

GREENING THE SILK ROAD: THE IMPACT OF THE BELT AND ROAD INITIATIVE ON GLOBAL RENEWABLE ENERGY

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ABSTRACT

As the global energy landscape undergoes a significant transition amid rising geopolitical tensions, international cooperation in renewable energy has become essential. Embracing green and low-carbon development is driving economic and social progress, with renewable energy sources such as solar, wind, hydropower, and nuclear power emerging as key growth areas. The Belt and Road Initiative (BRI) presents new opportunities for advancing renewable energy cooperation among participating countries. This paper explores the opportunities within the BRI framework for renewable energy collaboration, highlighting advantages in resource complementarity, policy support and market demand. It examines the current state of international renewable energy cooperation, detailing the principal forms of collaboration and key achievements. Furthermore, it explores future prospects for enhanced cooperation in renewable energy among BRI partners. The global drive towards carbon neutrality and clean energy development aligns with the Green Silk Road initiative, underscoring the collective effort towards sustainable development.

Keywords: Belt and Road Initiative (BRI); Renewable Energy; International Energy Cooperation; Green Silk Road; Energy Transition

INTRODUCTION

The Belt and Road Initiative (BRI) has made notable strides in advancing international cooperation in renewable energy, significantly contributing to global energy sustainability and climate change mitigation. This initiative has deepened cooperation through various mechanisms, including intergovernmental agreements, corporate investments, and financial support, which collectively enhance the development and application of renewable energy and foster sustainable economic growth. Intergovernmental agreements have been pivotal in enhancing renewable energy cooperation. Over the past decade, China has expanded its network of intergovernmental energy cooperation mechanisms, establishing partnerships with over 90 countries and regions, and collaborations with more than 30 ener-

gy-related international organizations and multilateral mechanisms. Over 100 energy cooperation agreements have been signed, and the member countries of the active BRI energy partnership has reached up to 33. These agreements promote policy coordination, resource sharing, and energy complementarity among nations. For example, the Agreement between China and Uzbekistan, signed in Beijing, aims to advance cooperation in renewable energy power generation, grid construction, technology, and innovation.

Since the BRI's inception in 2013, Chinese power companies have made significant direct investments overseas, exceeding 260 projects valued over \$150 billion. Approximately 30% of these investments are in renewable energy sectors such as solar and wind power [1]. Projects like the Nam Ou cascade hydropower project in Laos and the Sapphire wind power project in Pakistan illustrate how these investments are transforming local energy infrastructures and promoting green development. This international collaboration not only enhances technological expertise but also drives economic growth, employment, and poverty alleviation in participating countries. International financial institutions play a crucial role in supporting renewable energy projects under the BRI. They provide essential funding, technical advice, and financial guarantees that facilitate project development [2]. Notable examples include the Adama wind power project in Ethiopia, supported by the Export-Import Bank of China, and the Zhanatas wind farm in Kazakhstan, which received \$95.3 million from multiple banks, including the Asian Development Bank (ADB) [3]. These financial contributions ensure project success and contribute to significant carbon dioxide emission reductions.

EXPANDING COOPERATION AND RESOURCE COMPLEMENTARITY

From 2018 to 2022, renewable energy accounted for approximately 70% of newly added power generation installations and about 60% of newly added electricity generation capacity globally [4]. Major economies are increasingly contributing to climate change mitigation by advancing renewable energy as a leading direction

for a low-carbon energy transition. The BRI provides a strategic platform for this shift from traditional to renewable energy sources, aligning with global goals to limit temperature increases and reduce greenhouse gas emissions [5]. Countries involved in the BRI are actively developing strategies to support renewable energy, reflecting a global trend towards green and low-carbon energy solutions. Policy documents such as China's Action Plan for Carbon Dioxide Peaking Before 2030, Georgia's 2021-2023 Climate Strategy Action Plan, Kazakhstan's Strategy on Achieving Carbon Neutrality by 2060, provide comprehensive frameworks for promoting a green economy. The BRI has enhanced policy exchange and communication among participating countries, removing trade barriers and facilitating project implementation. Regional platforms such as the Belt and Road Energy Partnership, the China-ASEAN Clean Energy Capacity Building Programme, and the China-African Union Energy Partnership have been established to support policy dialogue, capacity-building, and technology exchanges. These platforms have significantly advanced renewable energy development across the BRI partners.

The BRI's geographical scope connects major energy producers, consumers, and corridor countries, creating opportunities for complementary renewable energy cooperation. Countries along the BRI possess substantial renewable energy resources, such as wind and solar energy. For instance, ASEAN countries have significant untapped renewable energy potential, with approximately 170 million kilowatts of technically developable hydroelectric resources and 9.9 billion kilowatts of photovoltaic and 1.1 billion kilowatts of wind power. Similarly, Africa holds 60% of the world's solar energy resources with a technological potential of 7.9 billion kilowatts, although renewable energy investments in Africa accounted for only 2% of global investments from 2000 to 2020, indicating considerable potential for development [6]. China's role as a major exporter of energy technology and equipment further complements the needs of BRI countries, fostering mutually beneficial partnerships, which could further promote international cooperation in renewable energy, and provide a new engine for the green low-carbon transition on a global scale.

Renewable energy investments have grown substantially, with increased investment scale and scope. The International Energy Agency (IEA) reports continued growth in global renewable energy investments, especially in wind and solar sectors. Greenpeace forecasts that by 2030, China's renewable energy investments in BRI countries will generate approximately \$3.715 billion annually and create 150,000 to 310,000 jobs [7]. From 2013 to 2022, cumulative investments

between China and BRI countries surpassed \$270 billion, with the energy sector accounting for about 40% of this total. Notable financial commitments include the Silk Road Fund's \$6.8 billion investment in 25 energy projects [8] and the Asian Infrastructure Investment Bank (AIIB) financing over \$38.8 billion across 202 projects by the end of 2022 [9], reflecting a positive trend in renewable energy development. Several landmark renewable energy projects have been successfully completed, including the Belo Monte phase II in Brazil, the Možura wind farm in Montenegro, and the Cauchari solar plant in Argentina. These projects have increased energy supply, optimized local energy structures, and supported green and low-carbon energy development in their respective regions. Cooperation between China and Central Asian countries in renewable energy has diversified, covering a range of projects from power grid renovations to large-scale wind and solar installations. Notable projects include the Zhamby wind power project in Kazakhstan and the Navoi solar plant in Uzbekistan, which signify the expanding scope and impact of BRI renewable energy collaborations in Central Asia.

PROSPECTS FOR FUTURE COOPERATION

International cooperation in renewable energy under the BRI holds substantial promise and potential. As technological innovations and policy support continue to evolve, opportunities for growth in this sector are expected to expand. The accelerating global energy transition underscores the increasing centrality of renewable energy in addressing climate change and reducing reliance on fossil fuels. The BRI's shift from traditional energy to renewable energy reflects a broader global movement towards cleaner energy sources. The share of renewable energy in total primary energy consumption reached 14.6% in 2023, marking a 0.4% increase from the previous year [10]. According to the IEA, it is projected that the share of fossil fuels in the global energy supply will decline from nearly 80% to around 20% by 2050. By then, approximately 90% of the world's electricity is expected to be sourced from renewable energies, with wind and solar contributing nearly 70% of this total [11]. As global demand for clean energy rises and technological advancements continue, the share of renewable energy in the global energy mix is anticipated to grow further. Governments and businesses are likely to increase their investments in renewable energy, promoting its large-scale and commercial development.

International cooperation in renewable energy enables countries to collaboratively build a diversified, clean, and efficient energy supply system. This collective effort reduces the risks associated with dependence on single energy sources and improves the stability and

reliability of energy supplies. Additionally, such cooperation facilitates the construction and upgrading of critical energy infrastructure. Enhanced infrastructure increases the flexibility and resilience of energy systems, allowing for better adaptation to fluctuations in energy demand and emergencies. Consequently, international cooperation in renewable energy can help mitigate the vulnerability of energy supplies, foster greater trust among nations in the energy sector, and address energy security challenges collaboratively. Scientific and technological innovation is playing a crucial role in this transition [12]. Advances in new-generation information technology, digital technology, and materials science are significantly enhancing the efficient development of renewable energy. The intersection of renewable energy with fields such as information technology, transportation, and construction is creating broader prospects for its development. Furthermore, the integration of renewable energy with emerging technologies like the Internet of Things (IoT) and blockchain is giving rise to innovative business models and new forms of energy finance and trading.

CONCLUSION

The shift from traditional oil and gas sectors to renewable energy within the BRI partners is marked by increased investments and enhanced technical collaboration. Renewable energy, being a low-carbon and clean alternative, helps reduce greenhouse gas emissions and tackle global climate change challenges. While international cooperation on renewable energy within the BRI framework offers significant opportunities, several challenges need to be addressed, including geopolitical risks, infrastructure gaps, and funding limitations. Overcoming these challenges through collaborative efforts can enhance the depth and scope of international renewable energy cooperation. By continuing to strengthen policy communication and fostering mutually beneficial partnerships, the BRI can further advance global energy sustainability and support the transition to a green, low-carbon environment. The rising share of renewable energy in global power generation, coupled with technological advancements, is expected to drive further investment and development in this sector. The integration of emerging technologies presents new opportunities for innovation in renewable energy, paving the way for a more sustainable energy future.

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