



China Council for International Cooperation  
on Environment and Development

# SPECIAL POLICY REPORT

## Green Opening-up and South-South Cooperation



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**China Council for International Cooperation on Environment  
and Development (CCICED)**

# **Green Opening-up and South-South Cooperation**

**CCICED Special Policy Study Report**

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## Executive summary

At present, global public issues are intertwined, and the systemic impacts of climate change and environmental degradation are evolving profoundly, highlighting the vulnerability of public systems and governance capabilities in developing countries under multidimensional challenges. South-South cooperation has always played a vital role in responding to global challenges. Through extensive cooperation among the global South in the fields of politics, economy, society, culture, environment and technology, developing countries share knowledge, skills, expertise and resources through joint efforts to achieve their development goals. In addition to the imminent challenges such as climate change, developing countries generally face multiple challenges such as poverty eradication, infrastructure improvement, employment increase, energy shortages, etc. The North-South development gap continues to widen, and they are in urgent need of financial, technical and capacity building support.

China has always played an important leading role in South-South cooperation, and China's own development has brought new opportunities and development ideas to other developing countries. In the process of promoting high-level opening up, China has carried out extensive cooperation with developing countries in the field of green and sustainable development through initiatives such as building a green Silk Road and launching global development initiatives, setting a good example for global South-South cooperation. In the future, China's technological advantages in new energy development and the strength of China's overseas investment will allow China to further expand its leadership role through green South-South cooperation.

From a regional perspective, developing countries in Southeast Asia, Africa, Latin America and other regions are facing the dual challenges of development and climate change. At the same time, they are also experiencing economic transformation and post-epidemic green recovery, which has released huge demand in infrastructure construction and industrial development. For example, ASEAN countries have set an overall emission reduction target of reducing energy intensity by 32% from the 2005 level by 2025, and making renewable energy account for 23% of ASEAN's total primary energy supply and 35% of total installed power generation capacity. In Africa, more than 90% of countries have submitted national voluntary contribution targets to the United Nations Framework Convention on Climate Change, 70% of countries have set very specific renewable energy targets, and more than 25% of countries have committed to achieving net zero emissions targets. South-South cooperation can help these regions cope with dual challenges. Taking investment as an example, China's investment in Southeast Asia, Africa and Latin America in 2021 was US\$50.88 billion, accounting for 33.1% of China's outbound investment that year. Therefore, this study will focus on and enter Southeast Asia, Africa and other regions, summarize the contribution of South-South cooperation in promoting local economic and social development, and provide a research basis for promoting wider and deeper cooperation in the global South.

CCICED established a special policy study on "Ecological Civilization and South-South Cooperation" in 2016, which comprehensively reviewed the practical achievements and

challenges of China's South-South cooperation, drew on the experience of developed countries in development aid, analyzed the needs of developing countries and the priority areas for China to carry out South-South cooperation under the concept of ecological civilization. In recent years, with its own development and changes in the international situation, China's cooperation with developing countries - whether it is foreign aid or more diversified participation methods such as trade, loans, and investment - is undergoing transformation. In 2024, China and the "Global South" regions such as Africa, ASEAN, and Latin America will usher in many important opportunities, such as the 10th anniversary of the Forum on China-Africa Cooperation and the China-CELAC Forum.

In this context, the topic of green opening-up and South-South cooperation will focus on two aspects: on the one hand, it intends to focus on cooperation in the field of green development, summarize the progress and achievements of China's South-South cooperation, identify the needs and challenges of developing countries in responding to climate change, renewable energy development and other fields with a focus on Africa, Southeast Asia, Latin America and other regions, seek opportunities for win-win cooperation, and create a new paradigm of South-South cooperation in the new development stage; on the other hand, with the help of the multilateral cooperation network of CCICED, share the research results related to South-South cooperation, summarize and share the experience and lessons of China's ecological civilization construction, and work with developed countries to help developing countries achieve green and inclusive transformation. South-South cooperation is a mutually beneficial and win-win process that requires consensus and mutual cooperation. This study will not only provide policy recommendations for the Chinese government to carry out green South-South cooperation in the new era and new situation, but also focus on the government departments of southern countries and provide docking recommendations for the governments of developing countries to cooperate with China. At the same time, the research will focus on promoting the construction and promotion of the global industrial chain of renewable energy. It will dock with China's overseas cooperation and investment, especially bilateral and regional cooperation, to help China's green technology and green capital go global and promote the implementation of global development initiatives and the construction of a green "Belt and Road".

The first chapter of the report starts with the development of South-South cooperation, systematically outlining the development of South-South cooperation in China and the global context, as well as the interaction between South-South cooperation and North-South cooperation, explores the necessity of China to promote green opening and South-South cooperation and the current management basis, and put forward countermeasures and suggestions for enhancing China's green opening and South-South cooperation. Chapter 2 and Chapter 3 focus on ASEAN and Africa respectively, assessing the main challenges and opportunities of China-ASEAN and China-Africa green South-South cooperation, especially in the development of renewable energy, green industrial parks, key minerals and environmentally friendly product manufacturing (especially new energy vehicles, lithium batteries and photovoltaic products); review and summarize the successful experience and difficulties of China-ASEAN and China-Africa climate action and green development cooperation. Finally, the

report provides policy recommendations for the governments of China, ASEAN countries and African countries to strengthen the mutual benefit and win-win situation of green development cooperation and climate action.

The policy recommendations are summarized as follows:

## **I. Develop a Roadmap for Promoting Green Opening-up and South-South Cooperation**

In the short term, enhance high-level coordination mechanisms for green opening-up and South-South cooperation and mainstream these efforts across various international cooperation activities. Leverage platforms like the "Green Development Investment and Financing Partnership" and innovative financial tools such as blended finance to increase private sector investment and expand South-South cooperation funding channels, including concessional public resources for low-income countries. Ensure comprehensive pre-feasibility assessments for energy projects before development. In the medium term, consider the needs of developing countries and China's comparative advantages in the green sector to formulate policy frameworks and development strategies for key countries and industries. Explore trilateral cooperation and adopt a new problem-oriented cooperation model, moving away from traditional state-centered approaches. Focus on addressing climate change and sustainable development to unite global South countries and enhance the responsiveness of multilateral institutions to their needs. In the long term, improve full-process management of green opening-up and South-South cooperation. Integrate environmental, social, and governance (ESG) impact indicators into the evaluation system during the project initiation phase. Develop a comprehensive legal system, policy planning, and industry guideline framework during the project implementation phase. Incorporate post-evaluation mechanisms based on ecological impact, technology transfer level, and contributions to local green development transformation during the project operation phase.

## **II. Accelerate and Enhance China-ASEAN Renewable Energy Cooperation**

Firstly, establish a comprehensive strategic partnership for the development and interconnection of clean and green energy infrastructure between China and ASEAN. Secondly, promote technology transfer through technical assistance and investment cooperation, accelerating the deployment of industrial decarbonization measures such as green power and green processing. Transform Indonesia's nickel mining production facilities' captive coal-fired power plants as a pilot for China-ASEAN low-carbon industrial cooperation. Thirdly, utilize the China-ASEAN Clean Energy Cooperation Center as a platform for knowledge sharing and capacity building to promote the development and incubation of new energy technologies tailored to ASEAN's needs. Fourthly, formulate regional guidelines for transforming production models of key minerals and green supply chains for clean energy technologies. Encourage and guide sustainable investment practices within the region, leveraging China's and ASEAN's respective green finance classification standards. Fifthly, establish dedicated, rapid-response project support channels and mechanisms to reduce financial risks in renewable energy project development and facilitate project financing.

### **III. Unlock the Potential of China-Africa Renewable Energy Cooperation**

Firstly, utilize high-level dialogues such as the Forum on China-Africa Cooperation (FOCAC) to expand cooperation in renewable energy, including solar photovoltaics and wind energy. Formulate overseas renewable energy installation and investment targets, proactively addressing green trade, green production capacity, and critical minerals. Secondly, Expand and diversify financing models for green development in Africa, offering low-cost, patient, and efficient climate investment and financing, especially for small and impactful projects. Thirdly, support Africa in creating a favorable business environment for green and low-carbon cooperation, helping integrate Africa into the global environmental product supply chain. Facilitate the establishment of joint ventures and nurture African green manufacturers to promote industrial chain localization. Fourthly, enhance the development capabilities of Africa's renewable energy manufacturing sector, implementing the "using renewables to promote renewables" model in renewable energy industrial parks. Promote the use of renewable energy in power supply for industrial parks and the development of new energy equipment manufacturing industries. Fifthly, Strengthen Africa's capacity for renewable energy development, including assisting African governments in formulating sound investment policies. support talent cultivation in Africa's solar photovoltaic and related key industries through programs such as the "Green Silk Road Envoy" plan and the "Belt and Road" ecological talent exchange plan.

### **IV Leverage the Opportunities of China-Brazil Cooperation**

Firstly, to advance Brazil-China collaboration on sustainable development, we create a task force within the "China-Brazil High-Level Coordination and Cooperation Commission", with public and private stakeholders, to discuss measures that can positively impact and further encourage decarbonization-linked Chinese foreign direct investment and Sino-Brazilian trade. The task force would explore concrete opportunities such as: the recovery of degraded pastureland; achievement of deforestation-free and conversion-free agricultural commodity production; the development of downstream industries connected to strategic minerals; Brazil's clean energy competitiveness for energy intensive industries – green fertilizers, green data centers, sustainable maritime fuels; and sustainable aviation fuels. Secondly, Discussions will aim at Sino-Brazilian initiatives to be announced in the context of upcoming high-level meetings between Brazil and China: China's State Visit to Brazil in November 2024; COP30 and BRICS Summit in Brazil in 2025. The recommendations of the task force should be included as the outcome of these high-level dialogues as the outcomes. Thirdly, building upon the advantages of mineral resources in Latin America, we will vigorously develop battery manufacturing and green transportation industries, attract green investment, and establish the local low-carbon industry system.



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# Green Opening-up and South-South Cooperation

## Introduction

As a major developing country, China has consistently been a staunch supporter and active participant in South-South cooperation, advocating for the sharing of development experiences and the promotion of economic and trade development among developing countries. For decades, China has actively facilitated the exchange of knowledge, experience, policies, technologies, and resources among southern countries. This cooperation spans various fields, including climate change, agriculture, health, and infrastructure.<sup>[1]</sup> Dima Al-Khatib, Director of the United Nations Office for South-South Cooperation, highlighted during the high-level meeting on the outcomes of the Global Development Initiative at the 78th United Nations General Assembly that China's steadfast support for South-South and triangular cooperation and its success in eradicating extreme poverty have set an example for other developing countries.<sup>[2]</sup>

Green development, as a critical aspect of global sustainable development, requires collaborative efforts from all countries. The achievement of significant international agreements such as the Kyoto Protocol and the Paris Agreement, along with global support for the United Nations 2030 Agenda for Sustainable Development, underscores the collective responsibility and obligation to advance green governance. This cooperation is essential in both North-South and South-South contexts to foster international cooperation for green development.<sup>[3]</sup> This section will review the development trajectory of South-South cooperation from a global perspective, examining the historical progress of South-South cooperation involving China and the world.

## Chapter 1 Conceptual Framework of South-South Cooperation

### 1 History of South-South Cooperation

In the global context, China is a vital supporter of the Global South and a key player in promoting South-South cooperation. With nearly 70 years of history in South-South cooperation, China's international development efforts have evolved and expanded alongside the broader process of South-South cooperation. To understand the transformation in the mode of cooperation between China and other developing countries, as well as their mutual influence, political context, and China's role, it is essential to analyze the historical development of South-South cooperation in China. This analysis will highlight the inevitability and rationality of the evolution of China's South-South cooperation model. Furthermore, it is important to compare the demand for cooperation within the Global South with the challenges of North-South cooperation during the same period.

#### 1.1 History of China's South-South Cooperation

Between 1955 and 1972, from the Bandung Conference to the pre-Reform and Opening-up period, Chinese South-South cooperation was primarily focused on political and diplomatic objectives, characterized by non-reimbursable assistance.<sup>[4]</sup> After the United Nations General Assembly divided the world into two camps, the South and the North, in 1948, the countries of the emerging South began seeking ways to cooperate as independent and sovereign states.<sup>[5]</sup> The Bandung Conference, held in April 1955, was the first international conference of independent Asian and African nations, aimed at opposing colonialism and fostering synergy among developing countries. This conference symbolized the emergence of the Third World and marked the beginning of South-South cooperation. During this period, South-South cooperation was largely driven by political-diplomatic considerations.<sup>[6]</sup>

After the founding of People's Republic of China, the global political landscape included socialist and people's democratic countries led by the Soviet Union, capitalist countries led by the United States, and newly sovereign nations in Asia, Africa, and Latin America that had emerged from national liberation movements against colonialism.<sup>[7]</sup> As an emerging socialist country, China sought to expand its international partnerships through South-South cooperation. Therefore, China actively supported the 10 principles of the Bandung Conference, emphasizing respect for national sovereignty and breaking out of its diplomatic isolation.

During this period, China's South-South cooperation was largely grant-based and equated to foreign aid, with the primary goal of maintaining the sovereignty of Southern countries.<sup>[8]</sup> Over time, the scope and content of China's South-South cooperation expanded. Initially focused on key partner countries, it grew to include cooperation across the Asia-Pacific region and transitioned from a focus on political diplomacy to encompass economic and technical cooperation.<sup>[9]</sup>

After the reform and opening-up, economic and technical cooperation has gradually become a crucial element of China's South-South cooperation.<sup>[10]</sup> As China entered the stage of developing a socialist market economy, Southern countries began to recognize the importance of regional cooperation and participation in international economic cooperation as they successively attained national sovereignty. These countries have increasingly valued cooperation among themselves, establishing regional economic cooperation organizations such as the Economic Community of West African States (ECOWAS), the Latin American Economic System (SELA), and the Gulf Cooperation Council (GCC).

China has increasingly prioritized mutual economic benefit in South-South cooperation, actively promoting economic and trade cooperation among Southern countries through various means, including trade cooperation, monetary and financial cooperation, and technical cooperation. In the 1960s and 1970s, developing countries initiated the establishment of cooperation mechanisms such as the United Nations Conference on Trade and Development (UNCTAD) and the New International Economic Order (NIEO) to promote a more equitable global trading system. The goal of economic and trade cooperation among the countries of the South was to eliminate inequalities that had favoured developed countries under frameworks such as the General Agreement on Tariffs and Trade (GATT) and the Washington Consensus. By the 1990s, developing countries in Asia, Africa, and Latin America had established numerous regional cooperation platforms aimed at enhancing regional economic and trade cooperation and strengthening economic and technical exchanges among Southern countries.

As China's economic and technological strength has advanced, its participation in international scientific and technological organizations has expanded significantly. From a total of 70 organizations before 1977, China's participation grew to 850 between 1978 and 1993. By 2008, China had signed 103 intergovernmental agreements on scientific and technological cooperation or economic and technological cooperation with 96 countries and regions.<sup>[11]</sup>

This shift towards economic and technical cooperation in South-South cooperation not only enhances China's participation in international economic and technological cooperation but also brings it closer to developing countries, diversifying its approach to promoting South-South cooperation.

Since the 18th National Congress of the Communist Party of China (CPC), the development cooperation model of mutual benefit and win-win cooperation among the global South has not only promoted common development among Southern countries but also injected new momentum into global development. Economically, China has built on the foundation of regional economic and trade cooperation among Southern countries, actively advocating for the reform of the international economic system dominated by Western countries and enhancing the voice of Southern countries in the international economic order.

China has taken an active role in leading the South-South cooperation process, exemplified by hosting regional exchange platforms like the BRICS Summit, the Forum on China-Africa Cooperation, and the Forum on China-Latin America Cooperation. Concurrently, emerging countries, with China at the forefront, are

endeavoring to establish international financial institutions tailored to the developmental needs of Southern Countries. Innovative mechanisms such as the Asian Infrastructure Investment Bank and the BRICS New Development Bank, championed by China, have injected fresh momentum into the economic growth and enhancement of people's livelihoods in developing nations. Beyond financial system construction, infrastructure development remains a crucial pillar supporting the economic advancement of developing countries. This aligns with the core focus of the Belt and Road Initiative, with over half of current South-South cooperation initiatives concentrated in the realm of infrastructure development.<sup>[12]</sup>

At the governance level, Southern Countries boast rich cultural heritages and distinctive social management frameworks. To advance South-South cooperation, China has proactively acknowledged the diverse cultural traditions and social systems of these nations, advocating for their respectful consideration in international exchanges. China's vision of global governance prioritizes collective advancement and multilateral collaboration, a departure from the North-dominated traditional model. Through concepts like the community of human destiny and its global development initiatives, China has injected unique insights into fostering a more inclusive and interdependent international order. Governance collaboration now stands as a potent complement to traditional financial and technical assistance endeavors. The South-South Cooperation and Development Academy, founded in 2015, systematically encapsulates China's developmental experience and national governance expertise. It assists developing nations in nurturing top-tier talent in governmental management, offering invaluable intellectual backing to propel the modernization of governance systems and capacities in these countries.

Thanks to the relationship of mutual trust and understanding built by Southern countries in South-South cooperation, China's model for South-South cooperation is not static, but is in the process of continuous improvement and optimization. The successful experience of South-South cooperation in the past is the accumulation of the fruits of mutual learning between China and other Southern Countries, the basis for advancing cooperation among Southern Countries, and the impetus for deepening cooperation in the future.

## **1.2 History of North-South Cooperation Between Other Countries**

The international diffusion of developmental collaboration expertise has been increasing over the last several decades, becoming a progressively vital component to the global economy. This trend is particularly notable in the clean development sector. Traditionally, much of the international developmental collaboration was initiated between industrialized countries, with emerging and developing countries primarily on the receiving end. However, this model is undergoing significant transformations.

First, as clean energy investment and manufacturing shift from industrialized to emerging economies, the concept of sustainable economic development increasingly prevalent in these emerging markets. Second, emerging and developing economies are progressively taking an active role in innovating and producing clean energy technologies. This evolution indicates a shifting geography of clean energy development and underscores the critical role of international clean energy collaboration in facilitating knowledge sharing and leveraging complementarities across national borders.

To enhance the effectiveness of SSC, lessons can be drawn from established North-South Cooperation frameworks. Multilateral regimes, such as the European Union and African Union, often facilitate these efforts, supporting cross-national and cross-continental projects that promote clean energy. Moreover, initiatives like the IEA Technology Collaboration Programmes (TCPs), Mission Innovation (MI), and the Clean Energy Ministerial (CEM) are instrumental in catalyzing advancements in clean energy technologies. They promote research collaboration, share best practices, and mobilize government and private sector engagement to accelerate the transition to a sustainable energy future.

In addition to the strategic roles played by multilateral cooperation, bilateral efforts have also proven to be particularly effective. Prominent participants in multilateral climate and energy governance, such as China, the United States, Canada, Europe, Japan, and South Africa, engage in bilateral collaborations that often result in joint investments and research endeavors aimed at technological advancement. A typical example of bilateral cooperation is the clean energy cooperation between the United States and China. Between 1991 and 2020, the United States and China entered into a total of 103 bilateral agreements focused on energy and climate, 50 of which explicitly underscored collaborative research and development initiatives.

Many mechanisms, such as BRICS, the Asian Infrastructure Investment Bank (AIIB), the Islamic Development Bank (IsDB), and the Belt and Road Initiative (BRI), maintain a multilateral approach. However, they also differ from the traditional North-South model in two keyways.

First, SSC has a strong emphasis on infrastructure development and enhancing domestic manufacturing capacity. This focus reflects a mutual understanding among nations of the global South that robust infrastructure and a vibrant manufacturing sector are critical to economic stability and growth.

Second, in contrast to traditional North-South Cooperation, which often involves a clear donor-recipient dynamic dominated by the North, SSC is characterized by a more equitable model of partnership with reciprocal exchanges and joint contributions. In international climate finance, for instance, joint contributions in financial investments, where countries collectively fund projects that benefit the region or contribute to solving common challenges such as energy security, climate change, or agricultural development. This collaborative financial model helps to distribute costs and risks more evenly among the participating countries, fostering a sense of ownership and commitment to the project's success. In clean technology cooperation, transfer between developing countries often involves an exchange rather than a one-sided gift, with each country providing complementary expertise that addresses the specific developmental needs of the participants. This cooperative model also allows for a more balanced power dynamic in international relations, challenging the traditional hierarchies imposed by NSC and promoting a more decentralized and democratic form of global governance.

The future SSC could focus on energy innovation and climate resilient investment. In the context of green innovation, the financial responsibilities for developing technologies that provide wide range of societal benefits should be distributed across nations. Shared investment in these technologies enables a more rapid deployment at scale, reducing overall costs through economies of scale and shared research and development efforts. The socio-economic co-benefit from the cooperation, including energy security, job creation, and increase in international competitiveness, could also be shared among the participants.

In addition, considering that countries in the Global South are particularly vulnerable to climate change, fostering cooperation among them on investments in climate resilience is essential. Future SSC should mobilize resources for building state and infrastructure capacities and encourage the exchange of successful experiences. Through collaborations within the global South, countries can help each other and share strategies for effectively identify and address climate change, poverty, and broader development goals. Through SSC, developing countries can unite to tackle these intertwined issues, leveraging shared experiences and resources to enhance resilience and sustainable development across the global South.

## **2 The Importance of Green Opening-up and South-South Cooperation for China in the Current Context**

## 2.1 Common Development Challenges Facing China and Other Developing Countries

In the face of rapid global environmental changes and evolving economic landscapes, China's role in the global South, particularly within the realms of green development and sustainability, have becoming more and more important.

As a developing country, China and other countries in the global South share a range of development challenges that are exacerbated by environmental and climate changes. For example, food security is increasingly threatened by unpredictable weather patterns and water shortages, influencing agricultural outputs globally but particularly in climate vulnerable regions.<sup>[13]</sup> In particular, the report on the State of Food Security and Nutrition in the World 2019<sup>[14]</sup> estimated that more than 780 million people experience food shortage in 2022, especially in the developing world of Africa, Latin America and Asia. In Africa alone, major grain crops such as wheat, maize, rice, and soybean are projected to suffer a yield decline of 40%-72% due to climate change, while economic crops like tea and coffee are expected to experience up to a 40% yield loss.<sup>[15]</sup>

Moreover, climate migration is becoming more prevalent as areas become uninhabitable due to rising temperature, extreme weather, rising sea levels or desertification, affecting developing countries like Ethiopia, Bangladesh and Pacific Island nations. From 2000 to 2014, over 4.9 million people, which most of them are from the global South, applied immigration to the European Union due to climate threat.<sup>[16]</sup> This number is projected to grow by at 28% to 188% by the end of the century. Such massive migration waves in turn will impact regional social, economic, as well as political stability.

In response to climate change, global demand for low carbon technologies is in an all-time-high. The total value of export market grows from \$71 billion in 1992 to \$1,119 billion in 2022. Considering the significant social-economic and security implication, many countries recalibrate trade and economic strategies in light of the global energy transition. Industries and technologies related to energy transitions are now deemed strategic in many countries. The scramble for critical minerals necessary for the green transition, such as cobalt and lithium, has led to what some describe as a new form of geopolitics. Countries like the Democratic Republic of the Congo, Argentina, Bolivia, and Chile, which holds significant reserves of these minerals, find themselves at the center of a geopolitics of critical minerals.

At the same time, the rapid changes in the global environment and climate may also exacerbate gender inequality. The resulting challenges, such as food and water shortages, frequent extreme disasters, and intensified refugee and migration crises, have a disproportionate impact on women's rights. First, due to the division of social roles and differences in economic status, women are often more vulnerable to the adverse effects of extreme climate. According to data from the Food and Agriculture Organization of the United Nations, although women account for more than 40% of the global agricultural workforce, less than 15% of landowners are women.<sup>[17]</sup> Women in poor areas are usually responsible for agricultural production, fetching water, collecting fuel and other household chores, and the harsh climate has greatly increased the burden on women. When climate change causes crop yield reductions and resource scarcity, the rights of women whose livelihoods cannot be guaranteed are the first to be impacted. Due to the lack of basic support such as drought-resistant crops, electricity, and agricultural equipment, women have a weak ability to adapt to environmental changes. Secondly, climate change limits women's access to education and medical services. Affected by environmental pressures, poor families are usually more inclined to let boys continue to receive education, further exacerbating gender inequality. Finally, women are usually unable to fully participate in the decision-making process of relevant policy planning such as climate change response and green development, neither can they influence the design and implementation of related projects.<sup>[18]</sup>

## 2.2 Opportunities for Developing Countries

The global push for a green transition represents a significant economic and environmental prospect for the Global South. The fast-expanding market for EV and renewable energy technologies offers a prime example.

Countries like India and Vietnam are becoming front runners in the manufacturing of solar panels, not merely to meet domestic needs but as a substantial export opportunity.

Moreover, South-South Cooperation provides a pathway to bolster the voices and capacities of vulnerable populations. By sharing technologies, policies, and financing models, countries can implement more robust climate resilience frameworks. For instance, China's cooperation with African nations in solar energy projects not only facilitates technology transfer but also supports local job creation and energy independence.

At the same time, Green Opening-up and South-South cooperation provide a platform for women to speak out. The international community has gradually recognized the importance of women in addressing climate change and promoting green transformation. International organizations and UN agencies have actively promoted the mainstreaming of gender issues. The parties to the United Nations Framework Convention on Climate Change (UNFCCC) have established a special agenda under the convention to discuss gender and climate change issues. The Global Environment Fund and the Green Climate Fund have incorporated gender policies into their institutional policy systems and actively promoted the implementation of gender policies at the project level.

### **2.3 Relationship Between China and Other Developing Countries**

China's trajectory as a developing nation that has emerged as a global economic powerhouse offers insightful lessons and a model for sustainable development through green policies. Its major initiatives, such as the massive tree planting projects in the Northern China Greening Project or the widespread deployment of clean public transportation systems, exemplify strategies that can be adapted and adopted by other developing countries. In addition, China has played a pivotal role in offering liquidity and development finance, thus pioneering the creation of Southern-led financial institutions. These entities not only expand the influence of the Global South in international economic governance but also provide vital new and alternative sources of funding. These initiatives facilitate greater autonomy and agency for developing countries in shaping their development trajectories.

According to the GDP Center study,<sup>[19]</sup> China has been a strong partner with the global South, especially through the BRI. Between 2008 and 2021, China's development finance institutions (DFIs) dispensed around \$500 billion in total, with at least \$331 billion allocated to the BRI from 2013 to 2021. Specifically in Africa, financing from Chinese DFIs reached \$123 billion from 2008 to 2021, with \$91 billion distributed in the BRI years. Moreover, Chinese commercial entities and other agents contributed an additional \$30 billion to African governments between 2008 and 2021, with \$23 billion of this through BRI.

In the global South, China's experience and investment in the global South have significant impact on local development. In a recent GDP Center working paper,<sup>[20]</sup> Wang and Xu find that Chinese infrastructure projects play a critical role in economic development in Sub-Saharan Africa. They find that a Chinese funded infrastructure projects is associated with 5 percent direct increase in economic performance (proxy by nighttime luminosity), and up to 15 percent indirect increase economic development in region. This demonstrated that Chinese infrastructure investment significantly decrease development gaps in the global South, enabling substantial and sustainable development in the developing world in the long run.

However, historically, Chinese development finance in the Global South has primarily focused on industrial and infrastructure projects, unlike traditional DFIs such as the World Bank, which are more oriented towards building institutional capacities. Consequently, Chinese financing is more directly linked to stimulating economic growth by alleviating infrastructure constraints and enhancing energy access, in contrast to the approaches typically employed by the World Bank.

Therefore, China has a great potential role to play in greening the global South through cooperation. China's role in SSC is pivotal, particularly as it transitions to more sustainable practices within its own borders and extends these practices through initiatives like the BRI, which now increasingly incorporates green standards



and sustainable practices. The alignment of BRI with sustainable development goals offers a template for infrastructure projects that balance economic growth with environmental stewardship.

In conclusion, China's engagement in green opening-up and South-South Cooperation is crucial for advancing global environmental governance and sustainable development. By addressing shared challenges, leveraging opportunities for green development, and enhancing cooperative relationships, China can significantly influence the global agenda towards a more equitable and sustainable future.

### **3 Existing Framework for China's Green Opening-up and South-South Cooperation**

As a major developing nation with rapidly increasing economic and political influence, China's advocacy for green opening-up and South-South cooperation unfolds within a multifaceted context, distinct from that of developed and other developing countries. On one hand, China, as a developing nation, has historically been the largest recipient of environmental and climate aid worldwide. Simultaneously, in accordance with the principle of "common but differentiated responsibilities," China is not required to assume the same level of responsibility for environmental protection as developed nations. Instead, China makes voluntary contributions when providing foreign assistance.

On the other hand, as the world's second-largest economy, China's developing nation status encounters international scrutiny and challenges. The U.S. Senate Foreign Relations Committee's endorsement of the "End China's Developing Country Status Act" reflects a push for China to be categorized as a "developed" or "high-income" nation in global cooperation frameworks. Negotiating China's dual role as both aid recipient and donor, while accurately acknowledging its international obligations and capabilities as a significant developing nation, poses critical questions for the expansion of South-South cooperation's influence in the future.

Green opening-up, being a non-confrontational issue necessitating close collaboration between developed and developing nations, could serve as a pivotal starting point in addressing these complexities. China not only possesses a cultural and historical tradition of harmonious coexistence with nature but also boasts a range of government departments overseeing South-South cooperation from a multidisciplinary perspective. It has initiated a suite of supportive and directive policies, leveraging the strengths of the private sector, civil society, and international institutions to jointly propel green opening-up and South-South cooperation forward.

#### **3.1 Culture and Values**

Green development in China is deeply rooted in traditional values and has evolved alongside international norms. Stemming from the ancient concept of "the unity of man and heaven," traditional Chinese values have embraced ecological principles and the laws of nature, emphasizing the harmonious coexistence of humans and the natural world. Notions such as "green mountains are golden mountains" and "harmonious coexistence of humans and nature" reflect China's rich traditional ecological culture and imbue contemporary green development with new significance. The idea of "innovative, coordinated, green, and sustainable development" was first articulated during the Fifth Plenary Session of the 18th CPC Central Committee in 2015. This session also introduced the five development concepts, including "innovation, coordination, green, openness, and sharing." Green opening-up, as a significant aspect, underscores a distinctive awareness of environmental challenges. As societal living standards continue to rise, there's an increasing emphasis on environmental quality and ecology. Consequently, green initiatives are becoming pivotal for both China's outbound and inbound endeavors, reflecting a modernization path characterized by harmonious coexistence between humans and nature.<sup>[21]</sup>

Since the establishment of the People's Republic of China (PRC), China's approach to green development has undergone a transformative journey, evolving from passive observation to cautious engagement, and ultimately

to proactive involvement and close collaboration. In the early years of the PRC, while the nation focused on rapid industrialization and development, Western countries had already grappled with environmental challenges stemming from their industrial revolutions. Environmental protection emerged as a pressing global issue.

During this period, China, amid its own development surge, faced the imperative of aligning domestic and international policies with the evolving global political landscape. In 1971, following its admission to the United Nations, China was invited to participate in the United Nations Conference on the Human Environment (UNCHE). Despite initially assuming a passive role, China actively contributed to the discussions, advocating for the developmental needs of developing nations and expanding its comprehension of environmental issues through dialogue with developed countries.<sup>[22]</sup>

Following the commencement of reform and opening-up, China transitioned into a period of socialist market economy, tentatively embracing the concept of green development. As the economy surged forward, domestic environmental concerns gradually surfaced. In 1983, during the second national conference on environmental protection, safeguarding the environment was established as a fundamental national policy.

The turning point came in 1992, following the United Nations Conference on Environment and Development in Rio, where China, in response to the UN's sustainable development strategy, unveiled its “China’s Top Ten Countermeasures on Environment and Development Issues”, solidifying the implementation of sustainable development as a national imperative. This commitment was further reinforced in March 1994 with the formal release of “China’s Agenda 21: White Paper on China’s Population, Environment and Development in the 21st Century” (China’s Agenda 21), making China the first country globally to formulate its own action plan aligned with the principles of Agenda 21.<sup>[23]</sup>

In 2006, China, recognizing its role as a significant developing nation, spearheaded the launch of “China’s National Climate Change Program”. Subsequently, in 2007, it engaged in negotiations with both developed and developing countries, forging agreements on greenhouse gas emission reduction commitments and collectively endorsing the Bali Road Map. Since then, China has actively engaged in green development initiatives and international collaborations, continually enhancing its domestic framework for green development. In 2015, the CPC Central Committee and State Council issued the “Overall Plan for the Reform of the Ecological Civilization System”, which gave advice at the level of institution-building on China’s ecological priority and green development path. Ecological civilization has become an important element of the socialist cause with Chinese characteristics, and has been integrated into all aspects and processes of economic, political, cultural and social construction in the country. In 2023, the white paper “China’s Green Development in a New Era” was formally released, describing China’s core concepts of green development and its practical experience in the development of a low-carbon economy.

Green development is a multifaceted goal that integrates the co-development of economic, social, and natural systems, aligning with the traditional Chinese value of “the unity of heaven and mankind.” At the economic level, China’s green development emphasizes low pollution emissions and minimal resource consumption, highlighting the importance of green technology, energy, and capital in driving economic growth. Socially, green development views human society as a community, stressing the significance of global governance. It advocates for developed countries to provide technical and financial support to developing nations, while urging developing countries to craft green development strategies tailored to their national contexts.<sup>[24]</sup> Currently, there is no definitive explanation of the concept and connotations of green opening-up in official documents and academic circles. Broadly speaking, green opening-up involves integrating green development into the national policy of opening up to the outside world. It represents a path towards high-level international development cooperation that adheres to green standards and embodies green principles. In a narrower sense, green opening-up encompasses three components: going out, bringing in, and mutual benefit and win-win outcomes. Going out involves extending the scope of green opening-up to include more economic sectors and industries, as well as expanding the geographical reach of openness. Bringing in includes aligning with

international advanced standards, learning from global green technologies, and developing an open institutional framework. Win-win cooperation entails establishing international cooperation platforms for green development, refining the policy system for green multilateral cooperation, and enhancing relevant laws and regulations.

### 3.2 Institutional Set-up and Division of Labor

South-South cooperation covers multilevel and multidisciplinary international cooperation among developing countries, including bilateral and multilateral and regional cooperation, as well as shared exchanges in the fields of finance, trade, environment, agriculture, health and other areas, and at the political, economic and diplomatic levels. Foreign aid, as an important manifestation of South-South cooperation, falls under the responsibility of the central government, with ministries and departments responsible for policy formulation and fund allocation in relevant areas according to their respective responsibilities, and for certain coordination and cooperation. After the 2018 government institutional reform, China International Development Cooperation Agency (CIDCA) is responsible for formulating strategic guidelines, planning, and policies on foreign aid, integrating and coordinating major issues of foreign aid and making recommendations, and It promotes the reform of foreign aid modalities, prepares foreign aid programs and plans, identifies foreign aid projects and supervises and evaluates their implementation, and integrates the management of global development and South-South cooperation funds. The Ministry of Finance (MOF) is responsible for preparing and organizing the implementation of the annual budget and final account of foreign aid funds, and ministries and commissions summarize their respective foreign aid budgets to the CIDCA, which then submits them to the MOF in a consolidated manner. The Ministry of Commerce (MOFCOM) is the primary department responsible for foreign aid in China, overseeing foreign aid training, material assistance, complete foreign aid projects, and South-South Assistance Fund projects.

The Global Development Promotion Center, under CIDCA, implements commitments related to global development initiatives, such as the Global Development Project Pool and the promotion of global financing for development. The Foreign Aid Support Center provides services and guarantees for supervising and evaluating foreign aid projects, constructs the index system for evaluating these projects, and conducts policy and theoretical research on foreign aid and international development cooperation. In the first batch of projects listed in the Global Development Project Pool, seven projects focus on green development. These projects include developing policy frameworks, technical training, and capacity building in areas such as agriculture, forestry, and habitat protection. The Global Development Promotion Center and the Foreign Aid Support Center, in cooperation with CIDCA, supported Mongolia’s “Planting One Billion Trees” plan. They facilitated visits for the Mongolian side to Ningxia and Inner Mongolia to learn about the “green advancing and sand retreating” experience and visited Mongolia alongside the National Forestry and Grassland Administration (NFGA). During this visit, the administration agreed to establish three large-scale demonstration zones for tree planting and sand prevention, along with seven monitoring sites for sand and dust storms. A 10-phase training project was also initiated.<sup>[25]</sup>

**Table 1 Green Development-Related Projects in the List of First-Batch Projects of GDI Project Pool<sup>[26]</sup>**

Serial Number	Beneficiary Country	Sports Event	Fields	Implementation Unit
1	Mongolia	Strengthening firefighting capacity towards green recovery in Mongolia	Climate change and green development	CIDCA, MOFCOM, UNDP
2	19 African countries, including Nigeria, Sierra Leone, Togo, Egypt, Somalia,	Coherent Integration of the Environmental Dimension of the Sustainable Development Goals in Regional and	Climate change and green development	United Nations Environment Program (UNEP)

Serial Number	Beneficiary Country	Sports Event	Fields	Implementation Unit
	Ethiopia, Uganda and South Africa.	National Policy Frameworks in Africa		
3	Pacific island country	Asia-Pacific Forestry Technology Training Center project	Poverty reduction, climate change and green development	APFNet
4	Global	Project on Innovative Products Development of Substituting Bamboo for Plastics	Climate change and green development	International Bamboo and Rattan Organization
5	Fiji	Technical Assistance Project of Juncao Technology Demonstration Centre-Phase III	Poverty reduction, climate change and Green development	CIDCA, MOFCOM
6	Myanmar, Laos, Thailand, Cambodia, Vietnam	Construction of Cooperation Platform for Tropical Fruit and Vegetable Processing and Testing	Poverty reduction, green development	Spice and Beverage Crops Research Institute (SBCRI), Chinese Academy of Tropical Agriculture Sciences (CATAS)
7	Indonesia, Thailand, Vietnam, Malaysia and other ASEAN countries	Nature-Based Climate Solutions: China - ASEAN Mangrove Conservation Partnership and Regional Demonstration	Climate change and green development	China-ASEAN Environmental Cooperation Center, MEE

In the realm of economy and trade, MOF, MOFCOM, and National Development and Reform Commission (NDRC) are primarily responsible for multi-bilateral economic and technical cooperation between China and other developing countries. MOF plays a key role in promoting international cooperation in green finance. First, it encourages international financial institutions such as the Asian Infrastructure Investment Bank (AIIB), the New Development Bank, and the World Bank to increase their resource allocation for green development in other developing countries. Second, it coordinates with international funds like the World Bank, Asian Development Bank (ADB), and International Fund for Agricultural Development (IFAD) to support green development projects, including capacity building, technology export, and green energy construction in developing countries. Third, it supports the construction of the Multilateral Cooperation Center for Development Finance (MCDF) and promotes the backing of international financial institutions for infrastructure projects under the Belt and Road Initiative (BRI).

MOFCOM is primarily responsible for expanding regional and international economic and trade cooperation between China and regions such as Africa, Latin America, and the Arab states. MOFCOM promotes the green transformation of these cooperating countries and regions through the construction of free trade zones, the signing of trade cooperation agreements, and the organization of economic and trade fairs. Since 2021, the China International Fair for Trade in Services (CIFTIS), organized by MOFCOM, has incorporated South-South cooperation as a key topic. The fair focuses on sustainable agriculture, new energy transformation, green production, and other related issues, providing a platform for exchanges and discussions. On October 18, 2023, during the Third Belt and Road Summit Forum on International Cooperation, China and 35 other countries and regions jointly released the Initiative on International Trade and Economic Cooperation Framework for Digital

Economy and Green Development, strengthening trade cooperation for green and sustainable development, and encouraging exchanges and investment in green technologies and services.<sup>[27]</sup>

NDRC is responsible for leading the promotion and implementation of BRI, undertaking overall coordination for international expansion efforts, promoting the sustainable development strategy, and advancing ecological civilization construction and reform. The NDRC coordinates ecological environmental protection and restoration, as well as the conservation and comprehensive utilization of energy and resources. Facilitating Center for Building the Belt and Road, under the NDRC, focuses on promoting financial innovation for BRI. This includes enhancing the capabilities of policy financial institutions and multi-bilateral cooperation funds, such as the Silk Road Fund, to mobilize private funds for South-South cooperation. The center also guides enterprises in their “Going Global” efforts, helping them improve risk prevention and control mechanisms, and encourages effective participation of private enterprises in South-South cooperation.<sup>[28]</sup>

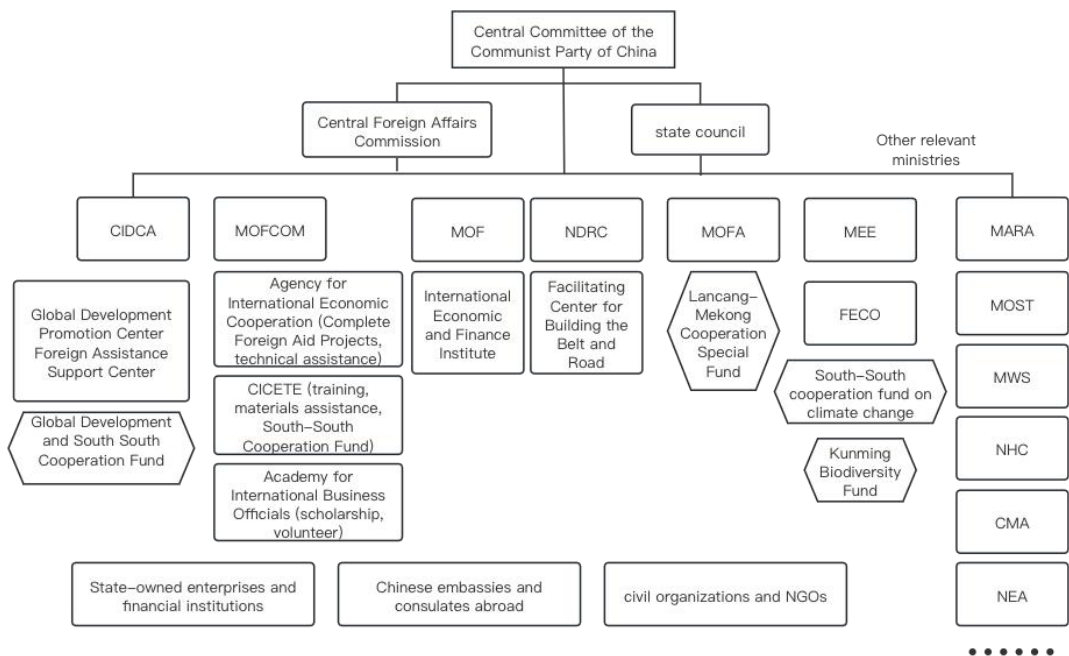
From a political-diplomatic perspective, Ministry of Foreign Affairs (MOFA) need to report to the Central Committee of the Party and the State Council on south-south cooperation with key countries and potential collaborative areas, including climate negotiations, biodiversity negotiations, and other critical issues within the overall diplomatic framework. MOFA also needs to consider the dynamics of cooperation within mechanisms and platforms such as the Group of 77, Lancang-Mekong Cooperation, and BRICS. In terms of cooperation with international organizations, China's diplomatic efforts at the United Nations and other international cooperation platforms are dedicated to promoting the common development of South-South and North-South cooperation. These efforts are aimed at firmly safeguarding the fundamental interests of developing countries and maintaining a global political and economic order in which developing countries can participate and have their voices heard on an equal footing.<sup>[29]</sup> Regionally, China has signaled its commitment to green opening-up and South-South cooperation with Africa through political-diplomatic measures. This includes signing declaratory documents such as the Declaration on China-Africa Cooperation on Combating Climate Change. While these declarations are not legally binding, they send a friendly signal of cooperation and have facilitated the signing of more concrete agreements on green South-South cooperation and trilateral cooperation projects.

In addition to foreign assistance, economic and trade exchanges, and diplomatic cooperation, specialized ministries such as the Ministry of Ecology and Environment (MEE), the Ministry of Agriculture and Rural Affairs (MARA), the Ministry of Science and Technology (MOST), the Ministry of Water Resources (MWR), the National Forestry and Grassland Administration (NFGA), the China Meteorological Administration (CMA), and the National Energy Administration (NEA) are all actively promoting the development of green South-South cooperation within their respective areas of responsibility.

MEE, as the authority responsible for addressing climate change and conducting international cooperation in ecology and environment, leads the implementation of the United Nations Framework Convention on Climate Change and related international negotiations. It coordinates international cooperation and capacity building to address climate change, manages the South-South Cooperation Fund for Climate Change and the Kunming Biodiversity Fund, and oversees the specific implementation of the South-South Cooperation in Material Assistance Project on Climate Change.

MARA has given full play to the advantageous foundation of South-South cooperation in agriculture, and has carried out bilateral and multilateral green agricultural cooperation with countries in ASEAN, Africa, Latin America and other regions, with a view to upgrading the level of green, cyclical and sustainable development of agriculture in other developing countries through the organization of regional forums on agricultural cooperation, the promotion of demonstration projects on agricultural technology, assistance in the establishment of a system of standards for the export of agricultural products, and the formulation of regional plans of action for green development in agriculture.<sup>[30]</sup> MOST enhance the productivity of other developing countries through technology transfer and capacity building, and established a South-South Cooperation Center for Technology Transfer (SSCCTT) during the 2019 United Nations Day for South-South Cooperation

to carry out South-South technology transfer for sustainable development under the framework of the United Nations.<sup>[31]</sup> MWR actively promotes China’s experience in the construction of small hydropower projects in the field of green energy, and continuously strengthens South-South cooperation in the field of hydropower and other green energy sources. NEA promotes China’s advanced energy-saving technology, products, standards, and business models to go out in the area of new energy technology. CMA supports the BRI trilateral Cooperation Agreement on Early Warning for All, to support developing countries in improving their capacity for early warning and adaptation to climate change.



**Figure 1 Overview of Institutions Related to Green Openness and South-South Cooperation in China**

### 3.3 Policy System

China has a long history of policy development and top-level design for green opening-up and South-South cooperation, having formulated numerous policies, plans, guidelines, and action programs for green South-South cooperation. The concept of green opening-up is integral to the new development paradigm of “innovation, coordination, greenness, openness, and sharing” introduced at the Fifth Plenary Session of the 18th CPC Central Committee in 2015. However, green opening-up is not a new concept that emerged in 2015; it is a summary of China’s extensive long-term efforts in international cooperation on green development, encompassing issues such as climate change response, biodiversity restoration, and habitat protection.

As early as the 1960s, China initiated green South-South cooperation programs, including biogas projects, small-scale water conservancy projects, solar and wind power projects in Asia and Africa, as well as training on climate change response, forest protection, and desertification restoration. The China-Africa Policy Document released in 2006 explicitly stated that “China and Africa will actively promote cooperation in the areas of climate change, water resource conservation, desertification control, and biodiversity restoration.”

At the macro-planning level, since the 12th Five-Year Plan, China has included the reduction of carbon dioxide emissions per unit of GDP (carbon intensity) as a binding indicator in the national economic and social

development plan. China has consistently emphasized the principle of “common but differentiated responsibilities” and the importance of South-South cooperation on climate change, gradually evolving to support the building of a global climate governance system and global partnerships.

**Table 2 Relevant Contents of the 12th, 13th and 14th Five-Year Plans on China’s Development of Green South-South Cooperation**

<b>Time</b>	<b>File</b>	<b>Related content</b>
March 2011	Outline of the 12th Five-Year Plan (2011-2015) for National Economic and Social Development of the People’s Republic of China	Adhering to the principle of common but differentiated responsibilities, we will actively participate in international negotiations and promote the establishment of a fair and reasonable international system for confronting climate change. We will strengthen international exchange and strategic policy dialogue on climate change. We will also develop pragmatic cooperation in areas like scientific research, technology research and development and capacity building, as well as push for the establishment of an international cooperation platform and management system for funding and technology transfer. We will provide help and support to developing countries in confronting the challenges of climate change. China should use the APEC as well as other international or sub-regional cooperation mechanisms and enhance regional cooperation with other countries and regions. South-South cooperation should be enhanced.
March 2016	Outline of the 13th Five-Year Plan (2016-2020) for National Economic and Social Development of the People’s Republic of China	We will take an active part in negotiations on global climate change and work toward a fair and equitable system of global climate governance based on mutually beneficial cooperation. We will help deepen bilateral and multilateral dialogue, exchange, and practical cooperation on climate change. We will ensure the South-South Cooperation Fund on Climate Change fully plays its role and support other developing countries in improving their capacity to deal with climate change. We will improve the structure of foreign trade by promoting diversification in export markets and increasing the proportion of emerging markets while maintaining the share of traditional ones. We will encourage the development of new types of trade and work to develop export credit insurance.
March 2021	Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and Vision 2035 of the People’s Republic of China	On the basis of equity and in accordance with the common but differentiated responsibilities and respective capabilities of all countries, we will play a constructive role and lead international cooperation in responding to climate change, promote the implementation of the United Nations Framework Convention on Climate Change and its Paris Agreement, and actively carry out South-South cooperation on climate change. We will proactively develop global partnership, promote coordination and cooperation among major countries, strengthen relations with neighboring countries, and advance unity and cooperation with developing countries. We will expand efforts to reform the institutions and mechanisms of foreign aid, improve the distribution of foreign aid, do our best to aid developing countries, especially the least developed countries, and strengthen foreign cooperation and assistance in the fields of healthcare, science, technology, education, green development, poverty alleviation, human resource development, and emergency humanitarian assistance. We will actively implement the 2030 Agenda for Sustainable Development of the United Nations.

At the specific policy level, policies related to green opening-up and South-South cooperation are primarily normative and guiding documents. These policies address key issues such as Chinese enterprises going global, the construction of a green financial system, the development of a green Belt and Road Initiative, global climate governance, and alignment with international green standards.

In addition to providing guidance and working guidelines, China has established a series of management methods and guidelines for the South-South Cooperation Fund on Climate Change, the Global Development and South-South Cooperation Fund, the Global Development Initiative Project Pool, and the Global Development Initiative Fund Pool. These guidelines clarify the allocation of authority and responsibility, and outline the priorities for the processes of project preparation, implementation, and evaluation.

**Table 3 Policy Documents Issued by China on Green Opening-Up and South-South Cooperation, 2013-2024**

Timing	Documents and Issuing Authority	Related Content
February 2013	MOFCOM and MEE: Guidance on Environmental Protection in Foreign Investment and Cooperation	It guides Chinese enterprises to further standardize environmental protection behaviors in outbound investment and cooperation activities, identify and prevent environmental risks in a timely manner, guide enterprises to actively fulfill their social responsibilities for environmental protection, establish a good foreign image of Chinese enterprises, and support the sustainable development of host countries.
August 2016	The People's Bank of China, the Ministry of Finance, NDRC, MEE, the China Banking Regulatory Commission, the China Securities Regulatory Commission, and the China Insurance Regulatory Commission: China's Guidelines for Establishing the Green Financial System	Supporting the establishment of various types of private green investment funds by social capital and international capital. Through the "Belt and Road" initiative, the Shanghai Cooperation Organization, China-ASEAN and other regional cooperation mechanisms and South-South cooperation, as well as the role of the Asian Infrastructure Investment Bank and the New Development Bank of the BRICS countries in prying green investment from the private sector, we will promote regional international cooperation in green finance, and support green investment in relevant countries. (c) Promote regional international cooperation in green finance and support green investment in relevant countries.
April 2017	MEE, MOFA, NDRC, MOFCOM: The Guidance on Promoting Green Belt and Road	It elaborated on the significance of building a green "Belt and Road" and made detailed arrangements for strengthening exchanges and publicity, safeguarding the ecological and environmental safety of investment activities, building a platform for green cooperation, improving policies and measures, and giving full play to local advantages.
November 2020	MEE and CIDCA: Interim Measures for the Management of South-South Cooperation Material Assistance Project in Response to Climate Change	Standardize and strengthen the implementation and management of material assistance projects for South-South cooperation in response to climate change, so as to ensure the quality of the projects and the effectiveness of the assistance.
February 2021	Guiding Opinions of the State Council on Accelerating the Establishment of a Sound Economic System with Green, Low-carbon and Circular Development	It is proposed to strengthen policy communication, technology exchange, project cooperation and talent training with various countries and regions in the world in the field of green, low-carbon and recycling development, so as to actively participate in and lead global climate governance.
July 2021	MEE, MOFCOM: Green Development Guidelines for Foreign Investment and Cooperation	Accelerate the promotion of outward investment and green development, establish a sound economic system of green, low-carbon and recycling development, win the initiative in international cooperation and competition, and better serve the



Timing	Documents and Issuing Authority	Related Content
		construction of a new development pattern.
August 2021	CIDCA, MOFA and MOFCOM: Measures for the Administration of Foreign Aid	It also clarifies the collaboration mechanism and channels between the CIDCA and the foreign aid implementing departments, and proposes that foreign aid is committed to helping recipients alleviate and eliminate poverty, improve their livelihoods and ecological environments, promote their economic development and social progress, enhance their capacity for independent and sustainable development, consolidate and develop friendly and cooperative relations with recipients, and promote the high-quality construction of the "One Belt, One Road" and the building of a community of human destiny. "Belt and Road", promote the construction of a new type of international relations and the building of a community of human destiny.
October 2021	Opinions of the Central Committee of the Communist Party of China (CPC) and the State Council on the complete and accurate implementation of the new development concept and the proper implementation of carbon peaking and carbon neutral work	We will actively participate in international negotiations on addressing climate change, adhere to the positioning of China as a developing country, and uphold the principles of common but differentiated responsibilities, equity and respective capabilities, so as to safeguard China's rights and interests in development. We will actively participate in the formulation of international rules and standards, and promote the establishment of a fair and reasonable global climate governance system with win-win cooperation. It will strengthen international exchanges and cooperation in addressing climate change, coordinate efforts at home and abroad, and proactively participate in global climate and environmental governance.
January 2022	MEE and MOFCOM: Guidelines for Ecological Environmental Protection of Foreign Investment Cooperation and Construction Projects	Standardize and optimize the whole life cycle ecological environment and climate management of enterprises' overseas investment and construction projects
March 2022	NDRC, MOFA, MEE, MOFCOM: Opinions on Jointly Promoting Green Development of the Belt and Road	Compared with the 2017 edition, major upgrades have been made at three levels: policy communication and rule co-construction, green industry cooperation and project landing, and two-way opening and empowerment of green financial markets
	MEE: Implementing Rules for the Supervision and Management of South-South Cooperation Material Aid Projects for Coping with Climate Change (Draft for Public Comments)	Strengthen the supervision and management of South-South cooperation material assistance projects for coping with climate change, enhance the supervision of projects during the process, and urge successful enterprises to implement the main responsibility for the performance of successful contracts.
	MEE: Implementing Rules for Evaluation and Management of South-South Cooperation Material Aid Programs for Coping with Climate Change (Draft for Public Comments)	In order to strengthen the evaluation and management of material assistance projects for South-South cooperation in response to climate change, standardize the evaluation procedures, improve the level of management and enhance the comprehensive effectiveness of material assistance.
February 2024	Guiding Opinions of the Ministry of Industry and Information Technology	Utilizing the existing bilateral and multilateral mechanisms to strengthen the exchange and docking

Timing	Documents and Issuing Authority	Related Content
	and Other Six Departments on Accelerating the Promotion of the Green Development of the Manufacturing Industry	of green development strategies, planning, policies, standards and conformity assessment. Deepen exchanges and cooperation with other countries in the areas of green technology, green products, green equipment, green services and product carbon footprint management, and promote the orderly export of China’s new energy, new energy vehicles, green environmental protection and other technologies and equipment.
	Notice by the National Development and Reform Commission and Other Authorities of Issuing the Catalogue for Guiding the Transition of Industries to Green and Low-carbon Energy (2024)	Further strengthen international and domestic exchanges, promote experience and practices in supporting the development of relevant industries, promote international cooperation on green standards, and gradually establish a mutual recognition mechanism between the Catalogue and relevant international green standards.
April 2024	Guiding Opinions of the PBOC, NDRC, MIIT, MOF, MEE, the National Financial Regulatory Administration, and the China Securities Regulatory Commission of Further Strengthening Financial Support for Green and Low-Carbon Development	Deepening green financial cooperation and promoting green investment in the Belt and Road, gradually incorporating climate change-related risks <sup>1</sup> into the macroprudential policy framework, guiding financial institutions to support green and low-carbon development, and promoting financial institutions to regularly report information on the scale, proportion and risk exposure of high-carbon assets to financial management authorities.

## 4 Financial Mechanism

### 4.1 Wide coverage and high total amount of public funds

Public funds for South-South cooperation are primarily composed of foreign aid funds, categorized as “foreign aid” according to the MOF’s “Classification of Government Revenue and Expenditure in 2019.” These funds include the Global Development and South-South Cooperation Fund, the Lancang-Mekong Cooperation Special Fund, the South-South Cooperation Fund on Climate Change, and the China-ASEAN Maritime Cooperation Fund, among others.

From 2011 to 2014, China provided a cumulative total of 270 million yuan (approximately US\$44 million) to promote South-South cooperation on climate change.<sup>[32]</sup> Established in 2015 with an initial \$2 billion from China to support developing countries in implementing the 2030 Agenda for Sustainable Development, the South-South Cooperation Assistance Fund was upgraded to the Global Development and South-South Cooperation Fund in 2022, with a capital increase to \$4 billion.<sup>[33]</sup> In 2015, China allocated 20 billion yuan to establish the South-South Cooperation Fund on Climate Change and introduced the “Ten Hundred Thousand” Initiative for South-South Cooperation along with the “Belt and Road” South-South Cooperation Projects on Climate Change. These initiatives aim to support developing countries in coping with climate change through

<sup>1</sup> Determining climate change-related financial risk is still a topic of ongoing discussion. According to a paper released by the People's Bank of China (PBOC) in 2020, “Climate-related financial risks - an analysis based on central bank functions” , climate-related risks can be categorized into two types: physical risks and transition risks. Physical risk refers to the threat that extreme weather events pose to the balance sheets of businesses, households, banks, and insurance companies, potentially leading to financial and macroeconomic instability. Transition risk is the financial risk that stems from changes in climate policy, technology, and market sentiment during the shift to a low-carbon economy. These changes can lead to fluctuations in asset prices or broader economic crises.

financing, capacity-building, and infrastructure construction, helping them transition to green and low-carbon development.<sup>[34]</sup>

The Lancang-Mekong Cooperation Special Fund, established in 2016, has provided \$300 million over five years to support small and medium-sized cooperation projects proposed by the six Lancang and Mekong countries in Southeast Asia. As a “golden model” of South-South cooperation, the Fund has been actively promoting green development and environmental protection in the region. To date, the Fund has supported more than 500 projects, benefiting the people in the six countries with an investment of over RMB 1 billion.<sup>[35]</sup>

During the Leaders’ Summit of the 15th Conference of the Parties to the Convention on Biological Diversity (CBD) in October 2021, China announced the establishment of the Kunming Biodiversity Fund and took the lead in contributing RMB 1.5 billion to support biodiversity conservation efforts in developing countries.<sup>[36]</sup>

## **4.2 Continuing to Leverage Public Funds to Promote High-Quality Chinese Enterprises Going Global**

Currently, there is a significant gap between the availability of public funds for green opening-up and the demand for South-South cooperation, highlighting the need for innovative participation from the private sector. The international community expects the private sector to amplify the scale and impact of South-South cooperation projects through credit guarantees and joint financing, thereby reducing the burden on government agencies in cooperating countries and addressing the shortfall in government resources. The 2011 National Environmental Protection Twelfth Five-Year Plan explicitly encourages the establishment of environmental protection industry development funds through various channels. It guides venture capital enterprises, equity investment firms, and other businesses to develop and expand the environmental protection industry. Additionally, it encourages increased investment in environmental protection from venture capital enterprises, equity investment firms, social donations, and international aid funds.<sup>[37]</sup>

China has made significant progress in mobilizing private-sector funds. Within the framework of the Global Development Initiative, CIDCA mobilized \$12 billion in special funds from domestic and foreign financial institutions for the first time in 2023. During the 1st high-level conference of Forum on Global Action for Shared Development in July 2023, CIDCA issued the Global Development Finance Pool (Guidelines) to pool development cooperation funds from various participating entities and promote multifaceted cooperation. This aims to create a scale effect, better match international development resources with the actual needs of developing countries, and enhance multi-party cooperation.

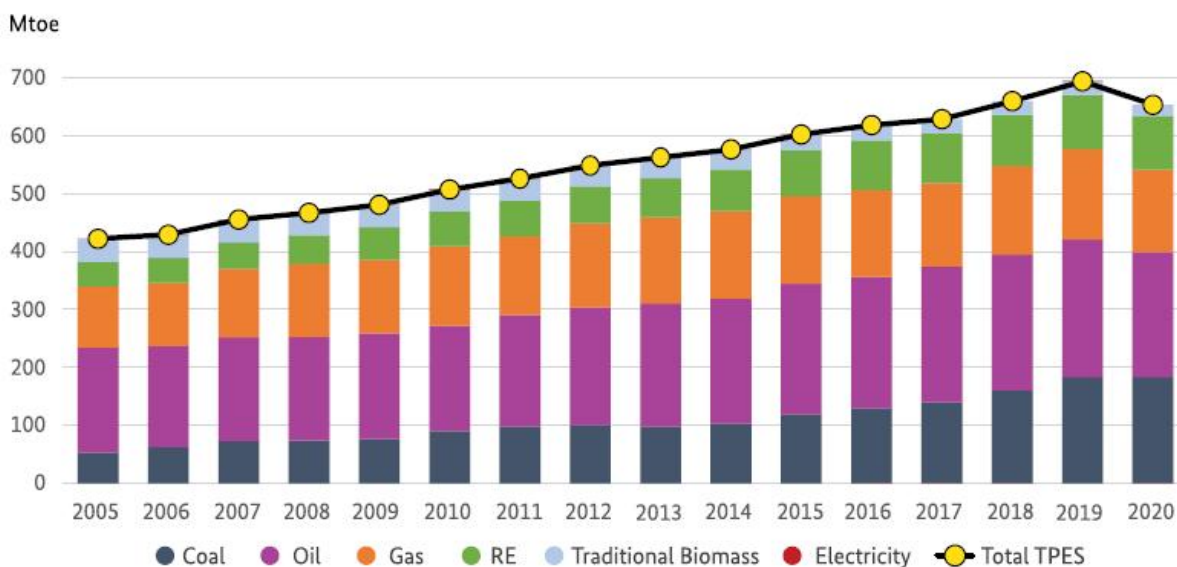
Under BRI, China has actively promoted the construction of the Multilateral Cooperation Center for Development Finance (MCDF), providing a grant of \$12.62 million. As of April 2023, the MCDF has provided \$12.62 million in grants to 10 projects in Indonesia, Cambodia, and Laos, supporting infrastructure project preparation and capacity building. These projects, implemented by the Asian Development Bank (ADB) and the African Development Bank (AfDB) alongside commercial and development finance institutions, are expected to mobilize \$2.8 billion.<sup>[38]</sup>

## **Chapter 2 China-ASEAN Cooperation**

### **1 The Landscape of Southeast Asia Energy and Economic Development**

## 1.1 Navigating energy security and climate change impacts in Southeast Asia’s low carbon transition

Southeast Asia is projected to be the world’s fourth largest economy by 2030, with the combined GDP of its member countries reaching USD 8 trillion (Nikkei Asia, 2016). Energy consumption will also increase along with the economic development. Regional energy demand is projected to triple by 2050 from 2020 baseline (ACE, 2022). Under business as usual scenario, fossil fuels, primarily oil and coal, will still be the main energy source for electricity generation, transportation, and industry. By 2020, fossil fuels dominated the total primary energy sources (TPES) at 83%, while renewables only accounted for 14.2% of the region’s primary energy sources (see Figure 1).



Source: ACE. All rights reserved. Note: RE excludes traditional biomass used in households.

**Figure 2 ASEAN Total Primary Energy Supply by Fuel, 2005-2020**

ASEAN’s dependence on fossil fuels will result in 2.70 GtCOe2 of emissions by 2050 if no significant policy improvements are made. These emissions can lead to heightened climate change impacts in the region and incur both economic and non-economic losses. It is projected that by 2050, ASEAN could lose 35% of its GDP due to climate-related impacts (Renault et al, 2021). The main contributors of emissions came from the power sector (58%), transportation (21%), and industry sector (18%). These sectors will need to be decarbonized in order for ASEAN to achieve sustainable economic growth.

AMS energy demand will rise in the period to 2050, especially with the drive for heavy industrialization. Despite ASEAN’s commitment to energy transition, fossil fuel still made up a significant share in ASEAN’s energy scenario. Under the APAEC scenario, by 2050, around 70% of ASEAN’s TPES will be derived from coal, oil, and natural gas. The scenario also projected that renewable energy share will pass fossil fuel by 2034, if AMS can achieve the regional target of 23% renewable energy share by 2025.

ASEAN member countries heavily depend on importing fossil fuels through both intra-ASEAN and global trade to meet their domestic energy needs. Under the business as usual (BAU) scenario, ASEAN has become a net importer of natural gas and will become a net importer of coal by 2039 (ACE 2023). In the global oil trade, ASEAN will become a net importer of oil in 2021. The region’s energy security is jeopardized by its reliance

on fossil fuels, which is exacerbated by the volatile nature of the global supply chain. The presence of inflation and price volatility in the fossil fuel market poses a significant risk to the affordability of energy prices.

In contrast to the APAEC scenario, IRENA Paris-aligned outlook for Southeast Asia estimated that renewable energy share in the region will increase to 60% of primary energy mix of power supply by 2050. Increasing the penetration of localized renewable energy generation is key to a resilient energy supply in the region. Transitioning away from fossil fuels and accelerating the utilization of indigenous renewable sources can enhance AMS energy security and independence.

Southeast Asia also faces the challenge of worsening impacts of climate change. Five ASEAN Member States - Myanmar, Philippines, Thailand, Vietnam, and Cambodia, are among the countries with high vulnerability to climate change impacts, according to the Global Climate Risk Index. These climate change impacts are highly affecting the productive economic sectors in the AMS, such as agriculture, tourism, and fisheries. By mid-century, if global temperatures continue to rise to more than 2°C, ASEAN could lose 35% to 37% of its GDP share. This scenario also projected that economic output would decline steeply in Indonesia, Malaysia, Philippines, Singapore, and Thailand. These countries are estimated to lose economic potential equal to seven times their 2019 GDP by 2050 due to the extreme impact of climate change.

ASEAN's aspiration to be the 'epicentrum of growth' by 2030 is threatened by the barrage of climate-related impacts in the region. The latent economic loss incurred from climate change impacts pose a multiple challenges to regional and national efforts for poverty reduction and the attainment of Sustainable Development Goals (SDGs). An assesment of the climate and energy nexus in ASEAN pointed to the inconsistencies in AMS climate mitigation efforts to the magnitude of climate change impacts that might strike the region in the future. The developing countries' dilemma—that climate actions are costly and curb economic development—is suggested as the reason behind these policy inconsistencies. A holistic approach is needed to address this dilemma. Rather than contradicting each other, the right course of policy action should be able to see the opportunity for economic development presented by serious climate mitigation endeavors.

Accelerating the transition towards sustainable, low-carbon energy sources could offer an alternative that combines approaches between economic development and climate change mitigation efforts. The low-carbon transition provides ASEAN with opportunities to boost economic growth while simultaneously reducing emissions in crucial sectors such as energy and industry.

## **1.2 The challenges and opportunities towards a decarbonized ASEAN**

### **1.2.1 ASEAN Decarbonization Pathways**

According to the World Bank (2023), Southeast Asia as a whole has consistently experienced economic growth rates ranging from 1% to 1.3% between 2006 and 2023. This sustained stability presents a unique opportunity for the region to proactively address global greenhouse gas emissions by embarking on a deliberate path toward decarbonization. Luciani (2020) contends that this transition, both as a narrative and a movement, holds the potential to invigorate economic growth but also foster employment opportunities. However, it will also introduce risks to existing economic norms heavily reliant on fossil fuels. To strike a balance between this opportunity and threat, embracing the transition becomes imperative for ASEAN to strategically pursue green development, ensuring a prosperous future while safeguarding environmental sustainability.

The power sector stands as the primary contributor to emissions within the region (ASEAN State of Climate Change Report, 2021). Further, according to ASEAN Energy Outlook, only 23.3% of ASEAN's electricity

production in 2020 was sourced from Renewable Energy (RE), while the majority relied on fossil fuels (see Figure 1). In addition to that, there are other underlying factors for ASEAN to accelerate this low-carbon transition that this study will explore and try to uncover barriers, which are unstable policies, limited environmental awareness among society, insufficient political will for energy transition, technological and capital disconnects, and regional coordination challenges (Yang & Li, 2024).

### 1.2.2 Cooperatives and Aspirations in Energy Sector among AMS

The ‘ASEAN Way’ of diplomacy is characterized by non-intrusiveness, signifying that member countries acknowledge the need to handle domestic issues internally (Suzuki, 2019). Despite frequent engagement in meetings and the adoption of various mechanisms, ASEAN—an international organization committed to regional integration—rarely achieves unified coordination in its foreign policies (Bo, 2021). However, through this study, we believe that, as global norms for climate mitigation, the abundance of renewable energy resources, and strategic green global value chain transitioning the energy towards low-carbon energy, it's really visible for ASEAN to become a role model for the other emerging and fossil intensive countries in green development.

In pursuing sustainable development and environmental responsibility, the AMS’s have unequivocally articulated their commitment to low-carbon energy transformation. This collective aspiration aligns with global efforts to achieve net-zero emissions and uphold the principles outlined in international agreements such as the Paris Agreement. However, realizing this vision requires multifaceted strategies, robust policies, technological innovation, and substantial investments. The path toward decarbonization involves optimizing renewable energy adoption, improving energy efficiency, and addressing systemic challenges. As AMSs navigate this complex landscape, they balance economic growth with environmental stewardship, leveraging regional cooperation and international partnerships.

**Table 4 AMS Energy Transformation Goals**

Country	Goals
Brunei Darussalam	By 2035, 30% of electricity by renewable energy will be achieved.
Cambodia	By 2030, the total installed capacity will reach 55% hydroelectric power generation, 6.5% biomass power generation, and 3.5% solar photovoltaic power generation.
Indonesia	An increase in the share of renewable energy in the primary energy supply will rise to 23% by 2025 and 31% by 2050.
Lao PDR	From 2021 to 2030, renewable energy will account for 52% of the newly added electricity capacity.
Malaysia	By 2025, renewable energy will account for 30% of the total energy consumption.
Myanmar	By 2025, aims to achieve 20% of renewable energy and 31% of renewable energy installed capacity in the electricity capacity portfolio.
Philippines	By 2025, the proportion of the renewable energy installed capacity will reach 20%.
Singapore	By 2030, the installed capacity of solar photovoltaic energy will be 2 GW.
Thailand	By 2037, Thailand aims to increase the proportion of renewable energy in the total final energy consumption to 30%, the capacity of renewable energy electricity to 36%, and the proportion of power generation to 20%.
Vietnam	By 2036, Vietnam will increase the proportion of its renewable energy in transportation fuel consumption to 25%. By 2030, renewable energy will account for 15–20% of the primary energy consumption and 25–30% by 2050. The installed capacity of solar photovoltaic and

Country	Goals
	wind energy is in the range of 31–38 GW. The installed capacity of offshore wind power is 4 GW, which will be 36 GW by 2045.

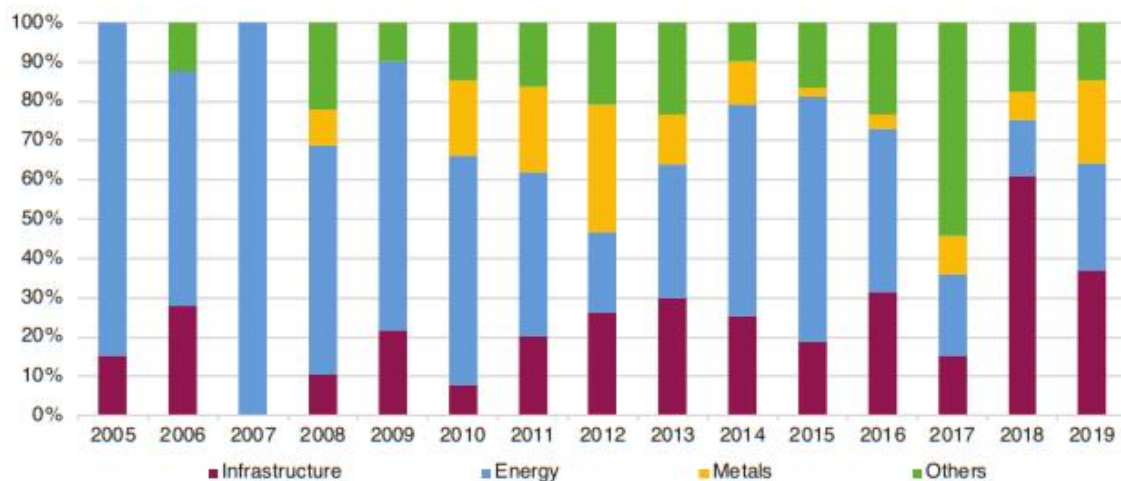
Source: *The Status Quo, Dilemma, and Transformation Path of the Carbon Neutrality-Related Policy of ASEAN* (Yang & Li, 2024) and Compiled by Author

Note: ASEAN member countries have both conditional and unconditional targets. In this table quoted renewable energy target under conditional target of NDC, which making the case for SSC more relevant.

In the same way, the ASEAN Centre for Energy has basically had an aspiration to decarbonize the power sector by enhancing the energy connectivity and market integration in ASEAN to achieve energy security, accessibility, affordability, and sustainability for all and by accelerating the energy transition and strengthening energy resilience through greater innovation and cooperation, under the project umbrella called the ASEAN Plan of Action for Energy Cooperation (APAEC). This initiative has seven key areas that cover 1) ASEAN power grid; 2) Trans-ASEAN gas pipeline; 3) coal and clean coal technology; 4) energy efficiency and conservation; 5) renewable energy; 6) regional energy policy and planning; and 7) civil nuclear energy (ACCEPT, 2021).

While this project has implemented comprehensive strategies to address the region’s energy transition challenges, several critical assessments are related to this agenda. Firstly, the project does not sufficiently emphasize the importance of close communication, knowledge-sharing, and action planning among AMS’s leaders. Secondly, APAEC should establish a collective understanding regarding terms such as ‘low carbon economy.’ Lastly, the project must engage in discussions and define specific values to ensure that no one is left behind in this effort to embrace systemic change through values of justice, inclusion, and equality in energy transition (ACE, 2023). Additionally, considering the current collaboration, it is essential to scale up efforts, making the objective of this aspiration feasible for implementation based on the recommendations covered in this study.

Yet, to implement this capability, unconditional support from foreign direct investment is required to shift the gray to green investment in ASEAN. Among the top five countries with the largest foreign direct investment to ASEAN from 2005 - 2022, China is the country that is supporting AMS to reach their energy security from both fossil and renewable energy. Figure 2 below explains that energy has the most sectors China invests in AMS.



**Figure 3 China Investment in Southeast Asia by Industrial Sector**

Source: *Chinese Investment in Southeast Asia* (ISEAS, 2023)

### 1.2.3 Scenarios and Implications for Renewable Energy Growth

Deploying renewable energy is the most accessible action to reduce carbon emissions in ASEAN. This is because the ASEAN member states have already expressed cooperative aspirations and goals, and the region has geographical potential with renewable energy resources. Additionally, there is a global value chain in manufacturing renewable energy. Most importantly, ASEAN's power and influence can become the backbone of Asia in energy transition.

**Table 5 ASEAN Renewable Energy Share in Installed Capacity Projections**

Institutions		2025	2030	2050
ACE	ATS (Aggressive)	41,5 %	47,8 %	63,2 %
	LCO (Moderate)	38,1 %	42,9 %	57,6 %
	(Baseline)	34,5 %	36,1 %	35 %
IRENA	1.5-S (Aggressive)	N/A	57 %	88 %
	TES (Moderate)	N/A	53 %	86 %
	PES (Baseline)	N/A	46 %	77 %

*Source: Compiled by Author from the 7th ASEAN Energy Outlook & Renewable Energy Outlook for ASEAN (ACE, 2022; IRENA, 2022)*

The forecasted distribution of renewable energy shares in the ASEAN region highlights the potential and accessibility of renewable energy resources. However, these models necessitate specific interventions to facilitate the transition effectively. These interventions encompass the following key aspects:

**Investment Requirements:** To reduce carbon emissions in the energy sector, an approximate USD 1,070 billion investment is necessary throughout the ASEAN region. Significantly, according to ACE (2022), investment in renewable energy development constitutes 59% to 77% of the overall investment.

**Risk Mitigation:** As ASEAN aims to gain unwavering support from the international community, it becomes crucial to evaluate local risks linked to different solutions. This review involves assessing investment risks associated with the stability of policies, the dynamics of the market, and technological improvements. Hence, if this factor is considered, AMS has a strong inclination to take measures to protect investors' interests when attempting to enter the market.

**Private Sector Involvement:** The active participation of private investors, venture capital, and public-private partnerships is essential. The involvement of the private sector expedites the transition by promoting creativity and supplying essential resources.

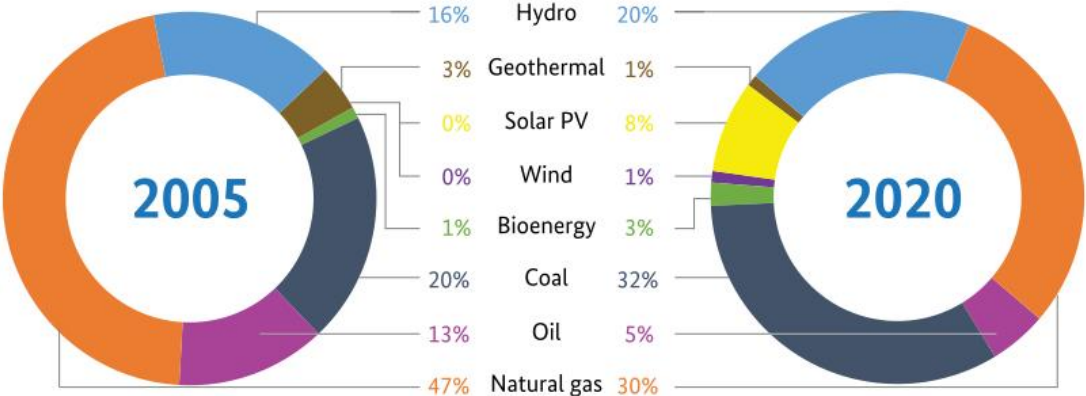
Embracing developing technology is crucial in order to keep up with technological advancements. Engaging in partnerships with both academic institutions and industries promotes the development of new ideas and solutions while investing in skill development enhances technical proficiency and the exchange of knowledge.



Social and Environmental Considerations: Diligently addressing social and environmental aspects. Community involvement, implementation of environmental protection measures, and the generation of employment opportunities all contribute to a comprehensive and enduring shift towards sustainable energy.

**1.2.4 Renewable Energy Development in the ASEAN Member States**

AMS has been actively involved in the development of renewable energy since 2005 as a means of addressing climate change. This effort has been furthered by implementing hydro power generation, geothermal energy, and bioenergy. However, the first phase's renewable energy (RE) share only represents 19.1% of the overall energy supply. Furthermore, this figure specifically applies to a limited number of countries that can expand their renewable energy sources. In 2020, according to the ASEAN Energy Outlook (2022) data, the proportion of renewable energy in the total energy supply increased to 33.3%.



**Figure 4 ASEAN Installed Capacity by Fuel 2005 vs 2020**

Source: *The ASEAN Energy Outlook 2022 (ACE, 2022)*

Variable renewable energy (VRE) sources, such as solar, wind, and certain types of hydropower, which have no implications of significant changes due to natural changes and resource exhaustion, accounted for less than 30% of the total renewable energy in 2020. The quantity must be augmented as this particular form of renewable energy clearly has the potential to serve as the foundation for the ASEAN energy mix, owing to its distinct benefits over other forms of renewable energy.

In order to comply with the Paris Agreement, IESR has declared that the renewable energy combination should make up 55%, with VRE contributing 42%. With the exception of Vietnam, Cambodia, and the Philippines, the remaining countries have not yet achieved a VRE penetration rate of 5 percent (IESR, 2024). This VRE must clearly expand in order to support the future development of renewable energy in the ASEAN region. The current rate at which member states install and target renewable energy falls short and does not align with the goal of limiting global temperature increase to 1.5 °C, as seen in table 6 below.

**Table 6 Installed & Target of Renewable Energy in AMS**

Country	Installed in GigaWatts	Target in GigaWatts
Brunei Darussalam	0,1	954 GWh (2025)
Cambodia	2,33	2,2 (2020)
Indonesia	13,11	46,30 (2025)

Country	Installed in GigaWatts	Target in GigaWatts
Lao PDR	0,03	0,9 (2025)
Malaysia	9,0	21,37 (2050)
Myanmar	3,51	0,4 (2020)
Philippines	7,77	15,30 (2030)
Singapore	5,8	15,30 (2030)
Thailand	12,55	19,68 (2036)
Vietnam	17,1	45,80 (2030)
Timor Leste	N/A	N/A

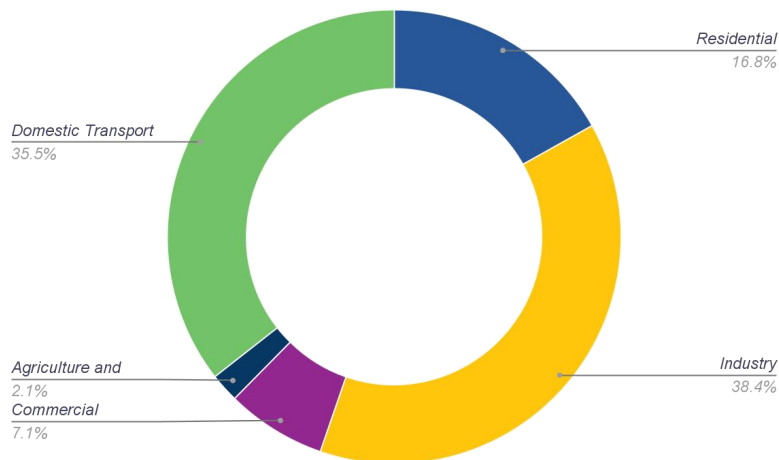
Source: Compiled by Author from Renewable Energy Capacity Tracker (Qery, 2024). An Overview of Renewable Energy in Southeast Asia (Erdiwansyah et al., 2020)

The building of a renewable energy industry is a strategic entry point for AMS to become a key player in Asia and even globally in ensuring energy security and reducing greenhouse gas emissions. Southeast Asia is a strategically located region that serves as a hub for renewable energy production. Specifically, around 9% - 10% of the world's solar photovoltaic (PC) cells and modules are manufactured in this area. Over half of the world's nickel production and other critical minerals are extracted. Lastly, this region also has accounted for 6% - 10% of the global production of electric two-wheelers (Asian Development Bank, 2023). The efforts to promote the growth of renewable energy in the region and expand the manufacturing capabilities of Southeast Asia's strategic power in the renewable energy industry can serve as a significant milestone in regional cooperation.

### 1.2.5 Scaling up Green Industry and Renewable Energy Technologies Manufacture

- **Green Industry**

As of 2020, electricity consumption in the ASEAN region is the second greatest share, amounting to 22.7%. The industrial and transportation sectors have consistently maintained their positions as the leading consumers of electricity, accounting for 38.4% and 35.5%, respectively (ACE, 2022).

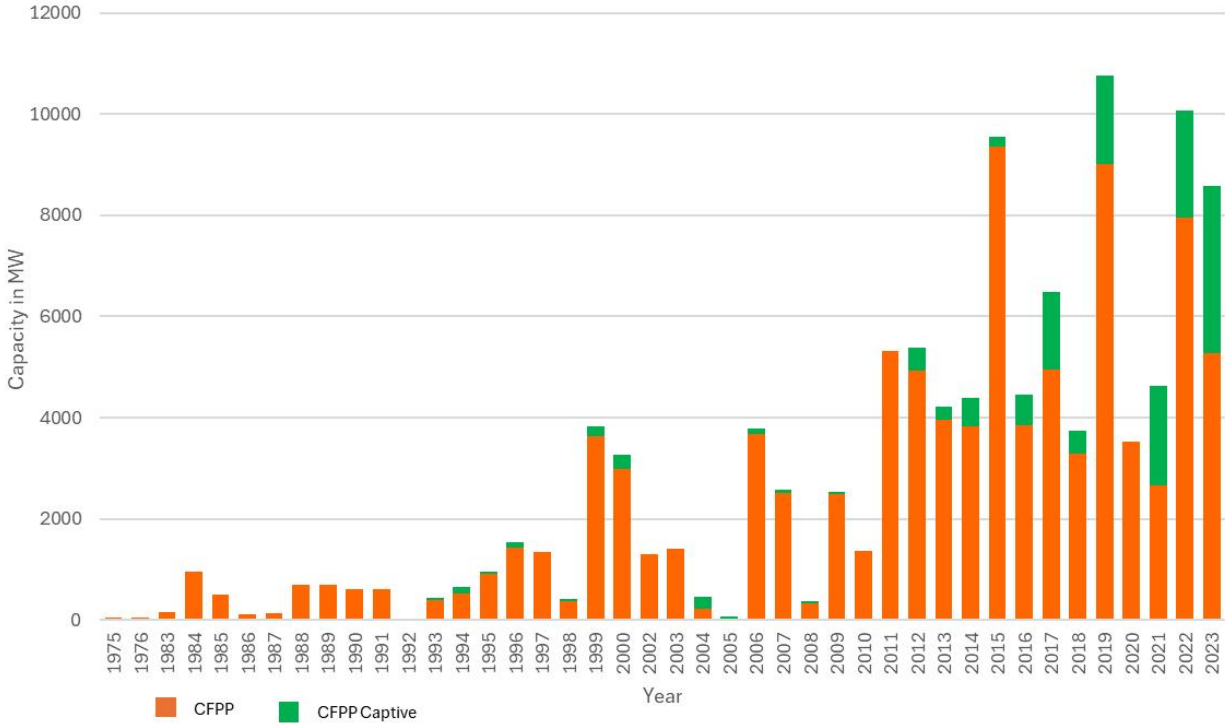


**Figure 5 ASEAN Total Energy Consumption by Sector in 2020**

Source: Curated by Author from The ASEAN Energy Outlook 2022 (ACE, 2022)

Given this ambition, the industry sector can serve as a pivotal point for AMS to expedite its efforts in environmental sustainability. Currently, the bulk of industries continue to rely on captive coal-fired power plants to provide electricity, heating, and coal systems for their operations. Furthermore, this power generation is primarily situated in industrial clusters of facilities geographically isolated from the main national networks.

Global Energy Monitor data reveals that most ASEAN member states rely on coal-fired power plants (CFPP) for their energy supply. The combined installed capacity of coal-fired power plants (CFPP) in these nations was around 97 GW between 1975 and 2023. Thus, within the realm of captive CFPP, these nations, with the exception of Brunei, have captive power capability, totaling around 14 GW from 1992 to 2023. The diagram below illustrates that Southeast Asian nations have implemented Captive CFPP, representing 13% and 87% of the overall CFPP integrated into the national power grid. The statistics for captive power in this country have experienced a significant increase due to the growth of heavy industries such as cement, chemicals, textiles, pulp and paper, iron and steel. Additionally, the government has recently shown a commitment to exploring the critical minerals industry, which also depends on captive power for their Industrial Parks (IP).



**Figure 6 Total Installed Capacity for Coal Fired Power Plant & Captive Coal Fired Power Plant in Several AMS**

*Source: Curated by Author from Global Coal Plant Tracker April 2024 by Global Energy Monitor*

China's overseas industrial parks are crucial in promoting the greening of the industry sector, as they are closely linked to the country's expansion in the global market and the establishment of a global value chain. According to the Ministry of Commerce PRC (2019), China had a total of 113 foreign economic and trade zones in 2019. These zones were spread over 46 different nations, including countries in Southeast Asia. As a result of the greening initiative, the Ministry of Ecology and Environment of PRC has released guidelines for promoting environmentally friendly foreign investment cooperation. These rules encourage enterprises to establish, construct, and enhance the growth of green industries (Song & Miao, 2023).

Finally, ASEAN-China cooperation on green development aims to significantly increase efforts to reduce carbon emissions in industries. This strategy is crucial for promoting low-carbon development, as China's influential role in Southeast Asia's industrial sector enables the private sector to easily adopt and transition to energy-efficient technologies.

- **Renewable energy Technologies and manufacturing**

Given that variable renewable energy is anticipated to become the global dominant energy source by 70% in the future (Ueckerdt et al., 2017), it is imperative to acquire a regional position in order to expand the manufacturing of these renewable energy sources to manage the global supply. The renewable energy technologies industry is a strategic prospect for ASEAN as a climate leader in the world, as it is geographically situated in the vicinity of critical mineral sources that are a resource for renewable energy technology manufacturing. Additionally, the industry has a strong manufacturing foundation in the global value chain.

Currently, Southeast Asia is the manufacturer of 9% to 10% of the world's solar photovoltaic (PV) cells and modules, as well as 6% to 10% of all electric two-wheelers. This lays a good foundation for strengthening ASEAN's renewable energy technology status and expanding green technology and manufacturing industry cooperation between China and ASEAN.

## **2 Achieving a Decarbonized Southeast Asia through International Collaboration: ASEAN-China Cooperation for Renewable Energy Development**

### **2.1 Jointly building the BRI provides broad space for green energy cooperation between China and ASEAN countries**

In June 2021, 29 countries, including China, ASEAN countries, central Asian countries, and some Arab countries, jointly launched the Belt and Road Green Development Partnership Initiative. The initiative emphasizes that countries should take action to address climate change based on the principles of fairness, common but differentiated responsibilities, and respective capabilities, combined with their respective national conditions. It also proposes that all parties should strengthen cooperation in deepening environmental cooperation, promoting green and sustainable development, promoting clean energy development and utilization, strengthening international cooperation in renewable energy, and encouraging countries and international financial institutions to develop green finance.

In jointly building the Green BRI, China and ASEAN countries have actively promoted green policy coordination, green infrastructure connectivity, unimpeded green trade, and green financial integration. China has taken the initiative to align the development strategies of participating countries, formulated the China-ASEAN Action Plan on Environmental Cooperation, the Five-Year Plan of Action on Lancang-Mekong Cooperation (2023-2027), and other development plans, and actively participated in the green industry development, clean energy transition, green technology innovation, climate governance, and ecological city construction of participating countries.

The ASEAN Plan of Action for Energy Cooperation (APAEC) (2016-2025) mentions strengthening ASEAN energy connectivity and market integration, enabling everyone to enjoy safe, accessible, affordable, and sustainable energy. The ASEAN Indo-Pacific Outlook, launched in June 2019, prioritizes the alignment of regional development agendas with sustainable low-carbon development goals.

The ASEAN Community Vision 2025, the ASEAN Indo-Pacific Outlook, the BRI, and other ASEAN-proposed contents were warmly welcomed and appreciated in the Joint Statement on Strengthening China-ASEAN Common Sustainable Development that the Ministry of Foreign Affairs of China released in 2022. At the same time, it was further proposed to strengthen cooperation between the two sides in the development and

application of new energy technologies, green investment, and financing, capacity building, as well as promoting energy transition and industrial structure upgrading, establishing a China-ASEAN Clean Energy Cooperation Center, and achieving low-carbon economic development and green sustainable growth.

## **2.2 Remarkable results have been achieved in the cooperation between China and ASEAN countries for promoting innovation and investment in clean energy technology**

With the guidance of the concept of green development, China and ASEAN countries have increasingly deepened their cooperation in clean energy. In November 2021, the joint statement released by the China-ASEAN Special Summit to Commemorate the 30th Anniversary of China - ASEAN Dialogue Relations announced that the two sides would strengthen cooperation in green investment and financing, new energy technology, and other fields, promote the transition and optimization of regional energy system, economies, and industrial structures, and jointly achieve low-carbon development and sustainable green growth. In addition, at this summit, both sides have decided to establish the China-ASEAN Clean Energy Cooperation Center to promote the sharing of clean energy technologies, strengthen financial support, and provide strong support for regional energy transition and sustainable development.

Since 2017, China and ASEAN countries have formed three cooperative mechanisms in clean energy: the East Asia Summit, ASEAN Plus Three, and ASEAN Plus One. They have conducted in-depth cooperation on comprehensive governance, policy planning, market cultivation, and joint clean energy research and formed a deep and good cooperative relationship. They have also established professional cooperation and communication brands such as the East Asia Summit Clean Energy Forum, ASEAN Plus Three Clean Energy Roundtable Dialogue, and China-ASEAN Clean Energy Capacity Building Plan, providing strong support for promoting practical cooperation between the two sides in the field of clean energy. The China-ASEAN Clean Energy Capacity Building Plan has successfully organized five exchange projects, covering multiple topics such as sustainable hydropower development, large-scale wind and solar power development, and multi-energy complementary technologies and applications. It has trained more than 1000 trainees for ASEAN countries.

The cumulative two-way investment between China and ASEAN countries has already exceeded 380 billion US dollars, involving multiple fields such as new energy and electric vehicles. According to ASEAN Energy Center statistics, so far, Chinese companies have invested in or participated in developing and constructing numerous clean energy projects in ASEAN countries, involving hydropower, wind power, solar PV power, biomass power, power grid, green equipment manufacturing, etc. Some typical projects include the Lower Sesan II Hydropower Station in Cambodia, the Nam Ou River Cascade Hydropower Project in Laos, the Upper Cisokan Pumped Storage Power Station in Indonesia, Binh Dai Offshore Wind Power Project in Vietnam, Soc Trang No.4 Offshore Wind Power Project in Vietnam, Sanchez-Mira Wind Power Project in Philippines, EA Phase II Wind Power Project in Thailand, Phu My Solar PV Power Project in Vietnam, Loc Ninh Solar PV Power Project in Vietnam, and so on.

Nowadays, Chinese companies are leading the world in the technology and production capacity of solar PV module manufacturing, with global market shares exceeding 80%. Several Chinese solar PV module manufacturing companies have identified ASEAN countries as the most important overseas production bases, such as China's Jinko Solar, investing in constructing a solar cell and module production factory in Penang, Malaysia, and establishing a joint PV R&D center. LONGi has actively expanded its presence in the Asia Pacific region since 2015 and invested in building factories in Malaysia and Vietnam. The investment in these manufacturing industries has greatly enhanced the technological capabilities of ASEAN countries in the research and development, manufacturing, and application of PV modules and has played a driving role in the overall development of the local renewable energy industry.

In summary, addressing global climate change and achieving national energy security are common challenges for China and ASEAN countries. During the process, China and ASEAN countries have established a mature cooperation mechanism with the vision of jointly building the Green BRI. The remarkable cooperation achievements being achieved, the cooperation foundation and the experiences established by both sides will support the in-depth and extensive cooperation in the future. They will further provide impetus for ASEAN countries to achieve the Net-Zero target early.

### **3 Best Practices of ASEAN-China Renewable Energy Cooperation**

#### **3.1 Cirata Floating Solar PV Power Project in Indonesia**

Cirata Floating Solar Photovoltaic Power Project in Indonesia is the largest floating solar PV power project in the Southeast Asia region, with a total installed capacity of 192 MWDC. The project is jointly invested and developed by Indonesian state power firm and Abu Dhabi Future Energy Company and constructed by POWERCHINA in an EPC model. This project has been selected as a national key strategic policy project in Indonesia, which is of significant milestone significance for Indonesia's development of clean energy and achievement of energy transition.

Cirata Floating Solar Photovoltaic Power Project is located on the surface of the Cirata Reservoir in West Java Province, Indonesia. The water surface section of the project includes 13 independent floating photovoltaic arrays, each measuring approximately 430 m in length and 230 m in width, including 48 sub arrays. The entire photovoltaic project consists of over 28,000 photovoltaic modules. Cirata Floating Solar Photovoltaic Project is the world's first floating surface photovoltaic project with a water depth of 100 meters.



**Figure 7 Overall View of the Cirata Floating Solar Photovoltaic Power Project**

After the completion of the project, the annual power generation will reach 300GWh, which can provide clean and green electricity for about 50,000 households. At the same time, it can reduce the consumption of about 117,000 tons of standard coal, carbon dioxide emissions by about 214,000 tons, coal ash emissions by about 82,000 tons, sulfur dioxide emissions by about 9,000 tons, and nitrogen oxide emissions by about 4,500 tons. Enhancing the power supply capacity of West Java Province's power system has effectively improved the local energy structure and increased the proportion of renewable energy, which is of great strategic significance for Indonesia in achieving carbon neutrality goals.

### **3.2 Solar PV Electricity Export from Indonesia to Singapore**

Singapore is located near the southern tip of the Malay Peninsula and is an important transit port and aviation center in the world. It is also the only developed country in the Southeast Asian region. Singapore has a population of over 5.5 million, but its land area is only 728.6 square kilometers, with high population density and very limited land resources. It is not suitable to build large-scale renewable power projects. At present, Singapore's electricity supply is mainly dominated by natural gas power generation, which accounts for over 95% of the total energy consumption. With the advancement of global efforts to address climate change, Singapore released its Green Plan 2030 in 2021, proposing the long-term development goal of achieving net zero greenhouse gas emissions by 2050. To achieve low-carbon electricity supply goals in Singapore, importing electricity has become an important option.

In October 2021, Singapore's Electricity Market Authority (EMA) announced a plan to import 4GW of electrical power from overseas, attracting the attention of many local and international electricity investors in Singapore. Indonesia is adjacent to Singapore, and the straight-line distance between Batam Island in Indonesia and Singapore does not exceed 20 km. Indonesia has abundant solar energy resources and a large amount of land suitable for solar energy project development. Developing and constructing solar photovoltaic power generation and storage projects on islands near Singapore and sending green electricity to Singapore through submarine cables is the best option to achieve complementary advantages for both sides. In April 2023, at the 6th Singapore Indonesia Leaders' Informal Meeting, the two countries signed a memorandum of understanding on renewable energy cooperation, aiming further to promote cooperation in the field of renewable energy, expand green power trading between the two countries, and improve the cooperation framework and infrastructure for power transmission.

### **3.3 Laos Wind Power Exports to Vietnam**

In recent years, with the rapid development of Vietnam's economy, its domestic electricity demand has also been rapidly increasing. To address the increasingly severe power shortage, Vietnam has further increased its efforts to import electricity from neighboring countries. Laos is a neighboring country that shares rivers and mountains with Vietnam, and its central region also has a lot of wind energy resources. Vigorously developing Laos' abundant wind energy resources, constructing wind power projects, and sending the green electricity generated in Laos to Vietnam is a win-win solution for both countries to achieve complementary advantages in resource and demand, as well as sustainable development.

The Monsoon 600 MW wind power project in Laos was born based on the above background site is located in the low mountain areas of the Sekong and Attapu provinces in central and southern Laos. It is the first wind power project constructed in Laos and currently the largest single wind power project invested in Southeast Asia. The entire project site covers an area of 1100 hectares, including 133 wind turbines with a single unit capacity of 4.51 MW. The wind farm will also have 5 booster stations and nearly two kilometers of 500 kV transmission lines. Impact Energy Asia Development Limited (IEAD) from Thailand invested in and developed this project. The Asian Development Bank (ADB) and several commercial banks have jointly provided financing plans for the project, the largest syndicated renewable energy project financing transaction among ASEAN countries.

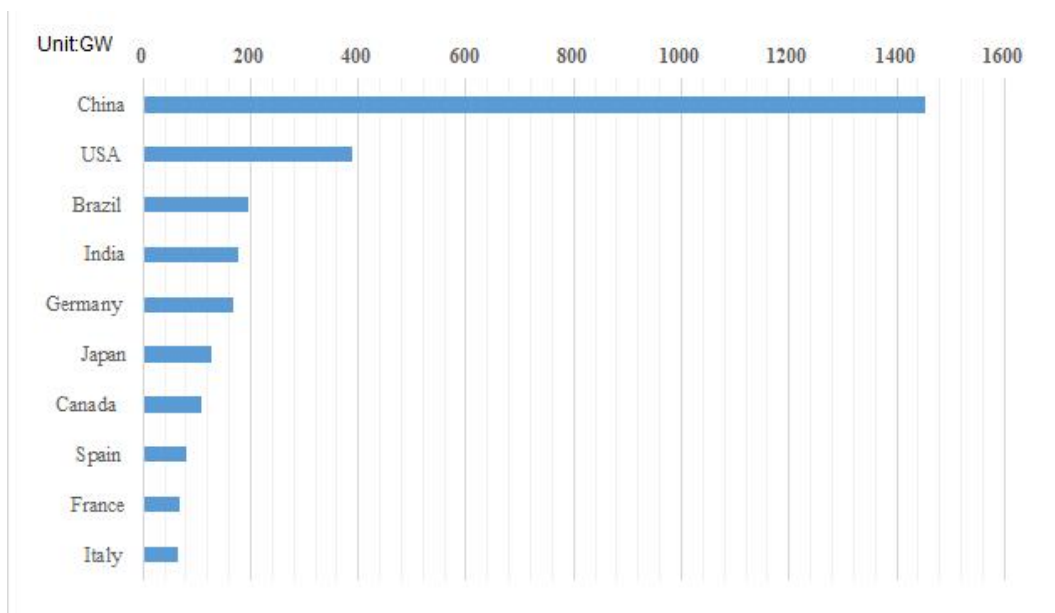
## **4 Potential to Scale Up ASEAN-China Cooperation for Green Development**

In recent years, to actively address increasingly severe global issues such as climate change, environmental risk challenges, and energy resource constraints, the Chinese government has proposed a development strategy to promote green transformation of economic and social development, accelerate the construction of a clean and low-carbon energy system, provide support for the sustained and healthy development of the Chinese

economy and society, and make positive contributions to maintaining world energy security, responding to global climate change, and promoting world economic growth. China's energy industry has made significant achievements in market size, technological innovation and development, technical standard system construction, industrial chain and capacity construction, etc. This undoubtedly lays a solid foundation for promoting cooperation between China and ASEAN countries in green energy.

#### 4.1 China is the world's largest clean energy market

After nearly a decade of rapid development, China has become the world's largest producer and consumer of green and clean energy, and its overall market size has remained the world's largest for many years. According to data released by IRENA, as of the end of 2023, China's total installed renewable energy capacity was 1453 GW, ranking first in the world. The specific capacity distribution of major renewable energy-installed countries in the world is shown in Figure 1.



**Figure 8 Distribution of Total Installed Capacity of Renewable Energy in Major Countries**

Specifically, as of the end of 2023, the total installed hydropower capacity in China was 421.5 GW, accounting for 29.9% of the global installed hydropower capacity. Among them, the total installed capacity of pumped storage power stations in China was 50.94 GW, accounting for 36.4% of the global total pumped storage capacity. The installed capacity of wind power in China is 441.9 GW, accounting for 43.4% of the global total installed capacity of wind power. Among them, the total installed capacity of offshore wind power is 37.29GW, accounting for 51.32% of the global total installed capacity of offshore wind power; China's installed capacity of solar power generation has reached 609.9 GW, accounting for 43.0% of the global total installed capacity of solar power generation. According to data released by the National Bureau of Statistics of China, the total electricity generation of hydropower, wind power, and solar power in China has reached 2755.87 TWh in 2023, accounting for more than 29% of the country's total electricity generation. Renewable energy generation has become the fastest- part of China's power system. It has made significant contributions to energy conservation, emission reduction, and green and low-carbon development of the entire power system.



China has a vast territory, significant regional differences, and significant differences in resource endowments, which have led to the formation of various development and application scenarios in the process of renewable energy development, including cascade development and scheduling models for rivers, large-scale development modes for wind and solar power, complementary development modes for water, wind, and solar energy, as well as agricultural and solar PV complementary modes, fishery and solar PV complementary modes, etc. These multi-scenario development modes also provide useful references for developing renewable energy in other countries and regions.

## **4.2 China's leading advantages for renewable energy technology**

China's rapid progress in renewable energy cannot be separated from its continuous innovation and progress in renewable energy technology. In the field of hydropower, Chinese companies are leading the way in surveying, designing, and constructing large-scale hydropower stations. They have achieved breakthroughs in building high dams, reinforcing slopes, managing high-flow discharge, and constructing deep tunnels. Their tunnel boring machine (TBM) construction advancements have also helped them cope with challenging geological conditions during power station construction.

In wind power, Chinese companies are also constantly creating new records in important indicators such as wind turbine unit capacity and reliability. China's capabilities in wind power engineering, design, construction, and wind turbine lifting are also rapidly improving. Various new and ultra-high wind turbine tower technologies continue to emerge, and breakthroughs have been made in offshore wind power's design and construction technology.

As for solar power generation, Chinese companies have maintained a leading position worldwide for many years in areas that reflect their core competitiveness, such as PV cell conversion efficiency and cost control. In recent years, Chinese PV manufacturing companies have vigorously promoted the intelligent PV manufacturing enhancement plan, promoted the intelligent manufacturing level of basic PV materials, solar cells, and components, promoted the research and application of intelligent production equipment, improved the intelligent connection of overall manufacturing processes, and constructed new intelligent manufacturing demonstration factory through dynamic resource allocation, precise process control, human-machine collaborative operation, and lean management.

## **4.3 Comprehensive system of renewable energy technology standard**

With the development and technological progress of the renewable energy industry, China has also made tremendous achievements in establishing the renewable energy technology standard system. China has established a complete renewable energy standardization management mechanism, from the national standardization management department to the competent department of the renewable energy industry, from the National Standardization Technical Committee to the Renewable Energy Industry Standardization Technical Committee. At the same time, China has preliminarily established an institutional system that connects and complements renewable energy technology standards at different levels. Regarding standard system construction, China has established relatively complete technical standard systems in many fields represented by new and renewable energy, such as hydropower, wind power, and solar energy.

In the field of hydropower, the existing technical standard system covers various aspects and professional technical standards of hydropower engineering, including general requirements, planning, and design, equipment, construction and acceptance, operation and maintenance, engineering cost, renovation and retirement, etc., involving more than 800 specific technical standards. In wind power technology, the entire standard system involves more than 180 aspects, including wind farm planning and design, construction and installation, O&M management, wind power grid connection management technology, wind turbine equipment,

wind power electrical equipment, etc. In the field of solar photovoltaic power generation, the existing standard system includes 7 directions and 35 subcategories, including general requirements, photovoltaic equipment manufacturing, photovoltaic materials, photovoltaic cells and modules, photovoltaic components, photovoltaic systems and applications.

In addition, in recent years, the Chinese authorities and relevant institutions have vigorously promoted the "introduction" and "going out" of renewable energy technology standards. Firstly, they have increased the alignment and mutual promotion between Chinese standards and international standards; second is to join the International Organization for Standardization and actively participate in the formulation of international standards. Third, continue to strengthen the translation of China's renewable energy technology standards, and enhance the influence and application of Chinese renewable energy technology standards relying on the cooperation with BRI participating countries. For example, in the processes of the design and construction of the Nanli I and II hydropower project in Laos, the Lower Sesan II Hydropower project in Cambodia, and the Karot hydropower project in Pakistan, Chinese hydropower technology standards have been adopted. Chinese standards have also been fully adopted in the design and construction of the Adama Wind Farm in Ethiopia. In the future, under the framework of China-ASEAN energy cooperation, both sides can further strengthen exchanges, cooperation, and mutual recognition in the field of renewable energy technology standards, and contribute Chinese wisdom and experience to their cooperation in the field of renewable energy.

#### **4.4 Strong production capacity advantage in the field of renewable energy development**

China's rapid development in the field of renewable energy cannot be separated from the support of strong production capacity advantages. At present, China has established the world's most complete manufacturing system, which provides great convenience for the research and development, manufacturing, operation, and maintenance of various energy equipment in the field of renewable energy, and also facilitates Chinese companies to "go out" and carry out international cooperation. In the field of hydropower, China's newly added hydropower installed capacity reached 8.04GW in 2023, and the approved and under-construction pumped storage power station capacity exceeded 158GW. In the wind power field, due to the rapid development of the Chinese wind power market, Chinese wind power manufacturing companies have performed excellently. Chinese companies occupy four positions among the top five global wind turbine manufacturers in terms of newly added capacity, demonstrating their huge advantage. In 2023, the total installed capacity of global wind power reached 118GW, while the Chinese market accounted for 77GW, contributing up to 65%. The Chinese market has become the main driving force for global wind power growth. China has also established a complete industrial chain and production capacity in terms of the supply of components for wind turbines, including blades, shafts, gearboxes, generators, control systems, and other links. In the field of solar power generation, in 2023, all of the top 10 global PV module manufacturers are Chinese companies, and Chinese companies have a market share of over 80% in the global PV market. According to data released by the China PV Industry Association, in 2023, Chinese PV companies exported 70.3 GW of silicon wafers, a year-on-year increase of over 93.6%; Export of 39.3 GW of solar cells, a year-on-year increase of 65.5%, and 211.7 GW of PV modules, a year-on-year increase of 37.9%. Chinese PV manufacturing companies have supported the rapid development of global solar PV power generation.

In summary, in the arduous development process of the past few decades, China has established a large and mature renewable energy market system, formed a sound technical standard system and scientific research and innovation capabilities, and built the world's most complete renewable energy equipment research and development, manufacturing industry chain. The capabilities and advantages of Chinese companies in the field of renewable energy have laid a solid material foundation for future cooperation between China and countries around the world, especially ASEAN countries.

## **Chapter 3 China-Africa Cooperation**

In the context of global climate change, Africa has to deal with dual challenges of development and climate change. Over 90% of African governments have submitted Nationally Determined Contributions (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC), 70% of African governments have very specific renewable energy targets, and over 25% of African governments have committed to net-zero goals.

Sino-African cooperation through Forum on China–Africa Cooperation (FOCAC) and the Belt and Road Initiative (BRI) will be crucial for Africa to meet the dual challenges. This research is designed to assess the progress of the Sino-Africa cooperation in the field of green development and explore issues and further opportunities.

### **1 Overview of Africa’s Climate Action and Green Development**

African countries are disproportionately affected by climate change. Over a decade ago developed countries committed to providing \$100 billion each year to developing countries in their fight against climate change.<sup>[39]</sup> However, until 2022, this funding had not materialised, leaving more vulnerable countries, including African countries, struggling to address climate change.<sup>[40]</sup> Similarly, financial pledges, in particular the Loss and Damage Fund - total over \$700 million - made during the COP28 would be insufficient to support countries in Africa. Other progress in providing climate finance to Africa was limited. For example, financial commitments to help Africa's energy transition to renewable were in short supply.<sup>[41]</sup>

Yet despite high levels of vulnerability, African countries have enormous potential for renewable energy production in the forms of solar, wind, hydropower, geothermal, and biomass energy. This potential for cleaner energy production is matched by high levels of climate ambition across the continent. Africa has developed strategies for climate action and green development, which operates through distinct policy frameworks at both the continental, regional and national levels.

#### **1.1 African Union’s Climate-related Policies**

Africa’s commitment to addressing climate change is guided by the African Union Agenda 2063, the UN Sustainable Development Goals (SDGs) and the Paris Agreement. Agenda 2063, adopted in 2015, is Africa’s blueprint for sustainable development for a 50-year period, with the goal of achieving ‘an integrated, prosperous and peaceful Africa, driven by its own citizens, representing a dynamic force in the international arena’<sup>[42]</sup>. Agenda 2063 Goal 7 is closely linked with Sustainable Development Goal 13, which calls for immediate action to fight climate change and its impacts<sup>[43]</sup>, and thus shows how determined African countries are to address climate change. More strategic documents on climate change have been issued since 2021, including a Green Recovery Action Plan in 2021 and a new action plan for climate change and resilience development strategy in 2022.

The first Africa Climate Summit held in September 2023 in Nairobi, Kenya shows a strong determination of African countries to find solutions of global climate changes. The Nairobi Declaration on Climate Change was the main outcome of the Summit to unify African states’ stance on climate action. The Declaration calls for reforms of global financial system to facilitate climate financing and a global tax to fund climate action. It also set an ambitious target to increase Africa’s renewable generation capacity to at least 300 GW by 2030.

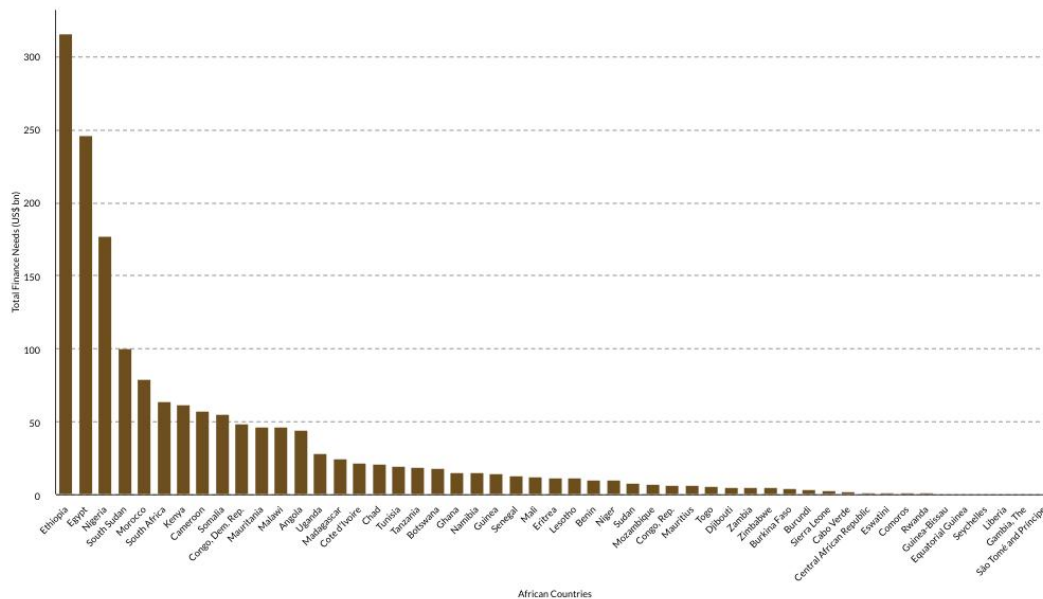
## 1.2 African Countries' Renewable Energy Policies

To boost renewable energy development, 30 African countries have established specific policy frameworks or renewable energy targets. Starting in 2008, several countries have set up targets on the percentage of renewable energy contribution to total energy generation. The targets are mainly assigned in the National Energy (Efficiency) Strategy or as part of their Climate and Sustainable Development Policy. The target percentage is normally below 50% while the detailed roadmap or action plans are mostly missing.

## 1.3 Climate Ambition in African Nationally Determined Contributions (NDCs) and Financing Needs

Fifty three African countries have now submitted their Nationally Determined Contributions (NDCs) to the UN Framework Climate Change Convention (UNFCCC). Of these 53 submitted NDCs, 43 are updated NDCs (also known as Enhanced NDCs (ENDCs)). The only countries that have not submitted NDCs are Libya and Saharawi Arab Democratic Republic. The large amount of updated NDCs highlights the continent's strong commitment to climate change mitigation and sustainable development.

According to the latest NDCs data, African countries have published their estimated climate mitigation and adaptation finance needs. Total financing needs for Africa are approximately US\$2 trillion, led by Ethiopia, Egypt, and Nigeria as illustrated in Figure 2 below. On the lower end of financing needs are Liberia, São Tomé and Príncipe, as well as The Gambia.



**Figure 9 Africa's NDC Financing Costs**

Forty-nine African countries indicate both mitigation and adaptation needs, while São Tomé and Príncipe as well as Zimbabwe only provide mitigation cost estimates. Notably, inconsistencies in the extent of country cost breakdowns limit the scope of analysis that can be done at continental level. However, data indicates that Africa's adaptation costs of about US\$438 billion are about half the continent's climate mitigation finance needs of approximately US\$870 billion.

### 1.3.1 Climate Adaptation

Thirty-five African countries detail climate adaptation financing costs. Among these countries, Egypt (US\$50 billion), Somalia (US\$48.50 billion), and Kenya (US\$43.93 billion) lead in terms of finance needs. Their combined needs represent approximately 33% of the continent’s total climate adaptation finance needs.

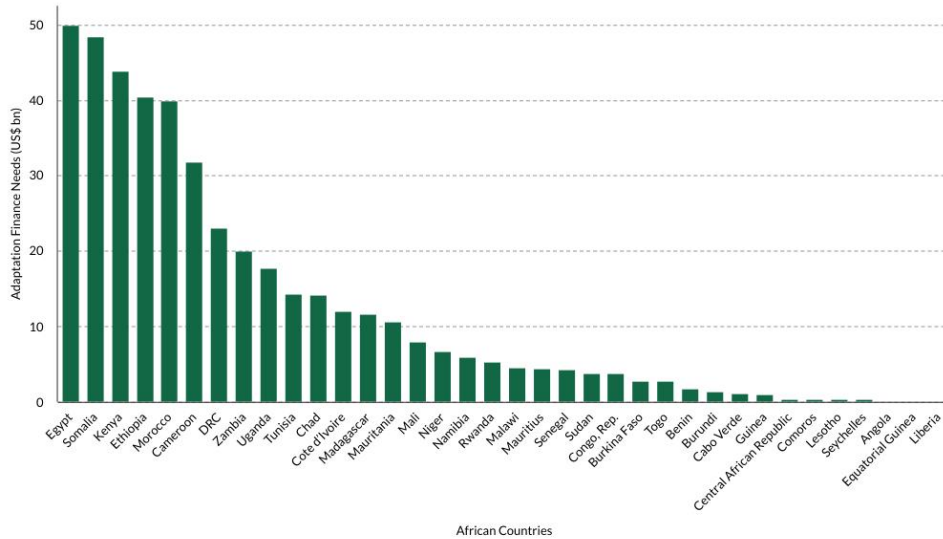


Figure 10 Africa’s Climate Adaptation Financing Needs

### 1.3.2 Climate Mitigation

Thirty-eight African countries have provided their climate mitigation finance needs in their NDCs. The greatest needs among these countries are from Ethiopia and Egypt, where their combined US\$417.50 billion mitigation needs make up about 54% of total known mitigation needs on the continent.

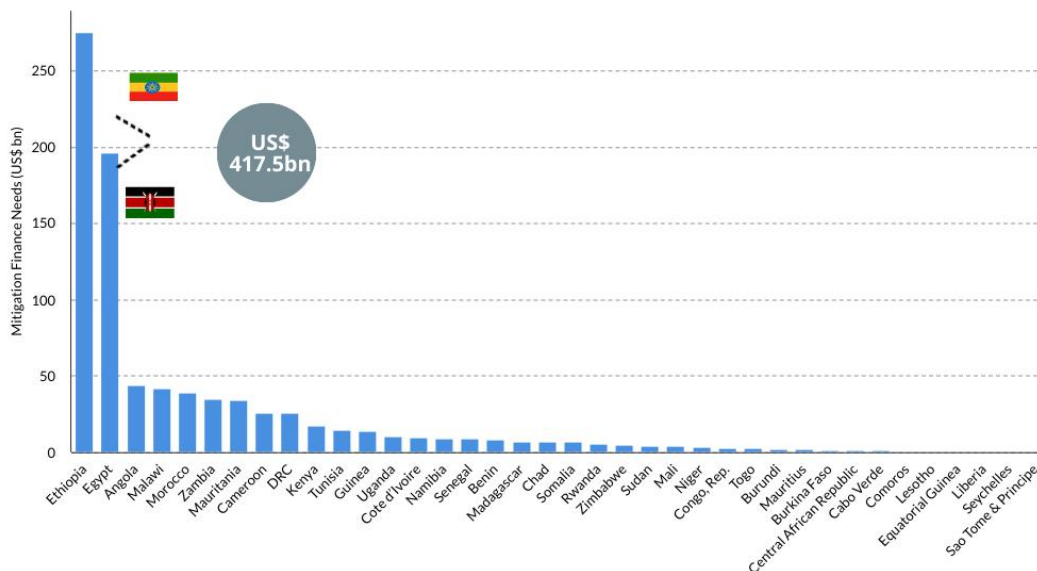


Figure 11 Africa’s Climate Mitigation Finance Needs

## 1.4 Africa’s Needs and Potential for Green Development

Compared to other regions in the world, the renewable energy development in Africa has been very slow. As shown in Table 3, the global installed capacity of renewable energy in 2022 reached 3382 gigawatts, of which China accounted for 1161 GW (34.4%), while 54 countries in Africa combined only accounted for about 59 GW, accounting for only 1.7% of the world total.

**Table 7 Installed Capacity of Renewable Energy Generation (GW) in 2022**

	<b>Renewable energy</b>	<b>Hydro</b>	<b>Solar PV</b>	<b>Wind</b>
Africa	58.7 ( 1.7%)	39.0 ( 2.8%)	11.4 ( 1.1%)	7.7 ( 0.8%)
China	1160.8 ( 34.3%)	413.5 ( 29.7%)	392. 4 ( 37.1%)	366. 0 ( 40.7%)
World	3381.8 ( 100%)	1392.5 ( 100%)	1055.0 ( 100%)	898.8 ( 100%)

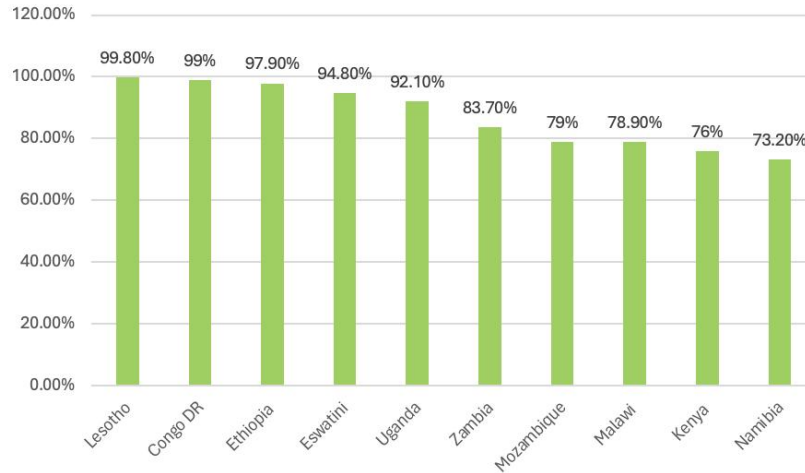
African countries boast abundant sunlight, wind, hydro, and geothermal potential, making them prime candidates for clean energy development. Furthermore, according to SE4All,<sup>2</sup> investment in energy transition technologies creates 3 times as many jobs as fossil fuels per \$1million invested. Through 2030, between 8 million and 14 million energy transition jobs could be created in Africa, potentially driven by government spending on public services and investment in transition technologies.

Currently, renewable energy accounts for over half of the total electricity capacity in 17 African countries. However, despite this vast potential, limited financial resources and underinvestment in the energy sector have hindered progress. On average, renewable energy accounts for only 23.1% of Africa's total electricity capacity, compared to the global average of 38.3%.<sup>[44]</sup> Exploring untapped renewable energy resources can place African countries at the forefront of sustainable development and contribute to the global transition to a low-carbon future.

At the same time, the development of renewable energy is also of great significance to gender equality and women's development. First, by providing a stable supply of clean electricity, the quality of life of local residents has been improved, and the nighttime learning and living conditions of women and children have been improved. It also creates employment opportunities for African countries, especially for women. According to the International Renewable Energy Agency, women account for 40% of full-time positions in the solar photovoltaic sector, almost twice as many as in the oil and gas industry (22%)<sup>[45]</sup>.

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<sup>2</sup> SEforAll. Africa Renewable Energy Manufacturing: Opportunity and Advancement



**Figure 12 Top 10 African Countries with the Highest Renewable Energy Share of Electricity Capacity in 2021<sup>3</sup>**

### 1.4.1 Solar Power

Global Energy data shows that Africa’s PV practical potential (4.51 kWh/kWp/day) is larger than China (3.88 kWh/kWp/day) and the Global average (4.19 kWh/kWp/day). However, the current operating capacity of large utility-scale solar power in Africa is 9478 megawatts<sup>[46]</sup>. This is only 32.3% of that of China and 1.7% of the global. Northern and Southern African region have the greatest practical potential, while Central Africa ranks last. Namibia, Egypt, Lesotho, Libya, and Botswana are the top five countries in terms of average practical potential.

### 1.4.2 Wind Power

Africa has great potential for the development of wind energy. Continental Africa possesses an onshore wind potential of almost 180,000 terawatt hours (TWh) per year, enough to meet the entire continent’s electricity needs 250 times over. Over two third of Africa’s total wind potential is located in places with average wind speeds over 7.5 metres per second, which was considered a good spot in terms of ideal conditions for turbine operation. However, Africa’s installed wind capacity only accounts for less than 1% of the global level.<sup>[47]</sup> Eastern Africa and Northern Africa are endowed with more wind power potential than other African regions. Chad, Lesotho, Djibouti, Cape Verde, and Morocco are the top five countries in terms of wind sources.

### 1.4.3 Critical Minerals

Critical minerals are the essential raw materials for manufacturing components in clean technologies and environmental goods.<sup>[48]</sup> Africa possesses 30% of the world’s mineral reserves, many of which are critical for the production of renewable and clean technologies.<sup>[49]</sup> For example, Africa holds roughly one third of global bauxite resources, the most common aluminum ore that is used in the production of solar PV components. One African country alone - DRC - accounted for over 70% of global cobalt reserves, a key mineral in lithium

<sup>3</sup> Generated by Development Reimagined. Data sources from IRENA, “Renewable Energy Capacity Statistics 2022”

batteries used in electric vehicles and energy storage. Table 8 below presents some of the key critical minerals in Africa and links those to their utility for environmental goods.

**Table 8 Critical Minerals in Africa and Its Scenario in the Environmental Goods Manufacturing<sup>4</sup>**

Critical Minerals	Major producing countries	Use for Environmental Goods
Aluminum	Guinea	Solar PV, EVs and battery storage
Copper	DRC, Zambia	Solar PV, Wind turbines, EVs and battery storage
Cobalt	DRC	EVs and battery storage
Graphite	Mozambique, Madagascar	EVs and energy storage
Nickel	South Africa	EVs and battery storage, wind turbines
Lithium	Mali	EVs and battery storage
Manganese	Gabon, Ghana, South Africa	Solar PV, EVs and energy storage
Rare earth elements	South Africa, Mozambique, and Namibia <sup>[50]</sup>	Wind turbines, EVs and battery storage

The Nairobi Declaration on Climate Change highlighted that Africa must “accomplish the vision of economic transformation in harmony with Africa’s climate needs”, highlighting the action of “shifting exports the energy-intensive primary processing of Africa’s raw material back to the continent”.<sup>[51]</sup> Meanwhile, the global trend towards green development has made Africa’s critical mineral reserves more attractive, which has led many African countries to review their strategies on minerals.

Africa still has many opportunities to upgrade production in the critical minerals and environmental goods manufacturing value chain. Research suggests that outside mining and refining, the production of components and device assembly – as demonstrated by South Africa’s battery assembly industry<sup>[52]</sup> – can influence value addition objectives. Furthermore, if policies encourage downstream applications, the growing demand for digital technology will not only be advantageous for small scale economies, but concerns over secondhand imports will be slashed. There is also massive opportunity in affiliated digital services which can also create jobs. For example, repurposing and recycling can also bring about circulation in the usually linear process of battery production.

#### 1.4.4 Manufacturing of Environmental Goods

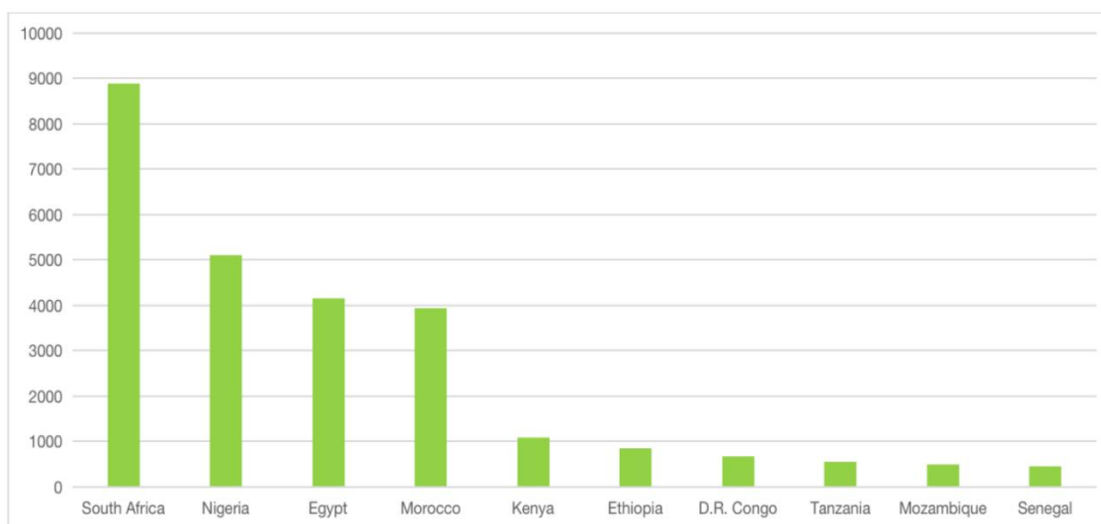
The interdependent relationship between the renewable energy deployment and environmental goods (EGs)<sup>5</sup> highlights the importance of developing its manufacturing supply chain, driving the ongoing transition towards a low-carbon future in Africa. For African countries, trade in environmental goods expands their access to green technologies. Globally, the trade of EGs has grown rapidly in the past 30 years and the EG exports have increased eight-fold from US\$219.3 billion in 1994 to US\$1.76 trillion in 2021. However, under this prosperity, Africa only accounts for 1% of the world’s total trade while 77.5% of the amount is from imports, meaning it is still in the infancy of local manufacturing.<sup>[53]</sup>

Within the African continent, total EGs trade is distributed with significant disparities. Figure 8 below show that South Africa leads on EGs trade, followed by Nigeria, Egypt, and Morocco. Also, 90% of Africa’s environment goods export volume is from four countries, which are South Africa, Egypt, Tunisia, and Morocco, with South Africa contributing to 55.8% of the total.

<sup>4</sup> Generated by Development Reimagined. Sources from [Mo Ibrahim Foundation](#) and [IEA](#).

<sup>5</sup> Environmental Goods (EGs) refer to products and services aimed at measuring, preventing, limiting, minimizing, or correcting environmental damage to water, air, and soil, as well as addressing waste, noise, and ecosystem-related issues. APEC defines it in four main categories: Environmental Protection (EP), Renewable Energy (RE), Environmental Monitoring & Assessment (EMA), and Environmentally Preferable Products (EPP). See more in OECD, 2005, Environmental Goods: A Comparison of the APEC and OECD Lists. [Link](#).





**Figure 13 Top 10 African Countries in Total Environmental Goods Trade in 2020 (in US Million)<sup>6</sup>**

Africa has policies on environmental, climate change and sustainable development at the continental, regional, and national level. However, these policies are mostly geared towards renewable energy projects or towards trade on environmental goods. For example, countries like Kenya<sup>[54]</sup>, Madagascar<sup>[55]</sup>, and Nigeria<sup>[56]</sup> have import tax exemptions on renewable energy products including solar and wind generation equipment. These policies bring dynamism to the local EG markets in Africa, but they can also have a negative impact on the incentives for localization of EG manufacturing, especially given that no African country has yet been found to have a holistic environmental goods manufacturing policy.

Nevertheless, as explained earlier, some countries do have some relevant policies for value-addition, and some efforts are now made to support Africa-based manufacturers of environmental goods. For example, at the 2023 Abu Dhabi Sustainability week, Sustainable Energy for All (SEforALL), The African Climate Foundation, Bloomberg Philanthropy, the ClimateWorks Foundation and the Chinese Renewable Energy Industries Association (CREIA) launched Africa Renewable Energy Manufacturing Initiative (Africa REMI) <sup>[57]</sup>. Africa REMI is a joint initiative that partners with intergovernmental agencies, enterprises, financial institutions, and research institutions working in the renewable energy field and green industries, to empower African countries to cultivate and scale up their renewable energy manufacturing capability. With a remarkable 1.2 terawatts of energy potential, 14 million new jobs, and 6.4% growth in GDP in Africa available under a green transition scenario, this new international initiative will help drive the financial, technical, and socioeconomic investments required to advance clean energy development and transition in Africa.

## **2 Status and challenges of Sino-African cooperation in green development in Africa**

### **2.1 Progress of Sino-African cooperation in renewable energy development**

According to China's Global Energy Finance (CGEF) Database<sup>[58]</sup>, China Development Bank (CDB) and Export-Import Bank of China (Exim Bank of China) provided US\$49 billion in loans to African countries to

<sup>6</sup> Generated by Development Reimagined. Data sources from IMF. "Trade in Environmental Goods." Climate Change Dashboard.

fund energy projects between 2000 and 2022. Of the total, \$13 billion was invested in hydropower, \$611 million was committed to wind, and \$480 million to geothermal and solar financing accounted for \$367 million.

Among the recipients of Chinese support in renewable energy development, Ethiopia has been one of the biggest. Over the years Chinese enterprises have funded several energy generation projects in Ethiopia worth over \$4 billion, accounting for over 50% of new power generation capacity. Kenya is another primary recipient of Chinese investments in renewables. China has financed and built large solar and wind farms across Kenya, helping expand renewable energy access, particularly in rural areas. Most notably, the 310 MW Lake Turkana Wind Power project, the largest wind power farm in Africa, was constructed by a Chinese consortium. This project came online in 2018, providing about 15% of Kenya’s electricity capacity. Table 9 below shows some selected renewable energy projects with Chinese involvement. These projects have provided substantial benefits to the well-being of women and children in Africa. These projects not only provide clean energy, but also bring substantial benefits to the development of women and children in Africa by creating jobs and improving education and living conditions.

**Table 9 Selected Renewable Projects Supported by China**

Country	Project	Capacity	Remarks
Ethiopia	Adama Wind I & II	204MW	Financed by China EximBank, constructed by PowerChina and CGCOC Group, commissioned in 2015
South Africa	De Aar Wind Power	244.5 MW	Longyuan Power, commissioned in November 2017
Kenya	Lake Turkana Wind	310 MW	Financed by EIB, AfDB, constructed by China NARI Group Corporation and Power China Guizhou Engineering Company, Commissioned in 2018
Kenya	Garissa Solar PV	54.5MW	Financed by China EximBank and built by China Jiangxi International Corporation and Jinko, commissioned in December 2019
Central Africa Republic	Sakayi Solar	15 MW	Chinese Government financed, built by China Energy Engineering Group Tianjin Electric Power Construction (TEPC), commissioned in 2022
Nigeria	Zungeru Hydro	700 MW	Financed by China Exim Bank, to be built by a Chinese consortium of Sinohydro and China National Electric Engineering Company, first unit commissioned in 2022
Ethiopia	Aysha Wind	120 MW	Dongfang Electric, commissioned in 2022
Mali	Gouina hydro	140 MW	Financed by the Export-Import Bank of China and constructed by PowerChina, commissioned in 2022
Zambia	Kafue Gorge Hydro	750 MW	SinoHydro, commissioned in 2023
Kenya	Menengai geothermal plant	35MW	Developed by Sosian Energy, a private developer; Kaishan Company as operator; constructed by PowerChina, commissioned in 2023
Uganda	Karuma Hydro	600 MW	Financed by the Export-Import Bank of China and constructed by PowerChina, commissioned in 2024

Country	Project	Capacity	Remarks
Rwanda	Nyabarongo II Hydropower	43.5MW	Financed by China Exim Bank (US\$214 million), to be commissioned by 2024
Egypt	Amunet Wind	500 MW	40% owned by Sumitomo Japan, EPC by Power China, to be commissioned by 2025
Ethiopia	Tulu Moye Geothermal	150 MW	Constructed by a Japanese and Chinese consortium Mitsubishi Corporation and SEPCOIII Electric Power Construction. To be commissioned by 2025
Ethiopia	Aluto-Langano Geothermal	70 MW	Financed by World Bank, with Chinese firm Kerui Petroleum as contractor, to be commissioned by 2025

Source: Compiled by Author

Compared to hydro power and wind power projects, there are fewer large solar PV projects in Africa. However, solar PV can be used to support mini-grids, which could be effective to meet the energy needs of people without electricity in Africa.

More recently, the Chinese Ministry of Ecology and Environment announced in September 2023 the implementation of the "African Light Belt" project, which will build a climate friendly "solar PV+" project through China Africa cooperation to spend 100 million yuan of public finance funds in the next 3 years, to provide electricity supply for 50000 African households.

## 2.2 Challenges faced by Africa in Green Development and China's role

Although African countries have great ambitions to address climate change and possess abundant renewable energy resources, the lack of adequate climate finance is a barrier to Africa's green development. Specifically, Africa needs at least US\$2.8 trillion from 2020-2030, or USD 250 billion each year to address climate change.<sup>[59]</sup> However, the annual climate finance currently made available is significantly smaller – for example climate finance to Africa was estimated at US\$30 billion in 2020, - just 12% of the declared amount needed, which is itself an underestimate (as explained earlier).

China has played a constructive role so far in availing climate finance to help Africa develop its clean energy sector, and it is important for China to continuous to issue innovate finance instruments. Since 2000, it is estimated that China has provided US\$25 billion in loan financing in Africa's clean energy sector.<sup>[60]</sup> Since FOCAC 2021, Development Reimagined has found that 95 climate action projects with contributions from China have been initiated, covering renewable energy, climate-friendly infrastructure, clean technology and transportation areas, also capacity building to Africa.<sup>[61]</sup> During the Belt and Road Forum last year, China launched a new Green Investment and Finance Partnership (GIFP) with more than US\$100 billion in financing for energy transition in the BRI countries. Certainly, based on the evidence outlined in this paper so far, targeting a high proportion of this new funding to unleash Africa's green development potential will be an excellent strategic move by China.<sup>[62]</sup> This can be done using the following three models.

### Model 1: Targeting Green Infrastructure with concessional finance

IRENA reported that Africa only contributes about 3% of the world's installed renewables-based electricity.<sup>[63]</sup> According to IEA, Africa accounts for around 20% of the world's population but attracts less than 2% of its spending on clean energy.<sup>[64]</sup> To achieve the target of increasing renewable energy capacity by at least 300 GW by 2023, as mentioned in the Nairobi Declaration, would mean that the continent would need to increase its current capacity of 56 GW by more than 400% in less than a decade. More green infrastructure is needed to meet this demand – both single-country-based and also cross-country-based infrastructure.

However, on the African continent, such infrastructure requires extremely patient capital, because it will – and certainly in its first 20-30 years of construction – be providing public goods to hundreds and thousands of poor citizens that do not have the resources to pay individually for such services, yet will each benefit hugely from the infrastructure, and will become more productive and generate both jobs and growth by having improved logistics and infrastructure.

China will be a key partner of Africa to build clean and affordable electricity infrastructure that adapts to Africa's context. Over the past 10 to 15 years, hydro projects accounted for 58% of overall Chinese investment in renewables which are driven by Chinese state-owned companies, in many cases utilizing concessional and semi-concessional financing from Chinese banks such as China Exim Bank and China Development Bank (CDB). Thus, this model of financing should continue and also be expanded towards transport infrastructure to build a stronger and more efficient logistics network across African countries as well.

### **Model 2: Green industrialization linked to environmental goods and critical minerals**

Effective industrial policies and market incentives play a crucial role in achieving growth.<sup>[65]</sup> <sup>[66]</sup> The implementation of policies like the EU Carbon Border Tax Adjustment Mechanism (CBAM)<sup>[67]</sup> could make Africa's downstream processing less competitive in the global green transition without a strong renewable energy supply.<sup>[68]</sup> One key means to deliver green industrialization is to leverage the potential for regional collaboration and integration under regional economic blocs and the African Continental Free Trade Area (AfCFTA) framework to utilize African's critical raw materials to integrate into the regional or even global supply chains of value-added manufacturing, including EGs manufacturing. Though most countries only have one or two competitive edges regarding manufacturing, which include critical minerals reserve, domestic policy and market, global trade network, and lower labour costs, cross-country collaborations could make a huge difference.

For example, within the Southern Africa Development Community (SADC), Congo, Zimbabwe and Zambia's leading position in critical minerals to produce nickel, manganese, and cobalt battery precursor minerals can be combined with South Africa's industrial foundation, labour resource, and global trade market to create a strong regional supply chain ecosystem.

However, the size of the local market is usually a prerequisite for manufacturers to build factories. While many African countries have national plans, few have the finance or formal markets to introduce solar feed-in tariff schemes, or other policy support such as secured offtake agreement for the electricity producers. That means foreign investors need to be more creative and engaged in local markets to identify avenues for demand promotion at scale.

In this regard, China's experience on industrialization will be helpful for Africa. For example, as the world's top environment goods exporter, China contributed 17.3% of the global volume in 2020, making it a valuable partner to leverage Africa's strategic role in establishing an EG manufacturing supply chain, especially in the manufacturing of photovoltaic products, lithium batteries and new energy vehicles, where China has developed the world's advanced manufacture ecosystem. Moreover, China's practice in developing specialized economic zones, cross-country (cross-province) logistics, the renewable energy industry and a value-addition oriented trade policy framework will contribute to the strategic steps. Chinese SOEs, which have been working at the continent level for over 20 years, normally have a strong capacity for integrating regional resources, which is also an asset. Furthermore, China has a long history of building up an industry-connected vocational training system which is vital in the context of Africa building its own environmental goods manufacturing.

### **Model 3: Piloting innovative PPP models in Africa for solar and wind deployment**

While building up a stronger on-grid renewable energy supply, off-grid solutions will also play a vital role in Africa's development – especially in rural areas and for adaptation. Many high-income countries and development banks are interested in supporting such solutions, including “de-risking” through subsidies provided to their private sector firms and investors from their development finance institutions (DFIs). In

order to add value, as the majority of Chinese wind and solar projects, especially the off-grid solutions come from the Chinese private sector, it is crucial to have initiatives and financial instruments that considerably reduce the cost of borrowing for such projects to further unlock the potential from bottom to up, in partnership with African governments, and enabling differentiating the offer from Chinese stakeholders amongst the competition.

One innovative means of exploring this – especially for adaptation and rural deployment - might be to test a mode of “Public Private Partnership” (PPP) that has been used in China for ecological conservation and rejuvenation of rural and/or degraded areas. The “Ecological Civilisation” model has been promoted in China since 2012, based on “Beautiful China incorporating “Beautiful China” into the constitution in 2018. In practice, the model involves a partnership between a local government and private firms, the latter that commit to environmental conservation and/or rehabilitation on the basis of an entitlement to the future spillover benefits from the area. Such benefits can include revenues from, for instance, tourism, agricultural products, or energy production. This kind of model could be piloted in some African countries as an innovative means for green, resilient development that leverages the role of the private sector, and could, for instance, incorporate solar and wind deployment as a standard requirement.

### **2.3 Africa’s potential in green manufacturing**

The development of manufacturing capacity is in line with Africa’s push for industrialization and localized manufacturing. According to SE4All,<sup>[69]</sup> investment in energy transition technologies creates 3 times as many jobs as fossil fuels per \$1million invested. Through 2030, between 8 million and 14 million energy transition jobs could be created in Africa, potentially driven by government spending on public services and investment in transition technologies.

Nevertheless, Africa is at the bottom of the global value chain with its share of global manufacturing at around only 1.9 percent.<sup>[70]</sup> Calls are increasing to localize processes along the manufacturing value chain as recent events such as the COVID-19 pandemic have exposed the overreliance of African countries on global supply chains. According to International Energy Agency, under the net zero scenario, the electricity generation from solar PV will be 1859 TWh, and from wind will be 593 TWh in Africa in 2050 , i.e. about 930 GW of installed capacity for solar PV and 200 GW of wind power. The renewable energy market of this scale cannot and should not all be imported from outside the region. Instead, local manufacturing should be vigorously developed, African countries should develop local manufacturing capacity for solar PV and wind power capacity to meet its energy needs and sustainable development goal. Moreover, Africa is resource rich in several raw materials critical for renewable energy products. The continent has high availability of raw materials with large reserves of inputs such as cobalt, manganese, and lithium. These resources provide an attractive option for companies looking to install renewables manufacturing facilities closer to resource supply chains.

At the 2023 Abu Dhabi Sustainability week, Sustainable Energy for All (SEforALL), The African Climate Foundation, Bloomberg Philanthropy, the ClimateWorks Foundation and the Chinese Renewable Energy Industries Association (CREIA) launched Africa Renewable Energy Manufacturing Initiative (Africa REMI). Africa REMI is a joint initiative that partners with intergovernmental agencies, enterprises, financial institutions, and research institutions working in the renewable energy field and green industries, to empower African countries to cultivate and scale up their renewable energy manufacturing capability. With a remarkable 1.2 terawatts of energy potential, 14 million new jobs, and 6.4% growth in GDP in Africa available under a green transition scenario, this new international initiative will help drive the financial, technical, and socioeconomic investments required to advance clean energy development and transition in Africa.

China leads the manufacture of renewable energy products. In the case of solar PV, as of the end of 2023, the production capacity of each link of photovoltaic equipment was about 1000 GW while the global market

demand for that year was only 400 GW. Due to the tariff barriers faced by the United States and Europe in recent years, some of China's solar industry's production capacity has shifted to Southeast Asia.

However, so far there was so far only one significant Chinese investment in renewable energy Manufacturing in Africa. In August 2014, Jinko Solar opened a 120 MW solar PV panel manufacturing factory in Cape Town, South Africa, becoming the first Chinese solar PV enterprise to establish a manufacturing capacity in Africa.

Overall, while China Africa cooperation on green development has increased and improved, it has significant further potential for growth due to the combination of high African potential and ambitions with China's existing capacity and experience in cross-country connectivity and industrialization. To enhance further China-Africa in green development, the following recommendations are proposed.

China's competitive advantage in renewable energy production is due to government support policies, market size, and ready labor and raw material supply. According to our survey of Chinese investors, several factors are needed to further promote Chinese investment in solar PV and other renewable energy manufacturing capacity in Africa.

First, local market size is a prerequisite for Chinese manufacturers to build factories in Africa. Chinese companies hope to see Africa stimulate solar and renewable energy demand through national plans, PV feed-in tariff subsidies and other policy support, such as providing guaranteed power purchase agreements for power producers. Most African countries lack sufficient incentives to increase domestic and regional demand for renewable energy products. For example, many countries lack clear solar policies and feed-in tariff systems to encourage large-scale solar panel manufacturing. Lack of local demand is a key factor that hinders investors from developing renewable energy.

Second, local production factors need to be strengthened, such as skilled labor, stable water and electricity supply, and improved transportation infrastructure. For example, in some cases, the cost of electricity is already high, and the unstable supply makes the situation worse. In addition, underdeveloped transportation infrastructure (such as roads and ports) is also one of the obstacles.

Third, local supply chains need to be gradually established. Currently, Africa's local supply capacity for components required for solar PV or other renewable energy is seriously insufficient. Many African countries lack supporting industries, such as glass, aluminum, and sulfuric acid. This weakness requires manufacturers to invest extra time and money to ensure supply chain production.

Fourth, the number of existing regulations encouraging localization of manufacturing is limited. Many countries lack a comprehensive regulatory framework for designing and implementing renewable energy manufacturing projects and lack incentives to attract renewable energy manufacturers and encourage local value creation.

## **Chapter 4 Policy Recommendations on Enhancing Green Opening-up and South-South Cooperation**

### **1 Formulate a roadmap for promoting green opening-up and South-South cooperation**

## **1.1 Short-term Initiatives**

1.11 Improve the High-Level Coordination Mechanism for Green Opening-Up and South-South Cooperation: Based on the existing sectoral management foundations for South-South cooperation, climate change cooperation, and green energy transition cooperation, invite CIDCA or its subordinate agencies to join the China Council for International Cooperation on Environment and Development (CCICED) as a steering committee. This integration will facilitate better interactions with the international community on issues related to green opening-up and South-South cooperation.

1.12 Incorporate Green Opening-Up and South-South Cooperation into international cooperation frameworks, including setting international cooperation goals, policy planning, management regulations, supervision, and evaluation. Simultaneously, expand the consultation of experts in the fields of environment and climate change during policy formulation and expert consultation processes. This will ensure that policies are well-informed and aligned with international standards and practices.

1.13 Expand South-South Cooperation Financing Modalities: maximize the use of existing funds, especially specialized funds in the fields of green development and climate change response, such as the South-South Cooperation Fund on Climate Change and China's contributions to the Global Environment Facility. Simultaneously, expand financing channels for South-South cooperation by attracting private sector investment. Explore innovative financial support modalities, such as public-private partnerships, green bonds, and other sustainable finance instruments to enhance resource mobilization for green projects.

1.14 Incorporate pre-feasibility study as a requirement for future projects. To minimize potential environmental and socio-economic risks, the Chinese government and funding recipient country governments should implement a pre-feasibility study requirement for all projects. Project financier and developers should be required to conduct a prefeasibility assessment of the project. Financiers and developers should undertake a thorough prefeasibility assessment, encompassing three critical stages: 1. Securing Access to the Project Site: This involves obtaining the rights to buy or lease the land necessary for the project, a crucial step as funders typically require secured land access before providing feasibility funding. 2. Conducting Comprehensive Assessments: This stage should include evaluations of the basic site characteristics, environmental impacts, grid connection possibilities, as well as solar and wind resource assessments. Additionally, an analysis of plant capacity and technical options should be carried out. 3. Financial and Cost Analysis: Developers should develop a high-level financial model that includes indicative electricity tariffs based on the assessments. This structured approach ensures that all potential risks are adequately addressed before project development proceeds.

## **1.2 Medium-term Strategies**

1.21 Formulate a policy framework and development strategy that aligns green opening-up with the promotion of South-South cooperation projects. This framework should consider the needs of developing countries and China's comparative advantages and output capacity in the green sector. Start with the formulation of cooperation plans in priority areas, improving specific cooperation programs for key countries and regions. This should be supported by a robust disciplinary mechanism and regulatory system to ensure effective implementation and oversight.

1.22 Enhance practical guidance for green opening-up and South-South cooperation across industries, utilize advanced technologies and resources from the trade, investment, industry, information, agriculture, and climate sectors to provide positive guidance for South-South cooperation at the project level.

1.23 Engage a wide range of partners, including government departments, enterprises, international organizations, NGOs, and social groups. Actively involve Chinese local governments, especially those in

border provinces, as well as "going out" enterprises and NGOs. Explore tripartite cooperation with other donors to broaden the participation of various actors in green opening-up and South-South cooperation.

1.24 Strengthen talent development and capacity building. Enhance the capacity building of talents related to green opening-up and South-South cooperation, especially of staff in relevant domestic departments. Strengthen the reserve of industry experts in green development and international exchanges. Improve the theoretical foundation for policymaking in green opening-up and South-South cooperation while fostering communication and cooperation with international organizations. Support the development of a robust discourse system for international green development cooperation to enhance China's influence and participation in global environmental governance.

1.25 Adopt an Issue Oriented Model. Previously, China's approach to South-South Cooperation was primarily country-focused. Moving forward, it would be beneficial for China to place climate change and sustainable development at the forefront of its South-South Cooperation efforts, emphasizing global issues such as the climate crisis rather than concentrating solely on individual countries. Adopting this systematic model of cooperation would enable China and the Global South to address global systemic challenges as a unified community, enhancing the collective ability to implement effective solutions.

### **1.3 Long-term Vision**

Improve the whole-process management of green opening-up and south-south cooperation. First, include comprehensive environmental, social, and governance (ESG) indicators in the evaluation system of South-South cooperation projects. Based on the early-stage demand research and country-specific programs, attract a wider range of green development projects to consider South-South cooperation. Second, establish a complete legal system, policy planning, and industry guidelines to provide protection and guidance for project implementation. This framework will safeguard the rights and interests of relevant organizations or enterprises, promote China's advantageous industries globally, and enhance the efficiency of project implementation. Third, Enhance the external communication of green opening-up and South-South cooperation during the project implementation period. Clearly explain China's green opening-up initiatives and the progress of South-South cooperation projects to the international community. Fourth, the construction of the post-evaluation mechanism after the completion of the project needs to combine existing domestic practices and international experience, formulate evaluation indicators based on different industry fields, and use green openness-related indicators as important evaluation bases, including the ecological and environmental impacts brought by the project, the impact of the degree of technology transfer on the local green development transformation, etc. At the same time, it is possible to consider incorporating gender equality-related standards into the whole process management of project design, implementation, and evaluation. Gender mainstreaming, as an important social development issue, is also an important part of "soft aid". It can not only effectively connect with international standards and enhance the international recognition of green South-South cooperation projects, but also focus on vulnerable groups and achieve the "soft and hard combination" of South-South cooperation projects.

## **2 Promote the acceleration of China-ASEAN renewable energy cooperation**

### **2.1 Enhance a regional-level comprehensive strategic partnership between ASEAN and China for clean and green energy development and energy infrastructure connectivity**

Expanding the ASEAN-China partnership to develop clean energy and decarbonize the region's industry and energy infrastructure is crucial. China's support is vital for accelerating renewable energy adoption.



Broadening the existing partnership agreement to tackle climate concerns could lead to increased economic prosperity and energy security. China's commitment to global climate efforts can be extended to include supporting energy transition in collaboration with the Association of Southeast Asian Nations (ASEAN). This partnership can kickstart renewable energy projects in the region and enhance energy infrastructure connectivity, supporting the ASEAN connectivity agenda by fostering the realization of the ASEAN Power Grid program.

## **2.2 Support the Green Manufacturing Of Goods And Materials For Clean Energy Technology Through Industrial Decarbonization Measures Using Green Electricity And Green Processing In ASEAN**

The ASEAN region is expected to experience an increase in carbon emissions due to industrial development. To tackle this issue, it is crucial to encourage Chinese companies to promote low-carbon technology and manufacturing processes in this region. This can be achieved through technical assistance, technology transfer, and partnerships, all of which are important steps in making the ASEAN industry less carbon-intensive. One potential area for collaboration is the utilization of captive coal-fired power plants in nickel facilities in Indonesia as a pilot site for China-ASEAN cooperation on low-carbon industrialization. Furthermore, directing ASEAN's industrial transformation towards export-oriented clean energy technology can contribute to regional green development.

## **2.3 Enhancing the Role of ASEAN-China Clean Energy Cooperation Center as a Platform for Knowledge Sharing and Capacity Building**

The ASEAN-China Clean Energy Cooperation Center is a hub for fostering innovative research and development of state-of-the-art clean energy technologies. The expertise cultivated within this center plays a crucial role in helping ASEAN address the technical obstacles associated with implementing renewable energy. Additionally, the center collaborates with private sector enterprises from China operating in ASEAN to support clean energy investments through technical analysis, feasibility studies for strategic projects, and recommendations to facilitate increased Chinese investments in the region.

## **2.4 Develop Regional-Level Guidelines for Responsible Practices in Managing Transition Minerals Processing and Greening Supply Chain for Clean Energy Technologies.**

Amidst the growing focus on mineral exploration and processing for sustainable development in the ASEAN-China region, it is essential to prioritize cooperation to ensure Environmental, Social, and Governance (ESG) standards. This alignment is crucial to ensure that the processing of transition minerals into materials for clean energy technology does not result in increased carbon emissions or adverse effects on the environment. ASEAN has introduced the Taxonomy for Sustainable Finance to provide guidance to investors interested in supporting environmentally friendly or green projects. Similarly, China has formulated the Green Development Guidance for its overseas investments, focusing on aligning with climate goals and promoting sustainable development. These initiatives can work hand in hand to encourage and guide sustainable investments in the region, including offering specific investment guidelines for transition minerals.

## **2.5 Establish a Project Pipeline Facility to Support Rapid Utility-Scale Renewable Energy Deployment both On-Grid and Off-Grid**

One of the causes of lagging renewable energy development in ASEAN is a lack of bankable projects. Due to unstable policies, investor risk perceptions towards renewable energy project development are high. The aim of this pipeline facility establishment is to provide a channel for ASEAN countries to access capital from China for renewable energy projects. The facility can also serve as an incubator for the early stages of project development by identifying technically and financially sound projects to be presented to investors. Through this measure, the facility can also identify which projects need leverage to get the necessary financing by providing de-risking instruments such as credit guarantees or equity. To ensure the operation of this project pipeline facility, it is recommended that the facility become one of the deliverables under the regional comprehensive strategic partnership. Engagement with national-level energy sector stakeholders is also crucial to assist them in preparing projects that will attract foreign capital.

## **3 Unlock the Potential of China-Africa Renewable Energy Cooperation**

### **3.1 Set more pragmatic goals for climate cooperation**

As part of the global response to climate change, Chinese and African governments have made strong policy commitments on climate action and green development cooperation in Africa, which have been translated into the implementation of clean energy projects. The Forum on China-Africa Cooperation (FOCAC), as the main platform for promoting China-Africa partnership, has shifted its focus to climate and environmental cooperation. As a staunch supporter of sustainable development in Africa, China has launched more than 100 clean energy and green development projects under the framework of the FOCAC to help African countries better utilize solar, hydropower, wind, biogas and other renewable energy sources. In the next step, we should continue to make good use of high-level dialogue opportunities such as the FOCAC, give play to the role of platforms such as the Belt and Road International Alliance for Green Development and the China-Africa Environmental Cooperation Center, and expand cooperation on renewable energy such as solar photovoltaic and wind power. Explore the formulation of more pragmatic action plans and goals in climate investment and financing and capacity building, such as setting overseas renewable energy installation targets and investment targets for the energy industry, and setting targets related to value-added investment and key mineral infrastructure in the trade field. More specific and pragmatic goals can ensure that all parties have enough confidence and motivation to try innovative models such as PPP and enable all participants to work towards common goals.

### **3.2 Provide low-cost, patient and efficient climate investment and financing for Africa**

Further expand and enrich the financing model in the field of China-Africa green development, continue to provide low-cost, patient and efficient climate investment and financing for Africa, and increase investment in "small and beautiful" projects. Africa faces a huge funding gap in achieving its climate ambitions. Therefore, China should focus on advantageous industries such as hydropower and continue to provide loans, especially long-term loans and concessional loans. Supporting regional green infrastructure construction is the key to promoting the green economic transformation of African countries. In addition, more Chinese private enterprises participating in solar energy, wind energy, environmental product manufacturing and other environmentally friendly "small and beautiful" project investments will inject new vitality into Africa's green development. Make full use of existing special funds in the field of China-Africa green cooperation, such as the China South-South Cooperation Fund on Climate Change and China's donation to the Global Environment

Fund, to improve the efficiency of fund use. Use cooperation projects such as the "Green Development Investment and Financing Partnership" to develop innovative financial instruments and hybrid financing paradigms, explore innovative fiscal support methods, leverage private sector participation, encourage multiple entities to participate in hybrid financing, create a North-South-South trilateral cooperation paradigm and project pilot, and form complementary resources and advantages. Coordinate with international financing institutions and bilateral development partners, encourage third-party market cooperation, and invite international investors to jointly develop renewable energy industrial parks with Chinese investors.

### **3.3 Support Africa to establish a business environment conducive to green and low-carbon cooperation**

Support Africa to establish a business environment conducive to green and low-carbon cooperation, and help Africa integrate into the global environmental product supply chain, including improving fiscal incentives, establishing joint ventures, cultivating African green manufacturers and other measures to promote the localization of the industrial chain. Strengthen policy dialogues in green areas such as renewable energy, empower African governments to formulate top-level designs for green and low-carbon development, and create a good business environment for Chinese companies to invest and cooperate in Africa. Encourage the establishment of joint ventures with African companies to cultivate a local green industrial environment in Africa. Relying on cooperation initiatives such as the "Green Silk Road Envoy Program" and the "Belt and Road" Ecological Talent and Environmental Protection Exchange Program, strengthen the skills training of engineering and technical personnel in related industries in Africa, and promote local employment and professional development of technical personnel. Support the construction of regional green infrastructure and improve regional logistics networks. Help Africa integrate into the global supply chain of environmental products, encourage Chinese companies to invest in the manufacturing industry in African countries, establish joint ventures to promote the localization of environmental product manufacturing, promote employment and reduce dependence on imports.

### **3.4 Build renewable energy industrial parks with the "renewables-driven-renewables" model**

Based on policy commitments, African governments should focus on two main areas with China's support: i) expanding renewable energy deployment, especially solar photovoltaic and wind power; ii) developing local renewable energy manufacturing capabilities by establishing renewable energy industrial parks. In fact, such renewable energy industrial parks can be designed as a "renewables-driven-renewables" model, that is, the power supply of the industrial park should come from renewable energy such as solar photovoltaic power stations and wind farms as much as possible; at the same time, the industrial park can assemble and manufacture the parts required for renewable energy equipment such as solar panels and wind power equipment to expand the deployment of these equipment in African countries. Considering that the domestic green product market in some African countries is relatively small at this stage, it is possible to consider establishing green industrial parks at hub-type city nodes, which can be jointly developed by relevant countries and supply renewable energy equipment and parts to neighboring countries. Through this model, the two-way promotion of renewable energy supply in industrial parks and the development of new energy equipment manufacturing industry can be promoted.

### 3.5 Support the ability to enhance renewable energy development in Africa

Support the ability of African governments to formulate correct investment policies to attract investors in the field of renewable energy manufacturing. Rely on the "Green Silk Road Envoy" program and the "Belt and Road" Ecological Talent and Environmental Protection Exchange Program to strengthen talent training in Africa's solar photovoltaic and related key industries. Fund the training, employment and career development of African engineers and technicians, focusing on solar photovoltaic and related key industries; share best practices to meet the needs of industrial chain localization, technology application and project development.

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