to the UN Framework Convention on Climate Change (UNFCCC), a consensus known as the "UAE Consensus" was reached on multiple issues, including the first Global Stocktake (GST) under the *Paris Agreement*, mitigation, adaptation, finance, loss and damage, and a just transition. This consensus set global targets for 2030, aiming to

[111] Ministry of Ecology and Environment. Promoting Pragmatic Cooperation to Enhance Reciprocity and Sharing, Making Green Growth the Foundation of BRI Cooperation.

accelerate transition away from fossil fuels, triple renewable energy capacity, double energy efficiency, and significantly reduce methane emissions. The goal of "tripling renewable energy" aims to triple installed global renewable energy capacity to 11,000 GW by 2030. In June 2024, the International Energy Agency (IEA) noted in its latest tracking report that renewable energy is key to achieving international energy and climate goals, yet only 14 of the 194 NDCs submitted had set clear targets for total installed renewable energy capacity by 2030, totaling just around 1,300 GW.

For developing countries along the Belt and Road, the construction and improvement of energy infrastructure is essential for boosting energy system resilience, enhancing energy efficiency, and mitigating the impacts of climate-related disasters and shocks. These countries, with their substantial economic growth potential, could become significant sources of global greenhouse gas emissions in the future. Therefore, there is both great potential and urgent need for China and BRI countries to collaborate in clean energy.

In this context, clean energy has become one of the most prioritized sectors in China's contracted construction projects with BRI countries, driving the transition of energy supply in host countries toward efficiency, cleanliness, and diversification (see Figure 12.5). Since China's commitment in September 2021 to stop building new coal-fired power plants overseas, it has halted all new investments in coal-fired power projects abroad. This commitment marks a major turning point and milestone in China's overseas power infrastructure efforts, highlighting China's firm determination to promote global energy transitions and address climate change as a responsible global power.

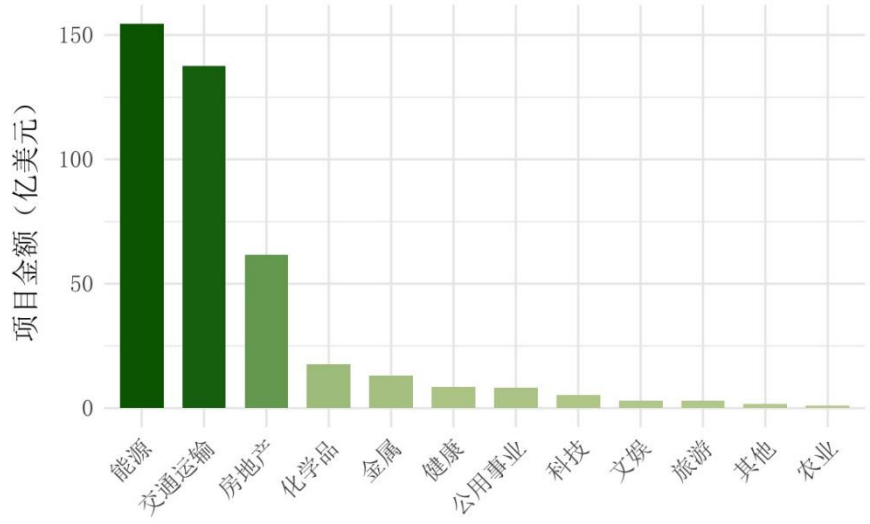


Figure 12.5 Industry distribution of China's contracted engineering projects in BRI countries in 2023

Source: American Enterprise Institute, BRI Research and Decision-Making Platform of DRC Net

China's energy technology exports are strategically tailored to meet local needs, focusing on renewable energy-rich countries and regions where technology development lags behind (see Figure 12.6). In Southeast Asia, China primarily exports hydropower technology, while in South Asia and Central Asia, the emphasis is on wind power. In Africa, a continent rich in diverse resources, China's clean energy technology exports span multiple sectors, including hydropower, wind power, photovoltaics, and geothermal energy[112]. As the world's largest clean energy market and equipment manufacturer, China's cutting-edge green energy technologies provide strong support to BRI countries. Meanwhile, the vast market potential of these countries helps lower China's clean energy manufacturing costs, reducing global emission reduction expenses and fostering positive interactions between the renewable energy sectors of BRI countries and China. This win-win model allows China to contribute "Chinese solution" to the sustainable development of BRI countries and inject "Chinese strength" into the global efforts to combat climate change and achieve green recovery.

[112] *People's Daily*. Chinese Green Technologies Driving Global Energy Transition. 2024.

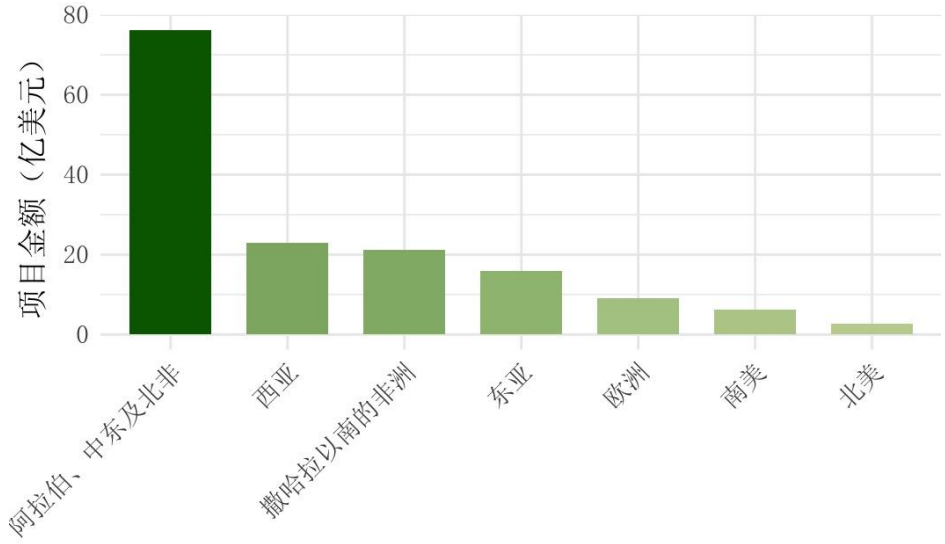


Figure 12.6 Regional distribution of China's contracted engineering projects abroad in the energy sector in 2023

Source: American Enterprise Institute, BRI Research and Decision-Making Platform of DRC Net

Over the past decade, China has conducted extensive cooperation in green energy projects with more than 100 BRI countries and regions. Under a "going global" strategy, Chinese renewable energy companies have formed a complete industrial chain across key technical links, including equipment manufacturing, project development, and engineering construction, which has provided practical and effective solutions for developing countries. This has facilitated the successful implementation of numerous large-scale flagship projects as well as many "small but beautiful" projects that benefits people's livelihoods. A typical example is the Al Shuaiba Photovoltaic Power Project built by a Chinese company in Saudi Arabia. The project adopts the world's most advanced N-type double-sided photovoltaic modules and flat single-axis automatic tracking brackets, with an installed capacity of 2.6 GW, making it the largest single-site PV power plant under construction in the world. Over the next 35 years, this plant is projected to generate approximately 282.2 billion kWh of electricity, reducing carbon dioxide emissions by nearly 245 million tons, which is equivalent to the environmental benefit of planting 545 million trees[113].

[113] People.cn. Construction of the World's Largest Single Photovoltaic Power Station Contracted by Chinese Companies is on Track. 2024.

Table 12.3 List of deliverables and technical needs of BRI countries from the first to third Belt and Road Forums for International Cooperation[114]

| Green Technology Needs of BRI Countries | Partner Countries /Regions | List of Cooperation Efforts |
|---|---|---|
| Biodiversity | ASEAN | Established ASEAN- China Mangrove Conservation Cooperation Partnership |
| | Arab Countries | Established China-Arab International Research Center for Drought, Desertification, and Land Degradation |
| | Mongolia | Signed the *Framework Agreement on supporting Mongolia's "One Billion Trees" Campaign and Strengthening Sino-Mongolian Cooperation on Desertification Prevention and Control* |
| Energy | African Countries | Launched the Africa Solar Belt programme as part of the South-South cooperation on climate change |
| | Pakistan | Signed the *MOU on the Dasu Hydropower Project and the Roadmap for Hydropower Planning in Northern Pakistan*, and the *Agreement on the Adjustment of China-Pakistan Economic Corridor Energy Project List* |
| | Laos, Myanmar, Niger, Pakistan, etc. (28 countries) | Established the Belt and Road Energy Cooperation Partnership (BREP) |
| | South Africa | Signed the *Framework Agreement on Promoting Investment in New Energy Power Projects* |
| | Pakistan | Established China-Pakistan Belt and Road Joint Laboratory on Small Hydropower Technology |
| | Worked with organizations such as UNIDO to initiate the Belt and Road Green Lighting Initiative and the BRI Green and Efficient Cooling Initiative | |
| | Signed the *MOU on Collaborative Advancement of Small Hydropower International Standards*, and the *MOU on Cooperation in Promoting Rural Sustainable Development based on Small Hydro-power International Standards* with UNIDO | |
| Water Resources | Malaysia | Signed the *MOU on Water Resources* |
| | Nigeria | Signed the *Technical Agreement on Niger River Basin Management Project* |
| Transportation | Cambodia, Pakistan, Myanmar, Saudi Arabia, Laos, Kazakhstan, | Signed the *MOU on Transport Cooperation* |

[114] List of Deliverables for the Belt and Road Forum for International Cooperation

| | | |
|---|---|---|
| | etc. | |
| | Signed the *MOU on Promoting Sustainable Transportation to Achieve Sustainable Development Goals* with the United Nations | |
| | Established the Global Sustainable Transport Innovation Alliance | |
| Green Agriculture /Forestry | Bangladesh, Cambodia, Myanmar, Nepal, Pakistan, Philippines, Thailand, Sri Lanka, Vietnam | Release the *Statement of Intent for Cooperation on Promoting Specification-setting for Pesticide Quality Under the Belt and Road Initiative* |
| | Uzbekistan | Conducted cooperation on the research and promotion of agricultural technology and water-saving irrigation |
| Human Health | Saudi Arabia, Oman, Mongolia, Laos, Cambodia | Signed the *MOU on Health Cooperation* |
| Infrastructure Construction | Cambodia | Signed the *MOU on Infrastructure Cooperation* |
| | Sri Lanka, Pakistan, Laos, Egypt, etc. | Signed financing cooperation agreements in ports, power, industrial parks, etc. |
| Natural Disaster Management | Signed a cooperation agreement supporting the UN's Early Warning for All Initiative with World Meteorological Organization | |
| | Launched the Southeast Asia Marine Environment Forecast and Disaster Warning System | |
| | Jointly developed *China-Island Countries Marine Disaster Risk Reduction Cooperation Plan* | |
| Covering Multiple Sectors | *The Belt and Road Ecological and Environmental Cooperation Plan* | |
| | The Belt and Road South-South Cooperation Initiative on Climate Change | |
| | Hosted South-South cooperation trainings on climate change | |
| | Established Belt and Road Environmental Technology Exchange and Transfer Center | |
| | Launched and implemented the Belt and Road Ecological and Environmental Talent Exchange Program | |
| | Launched the Belt and Road Special Cooperation Program for Sustainable Development Technology, and the Science Action Plan for Sustainable Development | |
| | Launched the *Central Asia Regional Green Technology Development Action Plan* | |
| | Established the Belt and Road Low-Carbon Service Partnership | |

Note: Green technologies listed are specific to the countries included in this

report.

### 2.3 Priority Areas for Potential Cooperation

#### (1) Advancing Cooperation in China's Areas of Strength

Sectors where China has developed mature technologies and BRI countries have demonstrated high demand and great growth potential are prioritized for future green technology cooperation and innovation. The energy sector remains one of the key drivers for "green" growth within the BRI framework. However, green energy technology and investment cooperation overseas is unevenly distributed across regions, influenced by the varying resource endowments of BRI countries, as well as barriers in the market, regulatory frameworks, and local government management of renewable energy development. In regions like Southeast Asia and Africa, renewable energy offers vast development opportunities and strong potential for collaboration. Currently, Southeast Asia's energy mix is still heavily reliant on fossil fuels, which account for more than 75% of its total energy consumption. To foster renewable energy development, ASEAN has set targets to increase the share of renewable energy to 23% of total energy supply and to 35% of installed capacity by 2025. Africa, with 40% of global solar reserves, 32% of wind reserves, and 12% of hydropower reserves, lags behind other regions in renewable energy development. In 2022, Africa's 54 nations together accounted for only 1.7% of the installed renewable energy capacity globally, indicating enormous potential for growth in this sector.

China is well-positioned to play a pivotal role in driving global energy transition and sustainable development. Green energy technologies account for 30.92% of China's environment-related technology patents (see Figure 12.7), making it the sector with the greatest potential for technology transfer. A prime example is the "PV+ agriculture" model, where China has seen rapid growth. According to the World Resources Institute (WRI), grid-connected "PV+ agriculture" projects in China have expanded from just two in 2011 to over 500 today, with a total installed capacity exceeding 30 GW[115]. Distributed renewable energy, particularly photovoltaic solar energy, has emerged as a crucial solution for improving electricity access with its advantages in cleanness, affordability and ease of implementation. In the future, China can promote the standardization of the "PV + agriculture" model in developing regions like Southeast Asia and Africa, carry out in-depth research on key factors

[115] World Resources Institute. Sunshine and Growth: New Opportunities for the Development of "PV +" Industry Integration under the BRI. 2023.

such as crop selection, panel height and shading area, and share China's best practices in the cross-sectoral development of the "PV +" model.

In addition, analysis of the technical needs assessments (TNAs) from BRI countries, alongside data on China's environment-related technology patents, reveals a strong complementarity between China's technological capabilities and the needs of BRI countries. As a result, it is crucial to not only continue deepening collaboration in energy and ecosystem adaptation technologies but also expedite the transfer of environmental technologies for sustainable transportation, solid waste management, and water resources. Promotion of green infrastructure and environmental standards in the transportation sector throughout the entire lifecycle, from project site selection and design to construction and operation, can mitigate impacts on ecologically sensitive areas, adopt energy-saving and water-saving standards, and ultimately improve resource efficiency. From a regional perspective, Southeast Asia and Africa are prioritized for cooperation due to their high vulnerability to climate and ecological risks and their strong political, economic and social ties with China[116].

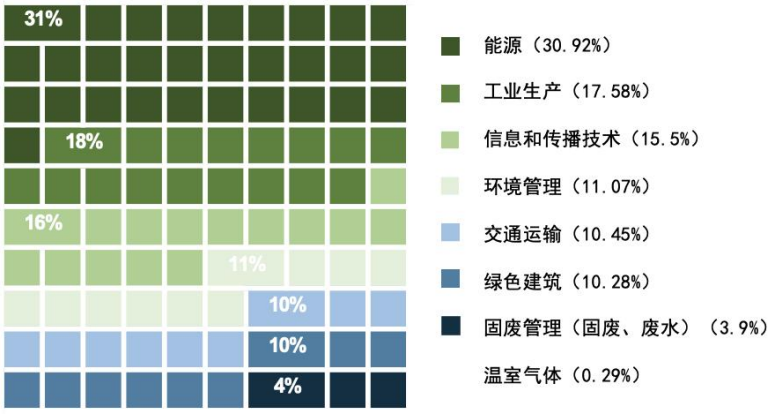


Figure 12.7 Distribution of green technology patents in China (2021)

Source: OECD Environment Statistics: Patents in environment-related technologies[117]

**(2)Fostering the Adoption of Emerging Green Technologies Including the Digital Economy**

It is worth noting that information and communication technologies (ICT) have seen remarkable development in China, with a significant share of 15.5% in green

[116] BRI Construction Promotion Center, National Development and Reform Commission. Research on the Construction and Application of the Typical Project Case Database for Green BRI (2021).

[117] OECD Environment Statistics: Patents in environment-related technologies https://www.oecd-ilibrary.org/environment/data/patents-in-environment-related-technologies/technology-indicators_e478bcd5-en

technologies (see Figure 12.7). The digital economy, with its inherent green attributes, has been proved by numerous studies to significantly boost environmental protection efficiency. On a macro level, the digital economy fosters high-quality economic growth, drives technological innovation, and improves green total factor productivity (GTFP) globally. It also helps address urban issues such as environmental pollution, resource waste and resource scarcity in BRI countries[118]. Moreover, the growth of the digital economy is closely linked to upgrades in industrial structure, which in turn stimulate regional innovation, urban technological progress, human resource aggregation, and industrial competitiveness[119]. For instance, big data and AI technologies provide strong support for environmental monitoring, and significantly enhance resource utilization efficiency through the use of IoT and cloud computing technologies. Furthermore, the use of AI in industrial production can substantially improve energy efficiency, thus reducing related environmental pollutant emissions[120].

In the digital age, BRI countries and China have highly promising cooperation prospects. On the one hand, China's digital economy has experienced remarkable growth. According to the *Research Report on the Development of China's Digital Economy (2023),* the size of China's digital economy expanded from 260 million *yuan* in 2005 to 50.2 trillion *yuan* in 2022, making it the world's second-largest digital economy endowed with a global competitive edge in technological innovation[121]. As domestic market competition intensifies, expansions into international markets has become a necessary strategy for China to develop its ICT sector. On the other hand, the growth of digital economy varies widely among BRI countries. Nations such as Singapore and Estonia have achieved high levels of digitalization. Countries like India, the UAE and Poland are also making rapid progress in their digital economies. However, some countries with weaker foundations experience almost stagnant

[118] Lei Wu, Chengao Zhu, Guonian Wang, The impact of green innovation resilience on energy efficiency: A perspective based on the development of the digital economy, Journal of Environmental Management, Volume 355, 2024, 120424, ISSN 0301-4797, https://doi.org/10.1016/j.jenvman.2024.120424.

[119] Weilong Wang, Jianlong Wang, Haitao Wu, The impact of energy-consuming rights trading on green total factor productivity in the context of digital economy: Evidence from listed firms in China, Energy Economics, Volume 131, 2024, 107342, ISSN 0140-9883, https://doi.org/10.1016/j.eneco.2024.107342.

[120] Malin Song, Heting Pan, Zhiyang Shen, Kristine Tamayo-Verleene, Assessing the influence of artificial intelligence on the energy efficiency for sustainable ecological products value, Energy Economics, Volume 131, 2024, 107392, ISSN 0140-9883, https://doi.org/10.1016/j.eneco.2024.107392.

[121] China Academy of Information and Communications Technology. China Digital Economy Development Research Report (2023).

growth[122]. These nations urgently need to harness information technology to enhance resource allocation efficiency and unlock significant untapped potential. Deepened cooperation on the digital economy between China and these BRI countries can effectively support their shift from traditional extensive economic models to green transformation and high-quality development.

In emerging fields of the digital economy, China has also signed multiple cooperation agreements with BRI countries, signaling strong cooperation momentum and promising prospects. At the third Belt and Road Forum for International Cooperation, China released the *Beijing Initiative on the Belt and Road International Digital Economy Cooperation*, which proposes to build an international economic and trade cooperation framework for digital economy and green development. In bilateral cooperation actions, China signed a bilateral action plan on Digital Silk Road cooperation with the Ministry of Innovation and Technology of Hungary and MOUs on investment cooperation in green development and the digital economy with the government of Turkmenistan[123]. Looking ahead, fostering new green economic growth through the digital economy, and enhancing digital connectivity to deepen cooperation in information, trade, and economy, will be key to driving industrial transformation, upgrading, and environmental improvement in BRI countries, while boosting the high-quality development of a green BRI.

## 3. BRI Cooperation in Green Technology Innovations: Summary and Recommendations

Since the early 21st century, China has actively promoted the transfer of environmental technology and South-South climate technology cooperation within the framework of the BRI. This effort is seen as a vital strategy to enhance the capacity of developing countries to address climate change. Since 2015, China has utilized projects such as the “Ten, Hundred, and Thousand Project” and the South-South Cooperation Fund on Climate Change to foster international cooperation in areas including clean energy, disaster prevention and mitigation, ecological protection, agriculture, and urban development, establish technology cooperation networks, and

[122] Tian, Yuan. Deepening Digital Economy Cooperation to Promote the Construction of a Green BRI. http://gfccc7a75c189cf6d46eah6cko0nupnfpn60xp.gfxa.libproxy.ruc.edu.cn/eDRCNet.Common.Web/DocDetail.aspx?DocID=7423548&leafid=22592&chnid=5722

[123] List of Pragmatic Cooperation Projects for the third Belt and Road Forum for International Cooperation.

broaden channels for technology transfer. This chapter identifies the following challenges and cooperation recommendations to deepen the contribution of green technology innovation cooperation to the green and low-carbon transition of BRI countries.

### 3.1 Challenges in Green Technology Innovation Cooperation

Experiences in green technology cooperation indicate that the green and low-carbon technologies exported by China should be further aligned with the needs of developing countries. Meanwhile, BRI countries frequently encounter language and information barriers in introducing Chinese technology. In the process of boosting the transfer, promotion and adoption of green technologies, there are also significant challenges related to economics and finance, policies and regulations, market failures, as well as technology and human capital.

**(1)Economic and Financial Barriers**

Economic and financial barriers are the most prevalent challenges in the cooperation between China and BRI countries in green technology innovations. These barriers affect the widespread adoption of green technologies. Major concerns include the high costs of installation, operation and maintenance. Many countries have underdeveloped financial markets, making it difficult to secure financing for green technologies. The high costs and extended payback periods increase investment risks for governments and businesses in importing countries, reducing their willingness to adopt these technologies[124]. For example, many developing countries face significant obstacles, such as high startup and operational costs, when adopting solar power generation technologies.

**(2)Policy and Regulatory Barriers**

Policy and regulatory barriers are also common in green technology innovation cooperation, covering issues such as intellectual property (IP) protection, environmental standards, transnational cooperation, data privacy, and transparent cooperation frameworks. As green technologies often involve innovation patents, a key challenge is to balance technology sharing with patent protection in international cooperation[125]. Transnational cooperation and technology transfer are also impeded

[124] Ge, P., X. Huang & Z. Xu. Financial Development, Innovation Heterogeneity, and Green Total Factor Productivity Improvement: Empirical Evidence from the BRI Cooperation[J]. *Finance & Economics*, 2018, (01): 1-14.

[125] Yang, S. & Y. Liu. Can China's Outward Direct Investment Enhance Regional Green Innovation Efficiency? From a Perspective of Intellectual Property Protection[J]. *International Economics and Trade Research*, 2021, 37(02): 83-98.

by varying standards and certification requirements for green technologies among different countries. For instance, environmental standards and efficiency requirements for the same technology may vary in different countries. Therefore, in transnational cooperation, complex contracts and legal agreements are often necessary to define responsibilities and rights regarding technology transfer, IP protection, and benefit sharing. Implementation of green technologies also requires substantial amounts of data, which makes it essential to ensure data security and privacy in international cooperation. With the growing use of intelligent technology and the Internet of Things (IoT) in the green technology sector, compliance with cybersecurity regulations is increasingly important. In addition, transparent policies on technology transfer are crucial for fostering green technology innovation and international cooperation. Issues such as information asymmetry, challenges in international coordination, and weak regulation can affect the transparency of policy implementation and undermine the fairness and efficiency of cooperation.

**(3)Market Failure as Barriers**

Green technology innovation and cooperation may encounter various market failure barriers, such as externalities, information asymmetry, market entry barriers, uncertainties, and risks, which may hinder the development and deployment of green technologies. The R&D of green technologies has positive externalities, but companies often fail to fully utilize these benefits, which discourages their investment in such technologies[126]. In addition, the widespread adoption of green technologies generally requires large-scale market uptake, but smaller markets and firms may struggle to achieve economies of scale, leading to market failure. Investors, consumers, and businesses often lack precise information about green technologies, an issues exacerbated in international contexts, which may hinder rational decision-making. Market entry barriers may also prevent emerging green technologies from entering the market, restricting competition and innovation. Furthermore, emerging green technologies are often associated with significant technical uncertainties regarding their maturity and performance stability, which can erode investor confidence.

**(4)Technology and Human Capital Barriers**

In transnational green technology cooperation, challenges may arise in

[126] Kolev A, Riess A. Environmetal and technology externalities: Policy and investment implications[J]. EIB Papers, 2007, 12(2): 134-162.

technology adoption, operation and maintenance, particularly concerning technical and human capital barriers. Firstly, environmental and market conditions vary across countries, requiring technologies to be tailored to local contexts, which increases technical complexity and costs[127]. Besides, due to the absence of unified international standards, different countries may adopt different technological standards and certification systems, which creates uncertainties and risks. Secondly, specialized scientific and technological talent is essential for the implementation and maintenance of green technologies. However, recruiting and training such talent can be challenging in international cooperation in this field. Green technologies often involve new workflows and operational skills, so importing countries may experience a mismatch in skills within their workforce, which makes it necessary to train local staff and incurs more human capital management costs. These challenges in technology implementation and human capital can impact the viability and sustainability of international cooperation on green technology innovations[128].

### 3.2 Recommendations for Green Technology Innovation Cooperation

Green technology innovation cooperation is essential for the successful execution of major BRI projects and for fostering sustainable development in BRI countries. This chapter offers the following recommendations to address the challenges for green technology innovation cooperation between China and BRI nations.

**(1)Enhancing Identification and Alignment of Demands**

The key climate technologies provided by China should be matched with the prioritized technology needs of BRI countries. It is essential to thoroughly identify these needs and align them with the technologies provided, ensuring that technologies provided are appropriate with for each countries' economic conditions and climate governance priorities. While South-South climate cooperation has focused on prioritized technology sectors in BRI countries, such as energy and agriculture, there has been less emphasis on green low-carbon technologies in transportation, waste management, and water resources. It is recommended that the diverse technological needs of different types of countries be considered when initiating cooperation. In addition to strengthening technology transfer in agriculture (both mitigation and

[127] Liu, W., J. Li & G. Xiao, *et al.* Research on the New Pattern of Science and Technology Cooperation under the BRI[J]. *Bulletin of the Chinese Academy of Sciences*, 2023, 38(9): 1246-1255.

[128] Chen, Qi. Innovative Research on Technical and Skilled Talent Training in Higher Vocational Colleges in the Context of the BRI[J]. *Modern Education Management*, 2018, (06): 87-91.

adaptation) and energy sectors, efforts should be made to advance the transfer of mitigation technologies in transportation and waste management, and adaptation technologies in water resources. Furthermore, it is also important to enhance the capacity of developing countries to assess and identify their green low-carbon technology needs, support country-specific research on these needs and transfer strategies, and develop a dynamic database of technology needs and transfer cases. This approach will help establish an effective information bridge between the supply and demand sides, and facilitate timely and effective technology transfer decisions.

**(2)Strengthening Policy and Financial Support**

It is also recommended to create green technology innovation funds between China and BRI countries to pool resources and offer financing opportunities for countries with underdeveloped financial markets. This will help overcome economic and financial barriers and support the implementation of green technology innovation projects[129]. Apart from that, green financial cooperation should be strengthened between China and BRI countries. Regional technology and finance service platforms, as well as investment mechanisms, should be established within multilateral frameworks such as the United Nations and the G20 in order to provide financial support for green technology innovation projects. Collaboration with financial institutions such as the Asian Infrastructure Investment Bank (AIIB), the New Development Bank (NDB) of BRICS and the Silk Road Fund is also crucial, as they serve to channel funds into green technology innovation and environmental protection through mechanisms like green bond funds and the issuance of green bonds.

**(3)Boosting the Development of Platforms and Mechanisms**

The development of green technology innovation platforms should be expedited to facilitate technology transfer[130]. Platforms like the Belt and Road Environmental Technology Exchange and Transfer Center (Shenzhen) should be fully utilized to enhance multilingual and multi-tiered communication of Chinese green low-carbon technologies in BRI countries through information platforms, technical training, and pilot projects based on the countries' green technology needs. Resources should be integrated to offer services such as technology exchange, resource sharing, and project matching, ensuring the smooth execution of cooperation projects and fostering

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[129] Meng, Gang. Leading BRI Financial Innovation with Green, Inclusive, and Local Currency Finance[J]. *New Finance*, 2017, (11): 38-42.

[130] He, H., S, Wu & J. Xin, *et al.* Current Status, Challenges, and Development Directions of BRI Cooperation on Science and Technology Innovation[J]. *Bulletin of the Chinese Academy of Sciences*, 2023, 38(9): 1315-1324.

green technology innovation and application. In addition, South-South cooperation demonstrations should be considered for key areas, and regional technology transfer centers should be established to increase the influence of Chinese technology. Strengthening legal and policy coordination between China and BRI countries is also vital, with cooperative mechanisms built under the principles of mutual trust, shared benefits, and reciprocity. Enhanced communication and collaboration among partners can be achieved through bilateral or multilateral agreements, joint development of laws and regulations, and policy dialogue platforms. Besides, it is essential to advance the unification of green technology standards and certifications between China and BRI countries, along with establishing integrated standards systems to promote technology exchange and application. In the joint R&D efforts for key climate technologies, unique regional advantages should be taken into account in order to develop more regionally applicable green low-carbon technologies.

**(4)Enhancing Technology and Talent Support**

Green capacity training platforms, such as the GBA Global Academy for Green Leadership and Innovation, should be leveraged to broaden the scope of technological assistance and exchanges, thereby enhancing support for BRI countries. Technological innovation in the digital economy, including big data, cloud computing, and the Internet of Things (IoT), should be fostered to provide robust digital support for green technology innovation. Digital economy innovation platforms should be established to facilitate technology exchange and collaboration, and promote the application and innovation of digital technologies in the field of green development[131]. Meanwhile, talent development and exchanges should be improved by implementing specialized green technology training programs, strengthening collaboration with BRI countries on talent exchange, and creating platforms for talent development to encourage cross-border mobility and two-way talent exchanges.

[131] Bai, Chunli. Scientific and Technological Innovation and Cooperation Supporting High-Quality Development of the BRI[J]. *Bulletin of the Chinese Academy of Sciences*, 2023, 38(9): 1238-1245.

# Chapter 13 Connectivity of Green Regulations and Standards

The Belt and Road Initiative (BRI) has been committed to openness and inclusiveness, aiming for high standards, sustainability, and enhanced livelihoods. It is dedicated to creating a community of shared future characterized by political mutual trust, economic integration, and cultural inclusiveness. Policies, rules, and standards determine the order, efficiency, and level of cooperation. Since its inception, the BRI has been emphasizing compliance with the laws and regulations of various countries and international obligations in its practice, adhering to and aligning with widely recognized international rules and standards. At the same time, it also calls for more countries and global financial institutions to commit to complying with these international rules and standards when joining the BRI [1]. In numerous fields such as infrastructure, agriculture, and energy, China, along with the countries involved in the Belt and Road Initiative (hereinafter referred to as "BRI participating countries"), uses laws, regulations, and standards as bridges to conduct extensive cooperation through mutual exchanges, technical standard recognition, and the like. The interconnected regulatory standards foster a "common language" for cooperation in investment, trade, finance, technology, and other areas under the BRI.

Global and regional ecological environments are facing challenges, making adverse effects increasingly pronounced. A favorable ecological environment has become a fundamental condition and common need for all countries' social and economic development. In particular, in recent years, initiatives such as the "Build Back Better World" (B3W) and the "Global Gateway" launched by the United States and the European Union respectively have emphasized high standards and sustainability as essential principles. The Belt and Road initiative involves numerous infrastructure projects, enhancing the "soft connectivity" of ecological and environmental laws, regulations, and standards. It is crucial to establish higher environmental regulations and standards and actively promote the alignment of environmental regulations and standards with BRI participating countries. As an important aspect of building a green Silk Road, these measures can effectively reduce the negative environmental impacts that infrastructure projects may trigger. In recent years, the Chinese government has issued several top-level design documents for the

green BRI and green investment and financing guidelines, making green standard cooperation one of the key tasks. These documents encourage foreign investment in construction projects to adopt internationally accepted rules and standards or China's stricter standards when host countries or regions lack relevant standards or when existing standards are too insufficient. This highlights the growing importance of the connectivity of environmental regulations and standards. However, it is undeniable that most participating countries are developing countries, which are widely distributed across different regions and exhibit significant disparities in economic development levels, political systems, legal and religious contexts, and environmental goals. Currently, the mutual recognition and connectivity of applicable environmental regulations and standards among countries are inadequate, posing significant challenges to promoting "soft connectivity" regarding green regulations and standards under the Belt and Road Initiative.

In this context, this chapter systematically reviews the current connectivity of green regulations and standards under the Belt and Road Initiative and the challenges it faces. The chapter analyzes the similarities and differences in environmental legislation, standard-setting, and enforcement across different regions to identify the opportunities and challenges for the connectivity of environmental regulations and standards among participating countries, while also anticipating the prospects for ecological and environmental regulations and standards connectivity along the Belt and Road.

## 1. Current Connectivity of Environmental Regulations and Standards under the Belt and Road Initiative

The Belt and Road Initiative has been widely recognized and welcomed. However, in terms of environmental regulations and standards, the regulatory frameworks differ significantly across various regions and countries. A universally accepted set of green rules and standards based on the framework of the Green Silk Road has yet to be established. The connectivity of environmental regulations and standards varies across regions, with different countries having unique environmental legislative frameworks and characteristics regarding the stringency of environmental standards and the setting of indicators.

### 1.1 Current Environmental Regulations and Standards Connectivity Among Countries in Different Regions

Environmental regulations and standards across regions have unique characteristics and varying levels of connectivity. Some regions have highly coordinated and consistent regulations and standards, while others show significant differences and poor connectivity.

**(1)Asia**

**Southeast Asian countries have a foundational basis for soft connectivity; however, achieving comprehensive regional environmental legal connectivity still requires time.** Since the 1960s, ASEAN countries have experienced rapid economic growth, increased industrialization and urbanization, a population surge, and a dramatic rise in resource consumption. This has resulted in environmental issues such as air and water pollution, with some instances of transboundary pollution. Recognizing the importance of environmental cooperation for achieving sustainable development and regional integration, ASEAN has begun to focus on enhancing environmental cooperation among its member states, with international environmental cooperation now included as a formal agenda item at ASEAN foreign ministers' and leaders' meetings [2]. In addition to complying with global environmental conventions, ASEAN has made substantial progress in developing regional environmental treaties, agreements, and declarations in recent years [3]. Currently, ASEAN member states are engaged in environmental cooperation work under the ASEAN Strategic Plan on Environment and the ASEAN Socio-Cultural Community Blueprint 2025. ASEAN has established a dedicated framework for environmental cooperation, including the ASEAN Ministerial Meeting on the Environment (AMME), the ASEAN Senior Officials Meeting on the Environment (ASOEN), and seven working groups focused on climate change, chemicals and waste, coastal and marine environments, environmental education, sustainable urban environments, natural resources and biodiversity, and water resource management. The AMME convenes every two years, while ASOEN and its subordinate working group meetings are held annually to oversee the implementation of the ASEAN Strategic Plan on Environment and the ASEAN Socio-Cultural Community Blueprint 2025. Since the 1985 Agreement on

the Conservation of Nature and Natural Resources[132] were signed by ASEAN countries, they have signed multiple regional environmental agreements and declarations, regularly engaging in exchanges and cooperation on environmental policies and regulations.

In terms of environmental standards, Southeast Asian countries generally refer to internationally accepted environmental assessment indicators and standards systems. Currently, most environmental standards have been translated into national environmental technical standards or norms. For example, Singapore bases its environmental management on international standards in many areas[133], influencing other ASEAN countries, while Indonesia has adopted stricter national standards based on the standards of Western countries in areas such as water resource protection and forest coverage.

The connectivity of environmental regulations in Southeast Asia is primarily manifested in regional environmental governance cooperation mechanisms. For instance, the countries in the Mekong River Basin—Cambodia, Laos, Myanmar, Thailand, and Vietnam—signed the 1995 Mekong Agreement, forming the Mekong River Commission to unify actions and jointly manage water resources[134]. Despite ASEAN countries having developed a series of soft laws in the environmental and resource sectors, these are primarily non-binding statements, resolutions, and agreements. This is attributed to various differences between countries, including economic development stages, historical trajectories, cultural contexts, and political will, as well as a lack of technical means and scientific consensus. Consequently, building a coherent, comprehensive, and well-rounded regional environmental legal system may still take considerable time [4-5]. Overall, environmental protection awareness among ASEAN countries remains to be enhanced. There are still

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[132] The document has not yet come into effect due to insufficient approval from member states, but it is part of the development of international environmental law, regarded as a precursor to the Convention on Biological Diversity, and is considered a national-level environmental law and policy among ASEAN countries.

[133] Singapore's air quality classification standard adopts the general standard set by the United States Environmental Protection Agency (USEPA), which reflects the concentration levels of air pollutants through the PSI index. The country is establishing stricter air quality targets based on the World Health Organization's air quality guidelines.

[134] China has also participated in the 1995 Mekong Agreement and has reached multiple cooperation agreements with the Mekong River Commission and ASEAN countries, such as the Agreement between the Ministry of Water Resources of the People's Republic of China and the Mekong River Commission on the Provision of Hydrological Information of the Lancang/Mekong River in Flood Season by MWR to MRC Secretariat, the Memorandum of Understanding between the Mekong River Commission Secretariat and the Lancang-Mekong Water Resources Cooperation Center, and various cooperation declarations.

significant barriers to deeper legal cooperation on environmental protection and better connectivity in environmental standards among countries.

**Table 1: Examples of Environmental Regulatory Standards in Southeast Asian Countries**

| Region/Country | Environmental Strategies | Policy | Rule | Standard |
|---|---|---|---|---|
| ASEAN | 1. ASEAN Agreement on the Conservation of Nature and Natural Resources (1985)<br>2. 1995 Mekong Agreement<br>3. ASEAN Agreement on Transboundary Haze Pollution (2002)<br>4. Commitments by member countries to peak carbon emissions by 2030 and achieve carbon neutrality as soon as possible between 2050 and the second half of this century | 1. ASEAN Environmental Strategy Planning Series (since 1997)<br>2. ASEAN Socio-Cultural Community Blueprint 2025 (2007) | 1. ASEAN Plan of Action for Energy Cooperation (2015)<br>2. Master Plan on ASEAN Connectivity 2025 (2016) | Most countries have established environmental air quality standards. |
| Malaysia | Malaysia Electricity Supply Industry 2.0 (2019) | | | |
| Indonesia | | Announcement on May 27, 2021, to phase out domestic coal power | Harmonization of Tax Regulation (2021, concerning carbon trading and tax adjustments) | |
| Vietnam | | Eighth National Power Development Plan | | |

**Central Asian countries have a high level of recognition for Chinese standards, providing a foundation for regulatory and standards connectivity**. Countries such as Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan have engaged in collaboration with China under the overall framework of "promoting the connectivity of policies, rules, and standards." The collaboration includes standardized management systems, mutual recognition of standards, personnel training, and information exchange. As the Belt and Road Initiative progresses, Central Asian countries are using more Chinese engineering equipment and products, leading to greater acceptance of Chinese standards. This facilitates environmental protection standardization efforts between China and Central Asian countries.

Among Central Asian nations, Kazakhstan boasts a well-developed and comprehensive environmental legal system that spans multiple areas. The country is developing its environmental legal framework by extensively drawing on foreign and international environmental protection experiences while considering its specific circumstances, resulting in a coordinated and forward-looking institutional system. Kazakhstan places great emphasis on cooperation and communication with various countries in environmental protection, although it lacks a structured regional enforcement mechanism. Additionally, Kazakhstan's environmental standards are notably aligned with international norms.

**In contrast, West Asian countries face a complex social environment characterized by a weak foundation for the connectivity of environmental regulations and standards.** Geographically, West Asia is primarily defined by plateaus and deserts, featuring a fragile and unique ecosystem with very limited forest resources. As a major oil-producing region, West Asia attracts numerous enterprises to develop and extract oil and gas; however, the economic growth model in this area is generally extensive. Data shows that fossil fuel consumption in West Asian countries accounts for over 88% of total energy consumption. In terms of carbon dioxide emissions, the average per capita emission in West Asia reaches 47 metric tons, which is comparable to the global average of 49 metric tons. Countries like Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE exceed the global average by more than 10 tons. These countries are facing pressures to reduce emissions and address environmental issues. The region is marked by ongoing ethnic and religious conflicts, creating a complex social environment that requires investors to fully understand local laws and investment conditions, comply with legal and protective policies, and respect local customs to avoid conflicts. The connectivity of environmental regulations and standards in this region is relatively weak.

**(2)Africa**

Environmental laws in Africa were largely promulgated in the late 20th century, many of which drew on the environmental laws of European countries from the same period. Among these, South Africa's National Environmental Management Act (NEMA), enacted in 1998, has greatly influenced Southern Africa and even the entire continent. Numerous African countries use it as a model to formulate and enact similar laws [6]. African countries have strengthened their environmental protection efforts by incorporating the right to a healthy environment into their constitutions,

resulting in increasingly stringent penalties for environmental violations. They regard the right to a healthy environment as a fundamental human right, supported by special religious principles for environmental protection in dealing with ecological issues. The regulatory framework of typical countries is as follows:

South Africa is gradually forming a new framework under NEMA, which encompasses five specific laws targeting national conservation area management, air quality management, species protection and biological resource use, marine environment management, and waste management. However, due to historical limitations, South Africa has heavily relied on international treaties and historical legislation, leading to a certain resistance to change within its legal framework. Adapting to new systems for environmental protection will take time. In terms of environmental standards, South Africa's standards are widely recognized internationally, particularly in coastal and marine protection legislation. In the foreseeable future, South Africa is expected to establish further a leading position within the international environmental standard system, creating more regulations regarding resources and issuing specialized environmental standards, thereby developing a universally applicable environmental protection standard system [7].

Zambia's Environmental Management Act stipulates in Chapter Five International Affairs, that the government shall, within the limits of international law, exercise sovereignty and act within its territory and sovereign regions to collaborate with other local government agencies or international organizations to protect the regional and global environment.

Egypt adopts relevant standards from Western countries such as France, Italy, and Germany.

Uganda's National Environment Act outlines international obligations, including the implementation of environmental assessment treaties and cooperation in environmental management. In 2019, the country enacted a comprehensive environmental code to address emerging environmental issues such as climate change, hazardous chemicals management, biodiversity compensation, oil development activities, tourism activities, and environmental challenges related to plastic production and use. The code also incorporates strategic environmental impact assessments. According to the code, Uganda has established environmental protection police forces, with increased penalties for crimes defined under this law.

Kenya's environmental regulations are significantly influenced by international

policies, with signed international environmental treaties serving as the foundational guidelines for its domestic laws.

**(3)Europe**

The 16 countries in Central and Eastern Europe have all signed cooperation agreements with China under the Belt and Road Initiative. Among these, 11 countries, including Poland, Hungary, and the Czech Republic, are members of the European Union (EU). Most EU member states are developed countries with solid economic foundations and technical capabilities, alongside a strong commitment to environmental protection, resulting in more robust environmental policies and legal frameworks. Central and Eastern European countries that have joined the EU must comply with EU laws regarding environmental policies and legislation. Meanwhile, countries yet to join the EU strive to adopt EU laws and standards to facilitate early integration into EU frameworks. In 2021, the EU issued the Zero Pollution Action Plan Towards Zero Pollution for Air, Water and Soil. It outlines key goals to be achieved by 2030, with a vision of zero pollution by 2050. These goals also provide benchmarks and references for Central and Eastern European countries.

The legal and standard cooperation under the Belt and Road Initiative concerning the Central and Eastern European region includes developing regional water partnerships through the European Water Association (EWA) and collaborating with the World Meteorological Organization (WMO) on flood and drought response. These cooperations promote cross-border dialogue concerning the equality of environmental factors, the impacts of harmful substances, and resource forms. Additionally, Central and Eastern European countries aim to play a larger role in various regional organizations, such as the United Nations Economic Commission for Europe (UNECE), the International Water Assessment Center (IWAC), the United Nations Development Programme (UNDP), and regional NGOs such as the Coalition for a Clean Baltic, to better protect environmental resources. Countries in Central and Eastern Europe place significant emphasis on establishing environmental standards, particularly air quality standards. With the exceptions of Moldova and Bulgaria, most countries in the region, especially high-income ones, implement EU standards, which meet the guidelines or phased targets set by the World Health Organization (WHO). Countries in Central and Eastern Europe have also established close cooperation with the United Nations Environment Programme (UNEP) and the World Wildlife Fund (WWF).

**(4)Americas**

The extensive economic development and over-exploitation of forest resources have led to severe biodiversity loss, intensified greenhouse effects, sandstorms, soil erosion, and desertification in South America. The "Our Nature" Program developed by the Brazilian government in 1989 significantly impacted South American countries. They subsequently enacted relevant environmental legislation and joined international environmental conventions. Countries across South America have also entered into multilateral and bilateral treaties to collectively address environmental degradation. Recently, South American countries have formulated the latest environmental policies and enforced stricter regulations, with increasingly rigorous ecological management policies and continuously heightened environmental requirements. Environmental regulatory standards in typical countries are as follows:

Brazil, being relatively economically developed, boasts the most sophisticated systems of environmental management in the region. Its environmental agency (IBAMA) certifies standards for products and projects entering Brazil, mandating that any product seeking entry into Brazil must undergo dual testing for quality, safety, environmental impact, and emission standards by certification bodies authorized by the environmental agency. After that, a testing report must be submitted to the government approval department, and a corresponding certification (construction permit) must be obtained before sales or construction can proceed. To cope with climate change, Brazilian legal regulations concerning carbon emissions are being updated and revised.

Chile's National Environmental Commission publishes technical regulations regarding pollutant emissions based on standards from abroad, requiring certain products entering Chile to pass 3CV certification to access the Chilean market.

Colombia and Argentina have reformed environmental taxes and fees, encouraging commercial banks to cut loan interest rates for environmental infrastructure projects. Additionally, in response to the economic recovery in recent years and the unstoppable trend toward a global green energy-saving market, the governments in these two countries have introduced tax reductions for eco-friendly products[135] to attract cutting-edge technologies for environmental protection, enhance the efficiency of products and projects, and stimulate further development of the environmental protection market.

[135] The Argentine government will reduce the import tax on electric and hybrid vehicles from the current 35% to 2%.

### 1.2 Similarities and Differences in Environmental Legislation Among Countries

Due to significant differences in economic and political conditions, legal traditions, and cultural customs among countries, their environmental legislation reflects considerable diversity. In general, environmental legislation worldwide is evolving from a broad approach to more detailed regulations, evolving from policy declarations and fragmented frameworks to strict law enforcement and systematic regulations.

**(1)Asia**

**Southeast Asian countries have experienced rapid overall economic growth. However, due to imbalanced social and economic development, their environmental legislation varies significantly.** Overall, the environmental legislation in these countries started later and is less comprehensive compared to developed countries, with significant variations in legislative conditions. Specifically, Singapore has a strong environmental rule of law, whereas Indonesia, Malaysia, and Thailand have opportunities for improvement in their environmental protection laws and regulations. In contrast, Cambodia, Laos, Myanmar, and Vietnam are far behind in environmental legal frameworks: Issues such as water and air pollution are becoming increasingly severe; Solid waste management is still at an early stage. Moreover, these four countries face severe deficiencies in environmental infrastructure due to limitations in funding, technology, and management. As a result, they are classified as having underdeveloped environmental rule of law.

A. From the perspective of environmental legislation, Southeast Asian countries generally have a relatively comprehensive environmental legal system. First, they have enacted national environmental policy laws or basic environmental protection laws that incorporate environmental protection into national sustainable development plans. Examples include Malaysia's National Environmental Policy (2002), Myanmar's Environmental Protection Law (2012), and Cambodia's National Policy on Green Growth 2013-2030. Second, they have improved standalone legislation in pollution prevention and natural resource protection. For instance, Malaysia has issued environmental quality regulations regarding air, water, and solid waste under the Environmental Quality Act, while laws related to natural resource protection include the Fisheries Act 1985, the National Parks Act 1980, and the Wildlife Protection Act (1991). Third, investment laws or foreign investment laws incorporate

provisions related to environmental pollution and natural resource protection. For example, Article 4 of Myanmar's Foreign Investment Law includes restrictions or prohibitions on projects that harm the natural environment and ecological chain, projects involving the import of toxic and harmful waste, and projects that are restricted by international treaties and produce or use harmful chemicals

B. **Legislative Models: The environmental legislative models in Southeast Asian countries mainly include standalone laws, basic laws, comprehensive laws, and codification of environmental law.** Singapore's legal system is categorized under common law (Anglo-American legal system). Some aspects of its environmental legal framework adopt a standalone law model. For instance, ecological accountability legislation is based on the Environmental Pollution Control Act, resulting in a diverse legal structure and institutional framework.

C. Institutional Measures: In most Southeast Asian countries, the environmental institutional systems are based on fundamental legal norms, categorized into encouragement, licensing, restriction, and punitive regulations. These principles are implemented in law enforcement, judicial processes, and environmental law education. Given the diversity of developing countries and the complex characteristics of their ecosystems, their environmental systems focus on land, environmental protection, and marine ecology maintenance, covering various fields of elemental environmental rule of law. BRI participating countries' environmental legislative structures can be divided into generalized, integrated, and mixed systems. Some countries still yet to establish independent environmental legal systems. The foundational institutional development across these nations also emphasizes different aspects, generally established according to their own developmental needs and major demands for environmental protection.

**In Central Asia and West Asia, the development of environmental law is highly unbalanced with significant disparities.** Some countries, such as Kazakhstan, boast well-developed legal systems with comprehensive environmental codes and standards, while others lack substantial legal frameworks.

**(2)Africa**

Since the 1980s, particularly after the 1992 United Nations Conference on Environment and Development, many African nations have intensified their environmental legislation efforts. Most countries have built an independent environmental legal system. In terms of legal content, African environmental laws

mainly emphasize procedural laws, detailing the institutions, functions, and related processes for environmental protection. Substantive rights are often regulated by standalone laws or tort laws. Only countries influenced by civil law traditions, such as Egypt, have enacted comprehensive and substantive codes like the National Environmental Protection Law. Additionally, the environmental law evolution in African countries is marked by specialized legislation. For instance, there are acts specializing in wildlife protection such as Kenya's Wildlife Conservation and Management Act, Tanzania's Wildlife Protection Act, and Zimbabwe's Parks and Wild Life Act. Apart from that, the rapid development of regional international environmental legislation in Africa has resulted in various treaties, protocols, and agreements aimed at protecting the marine environment, freshwater resources, soil, forests, and biodiversity, and controlling the transboundary movement of hazardous waste. Notable agreements include a tripartite agreement signed by Kenya, Tanzania, and Uganda for the Lake Victoria Environmental Management Project and the 1995 SADC Protocol on Shared Watercourses. These international environmental legal documents signed by a few countries in the same region are integral to the domestic environmental laws of African countries. As contracting parties, they collectively commit to these agreements.

In addition, African environmental laws exhibit distinctive characteristics in constitutional recognition of environmental rights, judicial remedies for environmental issues, and the specialization of environmental trials. For one thing, constitutional environmental rights provisions are combined with basic environmental protection laws, building a judicial remedy system for environmental rights which enable public interest litigation in environmental matters to possess enforceability. 33 African countries have recognized environmental rights as fundamental civil rights and state responsibilities embedded in their constitutions. Kenia, South Africa, and Ethiopia, for instance, have safeguarded environmental rights through constitutional judicial remedies, balancing substantive and procedural rights. These countries treat citizens' environmental rights as the subject of public interest litigation in addressing the relationship between economic development and environmental protection, as well as the rights to environmental information and participation. They also relax restrictions on litigation subjects to allow more environmental non-governmental

organizations (NGOs) to participate in environmental protection practices[136]. For another, African countries have rich and specialized environmental legislation, supported by a system of specialized environmental trials [6]. Furthermore, there is a strict legislative and judicial safeguard system for environmental law across African nations. Especially, regarding environmental criminal liabilities, the thresholds for prosecution are progressively lowered. Nevertheless, there are significant discrepancies in the actual implementation of these laws because some countries have to lower standards to attract foreign investment.

**(3)Europe**

Europe comprises a large number of countries. EU member states follow relatively unified legal principles, while non-EU countries exhibit some discrepancies in environmental legislation. Relevant laws in several representative countries are as follows:

Serbia operates under a civil law system with a relatively comprehensive legal framework. Its foundational law is the new constitution passed by the National Assembly (Serbia) in November 2006. To expedite its accession to the European Union, Serbia has gradually adjusted relevant policies and laws since 2009 to align domestic regulations with EU legislation. Recently, Serbia has adopted the National Renewable Energy Action Plan to realize its environmental management and sustainable energy strategy framework, committing to increase the share of renewable energy in electricity generation to 27% by 2020. Other areas of environmental concern include natural conservation, climate change, water management, ionizing radiation, chemical management, and national park protection. Additionally, as a member of EWA, Serbia participates in studying and formulating policies related to water resources and environmental issues in Europe. The primary environmental laws in Serbia include the Environmental Protection Law, Law on Environmental Impact Assessment, Law on Strategic Environmental Impact Assessment, Law on Waste Management, and Air Protection Law.

Montenegro is gradually adopting and implementing EU legislation. It has passed the Air Protection Act, which includes regulations to limit emissions from fixed sources of air pollution as part of its efforts to join the EU.

Greece’s foundational environmental regulations include the Environmental

[136] The relaxation of the eligibility restrictions for environmental public interest litigation is a key reason why environmental NGOs and individuals in African countries can use the system to halt large local investment projects.

Protection Act (1986 Law No. 4042/2012 on Environmental Protection, Law No. 3983/2011 on Marine Environment Protection and Management, and Law No. 3937/2011 on Biodiversity Protection. These laws comply with EU Council Directive 92/43/EEC and the Regulation for Protection of Natural Habitats for Wild Flora and Fauna. Regulations concerning environmental impact assessments for investments include Law No. 1327/1983 on Air Pollution Control, Law No. 3199/2003 on Water Resource Protection, JMD50910/2727/2003 on Solid Waste Management, Law No. 2742/1999 on Coastal Protection, Law No. 2939/2001 on Packaging and Packaging Materials Management, and Law No. 4635/2019 on Investment in Greece, along with relevant EU directives on environmental protection [2].

### 1.3 Similarities and Differences in Environmental Standards Systems and Indicators

In general, host country governments require foreign investments and inbound commercial activities to comply with national and international laws, regulations, and standards. Governments universally issue strong guidelines for domestic investments, mandating environmental impact assessments for projects. Some countries require foreign investors to consider and address potential environmental impacts and risks, including biodiversity, climate change, and pollution in decision-making and risk management. They regulate based on several recognized international standards, such as the World Bank's Environmental and Social Policies and the International Finance Corporation's Performance Standards on Environmental and Social Sustainability. To prevent investments from flowing into high-pollution industries and exacerbating environmental risks, some countries that engage in foreign investments have also developed guidelines, regulations, and policies that consider environmental factors, ensuring that financial institutions and businesses focus on greener overseas investments. However, from the perspective of standards, indicators, and limits, some developing countries have inadequate standard systems, with pollutant emission standards often being relatively lenient. For these countries, the constraints of ecological and environmental protection on economic and social activities need to be strengthened. For example, Cambodia does not set particulate matter pollution indicators, while countries in Central Asia, West Asia, and the Middle East pay limited attention to CO and O3 levels [9].

**(1)Asia**

In Southeast Asia, environmental standards are commonly composed of

environmental quality standards and pollutant emission standards, but these standards tend to be lax. The focus on specific media varies among countries such as Indonesia, Thailand, Laos, and Malaysia. For instance, Indonesia places more emphasis on air quality and atmospheric pollution emissions; Thailand's environmental quality standards establish benchmarks for air, water, and soil quality, while its pollutant emission standards pertain to air and water environments. Malaysia's ecological and environmental standards include environmental quality and pollutant emission standards. The quality standards encompass air environment quality and noise levels, while pollutant emission standards cover air emissions and wastewater discharge. Regarding limit values for indicators, there are discrepancies across countries. For example, concerning PM2.5 in environmental air quality standards, countries adhering to the World Health Organization (WHO) air quality guideline of 25 μg/m³ include Singapore, Afghanistan, Belarus, Montenegro, and Iran; countries with stricter limits than the WHO's interim target 3 (37.5 μg/m³) are Kazakhstan, Russia, Pakistan, Armenia, Israel, Kuwait, and Saudi Arabia; whereas Malaysia, Bangladesh, India, and Jordan set concentration limits meeting the WHO's interim target 1 (75 μg/m³) [9].

In Central Asia and West Asia, wealth disparities among countries result in variations in the establishment and enforcement of environmental standards. Some countries, such as Iran and Afghanistan, impose stricter standards; for instance, their annual average PM2.5 concentration limits must comply with the WHO air quality guideline of 5 μg/m³, while many other countries still adhere to limits of 25 μg/m³ or 35 μg/m³.

**(2)Africa**

Egypt's Environmental Law requires all industrial investment projects to conduct preliminary pollution treatment for pollutants generated during their production processes and to meet corresponding emission standards. For example, wastewater must comply with domestic discharge standards before being released into public sewage systems. In 2005, the Egyptian government revised a large number of environmental standards stipulated in the Environmental Law when re-establishing the indicator system and evaluation criteria and introducing stricter pollutant emission standards, pollutant treatment methods, and pollution source management strategies. In 2009, the government again amended the Environmental Law to add environmental protection measures for coastal areas and ozone layer protection. The legislation places significant emphasis on marine pollution. The law mandates that pollutants

cannot be discharged into the sea under any circumstances unless they are at least 500 meters from the coastline. It also stipulates that discharges into fishing zones, swimming areas, or nature reserves are strictly prohibited. Ethiopia's Environmental Pollution Control Law of 2002, in Chapter Three titled Environmental Standards, specifies that national regional states may implement stricter environmental standards than those set by the federal government and they cannot adopt more lenient standards.

In many African countries, environmental legislation is strict and violations can lead to criminal charges more easily. However, the enforcement of environmental standards is often lax in some countries, as they still need to attract substantial foreign investment.

**(3)Europe**

The European Union's environmental standards system encompasses regulations for water, air, noise, solid waste, chemicals, genetically modified products, nuclear safety, radioactive waste, wildlife protection, and general standards. Each category includes a series of directives and/or regulations. The environmental standards for water, air, and noise cover both environmental quality and pollutant emissions, while those for waste, hazardous chemicals, nuclear safety, radioactive waste, wildlife protection, and general standards focus primarily on core environmental policies. Most requirements for monitoring methods and implementation plans related to environmental standards are outlined in directives and/or regulations on environmental quality standards.[10]

The core of water policy in Central and Eastern Europe is the EU Water Framework Directive (WFD), adopted in 2000. The WFD departs from traditional administrative boundaries by promoting integrated management at the watershed level and establishing a management authority for each watershed unit, helping to resolve inter-sectoral conflicts. Supporting policies include the Environmental Quality Standards Directive (2008), the Marine Strategy Framework Directive (2008), the Floods Directive (2007), the Groundwater Directive (2007), the Bathing Water Directive (2006), the Drinking Water Directive (1998), the Urban Wastewater Directive (1991), and the Nitrates Directive (1991).）[2]。Regarding air quality, most Central and Eastern European countries, particularly high-income ones, adhere to EU standards. However, Moldova and Bulgaria have not established their own air quality standards. The limit values in EU standards generally align with the guidelines or

phased targets set by the WHO. In the area of waste management, Central and Eastern European countries largely base their solid waste policies and regulations on EU legislation, including the Landfill Directive, the Waste Framework Directive, the Waste Incineration Directive, and the European Economic Community Product Liability Directive.

**Table 3 Relevant Strategies and Directives in the EU Environmental Protection Field (Partial Statistics)**

| Field | Main Strategies | Main Directives |
|---|---|---|
| Water | Blueprint for the Protection of European Water Resources (2012) | Urban Wastewater Directive (1991)<br>Drinking Water Directive (1998)<br>Water Framework Directive (2001)<br>Bathing Water Directive (2006)<br>Floods Directive (2007)<br>Groundwater Directive (2007) |
| Air | Thematic Strategy on Air Pollution (2005) | National Emission Ceilings Directive (2001)<br>Ambient Air Quality Standards and Clean Air Act (2008)<br>Air Quality Directive (2008) |
| Soil | Thematic Strategy on Soil (2006) | COM（2006）232 Directive |
| Waste | Thematic Strategy on Waste Recycling and Prevention (2005) | Landfill Directive (1999)<br>Waste Incineration Directive (2000)<br>Waste Framework Directive (2008)<br>Directives related to Manufacturer Liability |
| Biodiversity | 2020 Biodiversity Strategy (2011) | Habitats Directive (1992)<br>Zoo Directive (1999)<br>Birds Directive (2009)<br>Wildlife Trade Regulation on Invasive Alien Species (2014) |
| Climate Change | 2020 Climate and Energy Strategy (2009) | —— |

| | | |
|---|---|---|
| | EU Adaptation to Climate Change Strategy (2013) | |
| Sustainable Development | Sustainable Development Strategy (2001)<br>Resource Efficiency Roadmap (2011) | Renewable Energy Directive (2009)<br>Energy Efficiency Directive (2012) |

As Central and Eastern European countries progress toward EU membership, their legal frameworks in areas like energy, transportation, the environment, and climate change will gradually align with EU standards. For example, Serbia's environmental department has adopted EU environmental policy as its benchmark. Although Serbia is not yet an EU member, as a candidate country, it is required to meet various EU standards, including those related to environmental and labor protection. This is similar to the situation of other non-EU countries in the region.

## 2. Prospects for Promoting the Connectivity of Regulatory Standard Along the Belt and Road

Developmental disparities along *the Belt and Road*, along with fragmented international rules and standards, highlight the need to continuously identify gaps and foster innovation while building on existing international frameworks. At this new stage of development, *the Belt and Road Initiative* will focus on achieving high standards, improving livelihoods, and promoting sustainability. By enhancing regulatory and standard connectivity, the initiative aims to drive high-quality development in participating countries, ensuring that progress is inclusive, resilient, and beneficial to all stakeholders.

The regulatory and standard systems of participating countries will be further improved, and project investment requirements will become increasingly strict

**Countries are placing greater emphasis on environmental protection and green development, and the corresponding environmental legislation and standards will also become more refined.** Currently, environmental protection and green development are recognized as global priorities, prompting improvements in legal regulations and policy standards for environmental management across various countries. In Southeast Asia, countries like Singapore and the Philippines are aligning their environmental legislation and standards more closely with those of developed

nations, and this trend is expected to remain stable in the near future, although new legislation related to climate change may emerge. Meanwhile, countries such as Vietnam, Malaysia, Indonesia, and Thailand are increasingly tightening their environmental standards. Laos and Cambodia are in the earlier stages of developing their environmental legislation but are expected to advance rapidly, particularly Cambodia, which aims to establish an environmental code to strengthen its environmental legal framework. In Central and Western Asia, significant disparities in poverty levels contribute to uneven development in environmental law, resulting in substantial long-term differences in the strictness and effectiveness of environmental The EU has established a relatively comprehensive environmental regulatory system and standards framework, featuring some of the strictest regulations in the world. In addition to modifying existing regulations to meet environmental protection requirements, there will be a growing number of laws and standards focused on addressing climate change, with legislation promoting energy transition receiving further emphasis. Central and Eastern European countries, which have successfully transitioned and are currently transitioning, with some being EU members, will increasingly refine their environmental standard legislative systems, moving closer to EU standards.

In Africa, countries will gradually enhance their biodiversity protection and climate change legislation based on the constitutionalization of environmental rights, aligning with international convention requirements. Although there will be variations in the indicators required by environmental standards among countries, the overall environmental standards system will continue to improve. Notably, in Francophone African countries, the codification of environmental law has emerged as a significant trend. With rising public awareness of environmental issues, lawsuits for environmental protection are expected to become more frequent, increasing the risks of environmental litigation against foreign investments.

**A standardized and rigorous regulatory standards system further compels stricter environmental requirements for investment projects.** Southeast Asian countries are progressively enhancing their environmental laws and regulations, establishing legal frameworks for environmental impact assessments of construction projects. Some nations have implemented stringent legal provisions and penalties, setting higher standards for the environmental management of investment projects. Although Central Asian countries are still developing unevenly, prioritizing

ecological and environmental protection is becoming a key trend in their development. In their environmental practices, Central Asian nations focus on adopting internationally recognized rules and standards, with countries like Kazakhstan and Uzbekistan enforcing laws relatively strictly and systematically.

Most African countries have established independent environmental legal systems, leading to increasingly stringent management of investment projects. Notably, there has been rapid development in international environmental legislation across the continent, with numerous regional conventions, treaties, and agreements concerning marine and freshwater resources, soil and forests, and biodiversity. These regional legal documents form the framework of environmental law for African contracting parties, which must be adhered to collectively. Consequently, when investing in African countries, it is essential to pay particular attention to regional environmental management requirements.

Global responses to environmental issues such as climate change, regional cooperation, and the development of green finance will further promote the connectivity of regulatory standards

The international community places significant importance on addressing climate change. On June 30, 2015, the Chinese government submitted its " Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions" to the Secretariat of the United Nations Framework Convention on Climate Change, outlining China's voluntary action targets for 2030. Other countries around the world have also proposed climate targets based on their national conditions and development stages. These nations are formulating corresponding action plans to achieve their goals, and their commitments regarding climate issues, low-carbon transition objectives, and specific indicators will facilitate the connectivity of environmental regulatory standards.

The Belt and Road Initiative offers high-quality, orderly, and long-term stable support for regional development cooperation. Relevant standard operating procedures, such as green development guidelines for investment cooperation, are expected to initiate a wave of clean construction in the future. These standards will provide a solid foundation for mutual understanding among countries and regions along the Belt and Road, becoming vital tools for promoting awareness and measuring the environmental performance of projects. They will encourage green interactions among enterprises, urging compliance with existing harmonized

environmental laws and regulations, stimulating the market to adopt green technologies and innovations, and increasing societal acceptance of clean energy and green solutions. [11] The establishment of corporate green standards resulting from large-scale foreign investments will not only help narrow economic disparities between regions but also lead to the standardization and harmonization of environmental protection requirements.

Furthermore, the development of green finance will facilitate the connectivity of regulatory standards by promoting the establishment of green investment standards in participating countries and aligning them with internationally accepted benchmarks. The Belt and Road Initiative will also enhance the construction of interconnected information platforms, establish ecological and environmental information disclosure systems, share project green certification information, and develop technical guidelines for environmental and social risk assessments, all of which will provide substantial support for the connectivity of regulatory standards.

Issues and challenges in the connectivity of environmental regulatory standards among the countries along the Belt and Road

As mentioned earlier, while the emphasis on environmental protection by various countries provides a certain foundation for the connectivity of environmental regulatory standards, the disparities and complexities among countries within the Belt and Road region in terms of economic development, political systems, legal and religious frameworks, and environmental goals far exceed those in other regions of the world, presenting certain challenges to the connectivity of green regulatory standards. [12]

**Differences in economic development.** Most participating countries in the Belt and Road Initiative are developing nations that often prioritize economic growth over environmental considerations, given significant domestic development demands and the need to protect their own, regional, and global ecological environments. [13] Besides, limitations in environmental protection technologies and concepts can hinder the pursuit of win-win solutions that reconcile economic development with environmental protection. Variations in economic development levels lead to differing degrees of awareness regarding green development and varying emphasis on environmental protection, resulting in discrepancies in the strictness of regulatory standards and creating "misalignment" in their connectivity.

**Differences in political systems.** The variations in the political systems of

participating countries, including significant differences in institutional mechanisms, operational mechanisms, and management standards, lead to institutional barriers to the connectivity of regulatory standards. These obstacles hinder the full display and sharing of resources and information among countries on a common platform, affecting the precision of policy communication, and making it difficult to fully, reasonably, and efficiently release the benefits of environmental regulatory standards.[14]

**Differences in the traditions of legal systems.** The legal environment along the Belt and Road is complex and diverse, with participating countries primarily belonging to either the Anglo-American legal system or the civil law system. The influence of religion on the legal frameworks of these countries is also pronounced, as some Middle Eastern nations continue to adhere to Islamic law. The legal systems of participating countries are shaped by historical, cultural, religious, and geopolitical factors, resulting in a variety of characteristics. Generally, most Central Asian and Eastern European countries align with the civil law system, while South Asia and Southeast Asia primarily follow the Anglo-American legal system. Western Asian countries are predominantly based on Islamic law. In addition to differences between legal systems, significant disparities exist within the same legal system. These variations lead to differing approaches to environmental issues, particularly regarding legal disputes over cross-border environmental pollution. This divergence weakens the applicability of inter-regional legal standards and poses substantial obstacles to the connectivity of regulatory standards among participating countries.

**Differences in environmental protection goals.** The environmental protection goals vary among different regions and countries; some countries are dedicated to improving the environment, promoting efficient ecological governance, and maintaining high-quality environmental conditions, while others prioritize economic development, focusing on resource utilization to alleviate poverty and escape backwardness. Some countries have already made carbon neutrality their primary goal. The regulatory standards serving different environmental objectives find it challenging to converge, which also presents challenges to the connectivity of regulatory standards.

## 3. Recommendations for the Connectivity of Regulatory Standards in the Belt and Road Initiative

The connectivity of environmental regulatory standards will promote green, efficient, and sustainable development within *the Belt and Road Initiative.* Recognizing that there are existing foundations and motivations among participating countries, as well as notable challenges, this chapter offers recommendations to enhance the connectivity of regulatory standards along *the Belt and Road*. These recommendations focus on strengthening intergovernmental strategic cooperation, deepening basic research, and leveraging green financial tools.

**Continuously promote the alignment of green development strategies among participating countries to further form an international consensus on green development and the connectivity of regulatory standards.** Countries and regional organizations around the world have established green development strategies. For instance, the African Union adopted the *"Agenda 2063"* in Addis Ababa, Ethiopia, as part of the *"African Vision and Action Plan."* Similarly, the 27th ASEAN Summit approved the *"Kuala Lumpur Declaration: Towards an ASEAN Community 2025,"* introducing the *"2025 ASEAN Community Vision"* and the *"Blueprint for the ASEAN Economic Community 2025."* These visions, goals, and measures for green development in participating countries provide a foundation for building a green *Belt and Road*, fostering green development cooperation, and ensuring the connectivity of environmental laws and regulations. It is recommended to continue promoting the alignment of green development strategies among participating countries, widely establish green exchange and cooperation platforms, and consistently consolidate international consensus on green development and the connectivity of regulatory standards along *the Belt and Road.*

**Strengthen official cooperation on regulatory standards within *the Belt and Road Initiative* and encourage diverse folk exchanges, fostering a broad and multi-faceted cooperation framework.** Enhance dialogue and communication with participating countries on environmental protection regulations, systems, and standards by organizing training sessions, exchange workshops, and other activities to promote capacity building for green regulatory standards within *the Belt and Road* framework. Utilize platforms such as *the Belt and Road International Green Development Coalition* to implement projects that build capacity in laws and

regulatory standards, assisting host countries in improving their own green laws and standards systems, and enhancing their ability to formulate and enforce these standards. Establish a cooperative platform for green regulatory standards under *the Belt and Road*, creating a foundational database of environmental policies and regulations. In environmental industry cooperation, strengthen collaboration on regulatory standards by prioritizing the development of high-standard demonstration projects within overseas industrial and trade parks. Encourage civil environmental cooperation by empowering NGOs from various countries to participate actively in environmental protection efforts.

**Strengthen basic research on green regulatory standards for *the Belt and Road Initiative* and consolidate the foundation for connectivity at the technical level.** Building on a thorough understanding of the differences in the ecological and environmental regulatory systems of participating countries, it is essential to study and promote methods for aligning and cooperating on regulatory standards. This involves constructing comprehensive ecological and environmental standards systems, implementing environmental laws and regulations, and comparing environmental standards across key industries. Efforts should focus on improving the cross-border environmental governance legal system, emphasizing "environmental management + ecological conservation, natural disaster prevention, emergency response to environmental incidents, and environmental rights remedies (including environmental litigation)." An environmental management standards system should be developed that incorporates mandatory, recommended, and voluntary standards, while also promoting mutual recognition and alignment with international standards. Additionally, strengthening the development of think tanks focused on environmental management policies, laws, and regulations will be crucial in supporting these initiatives.

**Continue to promote mutual recognition of environmental standards.** Drawing on the “Equator Principles”, aim to reduce environmental risks in emerging countries by strengthening existing standards while considering their applicability and standardization. Enhanced cooperation with relevant departments in participating countries—such as regulatory agencies, investment institutions, and project developers—will be essential for gradually unifying green project financing, investment, and operational standards. Emphasizing the coordination and harmonization of cross-border standards will further support these efforts.

**Establish a series of high-standard environmental demonstration projects.** Prioritize the promotion of China's high environmental standards in cooperation with key *Belt and Road Initiative* projects, using large infrastructure construction and capacity cooperation projects to showcase and export China's advanced environmental standards. Platforms such as the China-Cambodia, China-Laos, and China-Africa Environmental Cooperation Centers should be leveraged to design and create high-standard demonstration projects in key countries like Cambodia, Laos, and Kenya. In the development of overseas industrial and trade parks, reference the standards of eco-industrial demonstration parks to facilitate the adoption of Chinese standards abroad.

**Leverage green finance to promote the implementation of high environmental standards.** The guiding role of green finance in supporting green and sustainable projects aids in the formulation, promotion, and enforcement of green standards. Accelerate the alignment of domestic green investment standards with internationally recognized benchmarks and raise requirements for standards through financial institutions, ensuring their strict implementation.

## References


[1]. Zhang, Hua, and Song, Mingshun. "The Belt and Road Initiative Fully Reflects Openness and Inclusiveness." China Social Sciences Journal, 2022.

[2]. Ministry of Ecology and Environment of the People's Republic of China, Center for International Cooperation and Exchanges, Wuhan University. "Belt and Road Environmental Policy and Regulation Blue Book (Southeast Asia Edition / Central and Eastern Europe Edition)," Belt and Road Environmental Technology Exchange and Transfer Center (Shenzhen), 2021.

[3]. Ben Boer and Ma, Liang. "International Environmental Law in the Asia-Pacific Region: A Regional Progress Overview." Environmental Law Review, 2020, 2.

[4]. Simon Marsden, Elizabeth Brandon. Transboundary Environmental Governance in Asia: Practice and Prospects with the UNECE Agreements (Edward Elgar 2015) 228, 230.

[5]. Roda Mush-kat. International Environmental Law and Asian Values: Legal Norms and Cultural Influences (UBC Press 2004) 127.

[6]. Hong Yonghong, Zhang Xiaohu, et al. Environmental Law of Ten African Countries. Social Sciences Academic Press, 2021.

[7]. China University of Political Science and Law. Executive Summary of the Blue Book on Environmental Regulations of the Belt and Road Initiative. China University of Political Science and Law, 2020.

[8]. International Alliance for Green Development along the Belt and Road. Guidelines

for Green Development of Belt and Road Projects - Baseline Research Report, Policy Research Special Report. 2020.

[9]. Li Linzi, et al. Comparative Study of Ambient Air Quality Standards in Countries along the Belt and Road. China Engineering Science, 2019 (4): 83-84.

[10]. Hu Bibin. Analysis of the Environmental Standards System of the European Union. Chemical Industry and Pollution Prevention, 2005, 25(3): 195.

[11]. Emmanuel Ugirashebuja. Environmental Challenges in Africa. Beijing: International Seminar on Environmental Law and Standards in BRI Countries, 2021.

[12]. China Development Bank. Legal Risk Report for Belt and Road Countries (Volume 1). Beijing Legal Publishing House, 2016: 1-4.

[13]. Zhang Tianze. Research on Environmental Rule of Law in Southeast Asian Countries along the Belt and Road. China University of Political Science and Law Postdoctoral Research Work Report, 2021.

[14]. Wang Shan. Study on the Quality Differences of Institutions in Countries along the Belt and Road. Journal of Shanghai Economic Management Cadre College, 2018(2).

# Part IV Policy and Action Recommendations

# Chapter 14 BRI Green Development Outlook: Policy and Action Recommendations

*The Sustainable Development Goals Report 2023: Special Edition* shows we are leaving more than half the world behind. Progress on more than 50 per cent of targets of the SDGs is weak and insufficient; on 30 per cent, it has stalled or gone into reverse. Ecosystem degradation and the problems caused by population growth, economic development, urbanization and resource-intensive production and consumption are having a complicated and lasting impact. This has posed severe challenges to environmental governance and climate change response. Unfortunately, the national, regional, and even global governance structure we have today, is unable to provide effective solutions to reverse the trend.

At this crucial moment, the Belt and Road Initiative (BRI), especially the "Green Silk Road", allow us to see new possibilities from a new perspective. While delivering on the people's aspiration for a better life in BRI participating countries, the Green Silk Road also facilitates the achievement of the UN Sustainable Development Goals. It will bring vigor and vitality to the world in the new era. China will work together with BRI participating countries to build a closer partnership for green development. We will promote alignment of policies, regulations and standards, strengthen cooperation on green infrastructure, green energy, green transport and green finance, and improve capacity building for green development to facilitate green and low-carbon transition in developing countries, improve the global environmental governance system, and make new contributions to the building of a community of life for man and nature.

## 1. Integrate into the global governance process, align with the United National Agenda for Sustainable Development and other global and regional development goals

To effectively protect global ecology and environment, countries in the world must stand together through good and bad and work to build an environmental system that puts nature and green development first. As the largest developing country in the world, China has pursued sustainable development under the vision of building an

ecological civilization. The thought is also an effective solution offered by China to global climate governance. Going ahead, while actively participate in global environmental and climate governance itself, China will also promote the participation of BRI partner countries through advancing the building of a green Silk Road. China and BRI participating countries will help each other in times of difficulty and assume both rights and responsibilities. China will coordinate the efforts of all to uphold a fair and equitable international governance system, improve the quality of global environmental governance, and provide new perspectives and solutions to the implementation of the *UN 2030 Agenda for Sustainable Development* worldwide.

In the future, we should promote synergy between the Green Belt and Road Initiative and other global cooperation initiatives (e.g. Global Development Initiative, B3W, Global Gateway) and regional development plans (e.g. ASEAN Community Vision 2025, African Union's Agenda 2063). We should further align the Green BRI with the *UN 2030 Agenda for Sustainable Development* to support BRI participating countries to implement global environmental conventions (e.g. *Convention on Biological Diversity*, *Paris Agreement*). We should also improve the execution and management of the Kunming Biodiversity Fund to provide new paradigms and good practices to help developing countries to avoid reliance on traditional development paths and lock-in effect, and enable more countries to adopt and implement sustainable development actions.

## 2. Build platforms for exchange and cooperation, foster a closer partnership for green development

The development of the Green Silk Road needs to fully consider resilient economic growth in the post-epidemic era and the realistic needs of ecological conservation for BRI partners. Building exchange and cooperation platforms for green development is a key to match supply and demand, and could further build international consensus on green development. In the future, the development of the Green Silk Road needs to further deepen multilateral cooperation, strengthen its development and South-South cooperation, synergize with green development strategies of BRI partners and regional cooperation initiatives, expand consensus of all to greatest possible extent, share concepts and practices of green development, and jointly develop a system of global environmental governance featuring more equity,

justice and inclusiveness. Based on multilateral agendas, such as the *United Nations Framework Convention on Climate Change* and the *Convention on Biological Diversity*, greater synergy will be forged through coordination between economic development, eco-environment conservation and climate change response. Green development will be promoted to build a clean and beautiful world for all based on platforms for dialogue, such as the BRI International Green Development Coalition (BRIGC) and the Belt and Road Energy Partnership. Fully leverage the roles of intergovernmental cooperation platforms, such as China-ASEAN Environmental Cooperation Center, Lancang-Mekong Environmental Cooperation Center, China Centre for SCO Environmental Cooperation and China-Africa Environmental Cooperation Centre in improving the overseas network of focal points for BRI environmental cooperation. With the help of China-ASEAN cooperation, Shanghai Cooperation Organization, Lancang-Mekong cooperation, Eurasian Economic Forum, Forum on China-Africa Cooperation (FOCAC), China-Arab Cooperation Forum and other cooperation mechanisms, regional eco-environmental exchanges will be strengthened.

On the other hand, closer bilateral cooperation will also provide momentum for developing the Green Silk Road. It is necessary to deepen cooperation with governments of BRI partners, coordinate green development strategies, policies, laws, regulations and standards, continuously improve the level and standard of cooperation, and explore more efficient cooperation mechanisms. Strengthen research on key issues of green development, and bilateral dialogue and communication, and promote exchanges and cooperation in environmental management systems, and environmental industries and technologies. Based on existing BRI cooperation documents and strategic agreements on bilateral cooperation signed by China and BRI partners and international organizations, pragmatic cooperation under existing frameworks of bilateral environmental cooperation will continue to be promoted. With a focus on the actual needs of eco-environmental cooperation for BRI partners, bilateral green and low-carbon demonstration projects will be created, and exploration will be made to replicate and roll out best practices to more BRI partners.

## 3. Establish mechanisms to develop greater synergy in strategies, promote convergence and interactions of policies, rules and standards

Policy connectivity is the foundation for developing the Green Silk Road. Multi-tiered and all-round alignment and interactions of strategies, policies, rules and standards can better take into account the different interests, needs and concerns of various countries, and fully integrate with the goals of green and low-carbon development of BRI partners at the policy level. It is suggested that mechanisms building synergy for BRI should be strengthened, strategic alignment and implementation promoted with aligned policies, plans, standards and technologies, and dialogue and exchanges strengthened with stakeholders of BRI partners, such as government departments, financial institutions and enterprises, to meet cooperation needs and complement advantages of green development at home and abroad. Tell green stories of BRI well, share China's ideas of green development and green solutions to create synergies for cutting carbon emissions, reducing pollution, expanding green development, and stimulating economic growth, and deepen exchanges and cooperation with BRI partners in climate change response, biodiversity conservation and green supply chains.

To better promote convergence and interaction of policies, rules and standards for the Green Silk Road, this report has the following proposals. First, jointly prepare eco-environmental protection plans with BRI partners. Jointly develop plans for eco-environmental conservation and green development with BRI partners that have formulated plans for infrastructure connectivity and production capacity cooperation, and have prominent eco-environmental problems. Prepare relevant plans together during new cooperation in the future to ensure that concepts of green development are fully integrated into BRI cooperation. Second, promote cooperation over and application of eco-environmental standards. Strengthen coordination and connectivity of green infrastructure standards between China and BRI partners, conduct joint research, and develop international standards recognized by BRI partners in the fields of green transportation, green buildings and green energy. The Belt and Road Environmental Technology Exchange and Transfer Center (Shenzhen) and demonstration base for environmental technology and industrial cooperation could support enterprises to work with BRI partners on eco-environmental technology, and

jointly formulate and publish eco-environmental industry standards recognized by both sides with relevant industry associations. Third, promote technical benchmarking among BRI projects. Most of the BRI projects are transnational ones, and they face a series of complex issues in development due to technical limitations. The establishment of special committees could be explored to formulate key unified BRI technical standards and strengthen standard alignment and mutual recognition. Vigorously promote and apply demonstration projects for key green industries and technologies that have a positive impact on eco-environment.

## 4. Establish green investment mechanisms to guide and promote the development of green investment and trade

According to the *Financing for Sustainable Development Report*, average global growth has declined, while policy and regulatory frameworks still do not set appropriate incentives. Public budgets and spending are not fully aligned with SDGs. Private investors are not incentivised to invest enough in SDGs and climate action. Green finance can mobilize funds to support green industries and projects, and has become a priority area in the development of the Green Silk Road. At present, green investment in BRI partner countries and regions is an area of widespread focus, with bright prospects for green industries. Among them, green finance could effectively increase investment in energy infrastructure and clean energy technologies, and support additional multi-channel fundraising for developing countries as BRI partners.

In the future, the role of green finance should be further leveraged and investment quality improved. It is necessary to actively prevent social and environmental risks for projects with financial tools, do a good job in environmental information disclosure, strengthen management for environmental risks of projects, and make outbound investment greener. Motivate financial institutions and enterprises to promote green transformation of investment cooperation, and improve financial feasibility of projects with such tools as mixed financing, thus launching projects at a faster pace. Support and guide financial institutions and key enterprises to establish management systems for green investment, incorporate factors such as environment, climate and biodiversity into the entire process of project management, internal governance structure and risk management of financial institutions, and clarify green standards and operable evaluation guidelines. Improve “software connectivity” with

BRI partners on green project screening, environmental, social, and governance (ESG) evaluation, environmental and climate information disclosure, and create an enabling investment environment.

On trade, it is proposed to enhance trade facilitation for environmental products and services, and promote green development throughout the entire industrial chain, from production, circulation to consumption, by developing a BRI green supply chain cooperation platform, and improve sustained production and consumption of BRI partners with trade eventually, which could gradually improve the efficiency of resource utilization for consumption and production of BRI partners and global industrial chains.

## 5. Establish project management mechanisms, prevent environmental risks in infrastructure development

Many BRI projects need to pay special attention to preventing and controlling risks from climate change and biodiversity in the medium and long term because of their long cycles. In recent years, China has continuously improved eco-environmental management of BRI development, and promoted compliance with internationally accepted or China's higher environmental standards for BRI construction and outbound investment and cooperation projects, attesting to China's confidence and determination to take profound and real measures for the Green Silk Road. Implementing eco-environmental management mechanisms for specific projects is a vital starting point to prevent environmental risks for BRI. On one hand, it is necessary to implement the management mechanism of BRI projects based on classification and categorization. We should establish an eco-environmental management database of BRI investment projects, incorporate factors influencing eco-environment into the risk assessment system of BRI projects and conduct risk assessment. We should also clarify the degree of eco-environmental impact and evaluate environmental benefits of investment projects from the dimensions of ecological security and environmental pollution. On the other hand, it is necessary to explore and develop environmental management tools for BRI construction projects. Develop tools for identifying, evaluating, monitoring and managing environmental, climate and social risks of investment projects, and study tools for investment consulting services, covering policies, regulations, data and information. Based on the

BRI Environment Big Data Platform, eco-environmental information systems and evaluation tools are introduced for major countries of BRI investment and tools developed for technical support, making public environmental data more readily available. Conduct comprehensive, in-depth and detailed assessments of eco-environmental risks in Eco-Sensitive Zones (ESZs) or Ecologically Fragile Areas (EFAs), provide lists of risks and control measures, and ask investment projects to implement the tasks and follow requirements from the lists. On scope of assessment, based on current global concerns and the principle of voluntariness, environmental assessment are encouraged to include ecological health and climate change, among other factors.

## 6. Fully tap cooperation potential, support green and low-carbon transformation of BRI partners with innovative tools

Focus on actual needs of BRI partners and build complementary advantages in green development. Develop strategic synergy and project cooperation tailored to local conditions. Based on economic development level, natural resource endowment and green and low-carbon transformation plans of countries, China's technological advantages and practical experience in green development could be leveraged, and priority areas of cooperation determined based on national conditions and in response to the needs of BRI partners according to changing circumstances.

On one hand, focusing on key areas such as green energy and green finance, support BRI partners in seizing green development opportunities, actively cultivate growth areas in green transformation, integrate into global green industrial and value chains, and enhance standards and abilities of green investment and financing. Develop green technologies driven by innovations, give full play to China's advantages of market and development experience in global clean energy market, vigorously promote innovation, development and transfer of clean energy technologies, strengthen investment and trade cooperation with BRI partners in clean energy, build a more systematic and developed BRI industrial and technical cooperation mechanism for clean energy, and support BRI partners in their development of green and low-carbon energy systems. Second, rely on cooperation resources and platforms, such as investment and financing partnership for green development, and green and low-carbon expert network. Focusing on the realities and

needs of BRI partners, efforts will be made to resolve difficulties for green development, such as shortage of funds and technologies, and support Chinese enterprises and BRI partners in well aligning and launching demonstration projects in the fields of NEVs and green technologies. Finally, give full play to the spillover effects of China's carbon trading markets, explore demonstration projects of carbon markets with Southeast Asian and other major countries, and support BRI partners with innovative tools to achieve win-win results in carbon reduction and economic development.

## 7. Enhance project sustainability and jointly foster a community of life for man and Nature

Creating synergies for ecological conservation and pollution control is the premise of pursuing greener BRI cooperation and sustainable development. In the future, it is necessary to improve the system of eco-environment governance and management, strengthen cooperation in preventing air, water and soil pollution, continuously improve eco-environment quality, control sources of pollution, strengthen ecosystem protection and restoration, and create synergies for cutting carbon emissions, reducing pollution, expanding green development, and stimulating economic growth. Enterprises will continue to receive guidance in improving eco-environmental management capabilities, and strictly abiding by environmental laws, regulations, rules and standards of the host country to jointly safeguard regional eco-environmental security.

Facing the two global challenges of biodiversity loss and climate change, the Green Silk Road will offer solutions for developing countries. On boosting biodiversity conservation in a coordinated manner, China will earnestly implement the *Convention on Biological Diversity*, promote the Kunming-Montreal Global Biodiversity Framework, form synergy for biodiversity conservation and governance, and start a new process of global biodiversity governance that is fairer and more equitable and with each doing its level best. Give full play to the role of the Kunming Biodiversity Fund, and support the formulation and revision of strategic plans related to biodiversity for BRI partners, improving biodiversity-related capacity building, information exchange, and matching funds and projects.

On coordinated actions to address climate change, under the framework of the

Green Silk Road, China will provide financial, technical and capacity support for BRI partners to the best of its capacity, and provide solutions to climate change and achieve SDGs. Work with BRI partners to achieve the full, balanced, effective and sustained implementation of the *United Nations Framework Convention on Climate Change* and the *Paris Agreement*, share best practices, policies and measures on climate change response, and help build a fair and rational global climate governance system directed towards cooperation and win-win results. Continue to implement the Belt and Road South-South Cooperation Initiative on Climate Change, develop low-carbon demonstration zones, implement projects to mitigate and adapt to climate change, provide relevant assistance for climate change response, work with BRI partners to enhance abilities to address climate change, and work together to protect the earth, a common homeland for humanity.

## 8. Build closer people-to-people ties, help BRI partners with green capacity-building

Capacity-building provides support and guarantee for green development, and an internal basis for improving the standard of green development of BRI partners. In the future, the Green Silk Road will closely focus on the practical needs of green growth and low-carbon development for BRI partners, promote cooperation and exchanges in environmental policies, legal systems, talent exchanges, and demonstration projects, among others, jointly strengthen capacity building for green development, and help BRI partners improve internal driving forces for green development. Focus on priority areas such as environmental management, biodiversity and ecological conservation, climate change response, green finance, green transportation and sustainable infrastructure development, and carry out more targeted capacity-building activities, such as the Green Silk Road Envoy Program and the BRI Green Talent Program to help BRI partners improve their eco-environmental management capabilities and gain the acceptance of local communities. More support will be offered to train talents for green BRI development, foster a number of high-calibre, versatile talents with global vision in the field of ecology and environment for BRI partners, and build an intellectual support system for green development.