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Driving Forces, Constraints, and Optimization Pathways in China-Russia Green Cooperation ¹

Abstract. Amid the accelerating global low-carbon transition and a shifting geopolitical landscape, China and Russia face growing incentives to deepen green cooperation. However, empirical research on the drivers and constraints shaping bilateral cooperation remains limited. This study applies the Driving Forces-Resistance framework to examine the dynamics of China-Russia green cooperation through textual analysis, comparative assessment, and case studies of the Tianwan and Xudabao nuclear power plants and the China-Russia Eastern Route Gas Pipeline. Drawing on bilateral policy documents from 2006 to 2025 and data from the WIPO Global Innovation Index 2025, the study identifies four key driving forces: strategic consensus, economic complementarity, shared interests in global climate governance, and multi-level cooperation mechanisms. It also identifies three major constraints: structural, institutional, and technical and financial. Structural constraints are reflected in Russia's continued dependence on oil and gas revenues, while institutional constraints arise from differences in technical standards and certification systems. Technical and financial constraints are associated with disparities in innovation capacity and limited access to green financing. Based on these findings, the study proposes a phased set of policy measures, including mutual recognition of green technology standards, a green cooperation sub-fund, a Far East green project matching platform, and joint green technology laboratories. The findings contribute to a deeper understanding of the factors shaping China-Russia green cooperation and provide targeted theoretical and policy insights for its further development under the Green Belt and Road framework.

Keywords: China-Russia green cooperation; Driving Forces-Resistance Theory; Green Belt and Road Initiative; sustainable development; energy transition; green finance

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Движущие силы, ограничения и пути оптимизации китайско-российского сотрудничества в сфере зелёной экономики

Аннотация. По мере ускорения глобального перехода к низкоуглеродной экономике и меняющейся геополитической обстановки у Китая и России появляется всё больше стимулов к углублению сотрудничества в зелёной сфере. Вместе с тем эмпирических исследований, посвящённых факторам, способствующим и препятствующим такому сотрудничеству, пока немного. В настоящей работе для анализа динамики китайско-российского зелёного сотрудничества применяется теоретическая модель «Движущие силы — Сопротивление»; используются методы текстового анализа, сравнительной оценки, а также рассматриваются кейсы Тяньваньской АЭС и АЭС «Сюйдапу» и газопровода «Сила Сибири» (китайско-российский газопровод по восточному маршруту). На основе анализа двусторонних политических документов за 2006–2025 гг. и данных Глобального инновационного индекса Всемирной организации интеллектуальной собственности за 2025 г. выделены четыре ключевые движущие силы: стратегический консенсус, экономическая взаимодополняемость, общие интересы в области глобального климатического управления и многоуровневые механизмы сотрудничества. Также определены три основных вида ограничений — структурные, институциональные и технико-финансовые. Структурные ограничения связаны с сохраняющейся зависимостью российской экономики от доходов от экспорта нефтепродуктов; институциональные обусловлены различиями в технических стандартах и системах сертификации; технико-финансовые — разрывом в инновационном потенциале и недостаточным доступом к зелёному финансированию. С учётом полученных результатов предложен поэтапный комплекс мер, включающий взаимное признание стандартов зелёных технологий, создание субфонда зелёного сотрудничества, платформы для сопряжения зелёных проектов на Дальнем Востоке и совместных лабораторий зелёных технологий. Результаты исследования углубляют понимание факторов, определяющих китайско-российское зелёное сотрудничество, а также задают практические и теоретические ориентиры для его дальнейшего развития в рамках экологического компонента инициативы «Один пояс, один путь».

Ключевые слова: китайско-российское зелёное сотрудничество; теория «Движущие силы — Сопротивление»; зелёная составляющая инициативы «Один пояс, один путь»; устойчивое развитие; энергетический переход; зелёное финансирование

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Introduction

Against the backdrop of the global low-carbon transition and profound shifts in the geopolitical landscape, China and Russia, as important neighbours and comprehensive strategic partners, are deepening their cooperation in the field of green development. This cooperation not only contributes to the sustainable development of both countries but also carries far-reaching implications for global climate governance. The global energy transition is accelerating, with renewable energy accounting for more than 25 % of primary energy consumption. In response to this trend, China has established its “dual carbon” goals of peaking carbon emissions before 2030 and achieving carbon neutrality before 2060, while Russia has adopted its Strategy for Low-Carbon Socio-Economic Development through 2050. These policy commitments demonstrate a significant degree of strategic alignment between the two countries in pursuing green and low-carbon development (Xu & Yi, 2022).

China-Russia green cooperation, which has developed over many years, has established a multi-domain, multi-level, and multi-mechanism

framework. In terms of areas of cooperation, it encompasses environmental protection, green energy, green finance, green agriculture, and other fields. In terms of levels, cooperation takes place bilaterally, regionally through mechanisms such as the Shanghai Cooperation Organization and BRICS, and globally through platforms such as the United Nations climate negotiations. Regarding cooperation mechanisms, institutional arrangements such as the Environmental Protection Cooperation Subcommittee under the China-Russia Prime Ministers' Regular Meeting Committee have been established. In addition, the policy alignment between China's Green Belt and Road Initiative and Russia's Eurasian Economic Union strategy has created further opportunities for bilateral green cooperation.

However, China-Russia green cooperation continues to face several challenges, which constrain its depth and breadth. Russia's economy remains highly dependent on the energy sector, with oil and gas revenues accounting for 45 % of its fiscal budget in 2023, which constrains the pace of its green transition. Differences in technical standards and certification systems between China and Russia also

increase the costs of cooperation. Furthermore, due to Western sanctions, financing costs for green projects are 2 to 3 percentage points higher than those in Europe (Xu et al., 2025).

This paper employs the driving force and constraint theory framework to systematically analyse the internal drivers and external constraints of China-Russia green cooperation. It aims to identify the underlying logic of the cooperation mechanism and propose potential pathways for optimization. Driving force and constraint theory provides an effective framework for analysing international cooperation by emphasizing the dual dimensions of forces that promote cooperation and factors that constrain its development. Within this framework, the driving force system of China-Russia green cooperation encompasses four dimensions: strategic consensus, economic complementarity, global governance, and mechanism building. The constraint system consists of three levels: structural, institutional, and technical and financial constraints. This analysis may thus contribute theoretical and policy insights into the development of China-Russia green cooperation.

Data and Methods

This study is grounded in a comprehensive review of scholarly literature and policy documents, employing a mixed-methods approach that integrates qualitative analysis with descriptive statistical analysis.

Research on China-Russia green cooperation has expanded in recent years, yet empirical studies systematically examining the underlying drivers and constraints remain limited. Existing literature can be broadly categorized into three strands. The first focuses on the strategic and policy dimensions of bilateral environmental and energy cooperation. Scholars such as Xu & Yi (2022) highlight the alignment between China's dual carbon goals and Russia's low-carbon strategy, emphasizing the role of high-level diplomatic mechanisms in facilitating green partnerships. The second strand examines specific sectors, including nuclear energy, natural gas, and agriculture, often through case studies of landmark projects (Li, 2024; Lu & Song, 2022; Zhang et al., 2025). The third strand addresses institutional and financial barriers, noting that differences in technical standards and limited access to green financing constrain the scale and efficiency of cooperation (Xu, Huang & Yi, 2025; Wu & Ge, 2024).

Despite these contributions, few studies systematically apply a theoretical framework to analyse the dynamic interplay between driving forces and resistance in China-Russia green cooperation. This study addresses this gap by employing the Driving Forces-Resistance model, drawing on the tradition of Lewin (1947) and its subsequent applications in organizational and social-change research (Burnes, 2004; Coghlan & Brydon-Miller, 2014).

Data Sources

The data primarily derive from publicly available policy regulations, authoritative statistical databases, and landmark project case studies, spanning the period from 2006 to 2025.

Core materials include official documents related to China's "Dual Carbon" goals, Russia's Strategy for Low-Carbon Socio-Economic Development until 2050, and Joint Statements issued by the Chinese and Russian heads of state between 2006 and 2025 (with particular emphasis on the 2024 Joint Statement on Deepening the Comprehensive Strategic Partnership of Coordination for a New Era and the latest statement from 2025). Additionally, this study incorporates the SCO Concept for Environmental Protection Cooperation and relevant cooperation documents from BRICS.

Data were sourced from the World Intellectual Property Organization's (WIPO) Global Innovation Index (GII) 2025 report to obtain rankings for China and Russia regarding innovation infrastructure and knowledge output. Furthermore, public data from the Russian Ministry of Finance (e.g., the proportion of oil and gas revenue in the federal budget for 2023) and energy trade statistics (e.g., China-Russia natural gas trade volume in 2024) were utilized.

Information regarding flagship projects in nuclear energy, natural gas, and green finance was collected. This includes operational data from the Tianwan and Xudabao Nuclear Power Plants, commissioning status of the China-Russia Eastern Route Natural Gas Pipeline, and industry standards such as the Green Finance Guidelines issued by VEB.RF (Vnesheconombank).

Research Methods

The "Drive-Resistance Analysis Model" originated from Kurt Lewin's (1947) force-field analysis of group dynamics and has since been widely adopted in the social sciences and economics to study the drivers and barriers of institutional and organizational change (Burnes, 2004; Coghlan & Brydon-Miller, 2014). The core assumption of this model is that any collaborative process is the result of the interaction between driving forces and resistance. When driving forces outweigh resistance, collaboration moves forward; when resistance prevails, collaboration is hindered or stalls. Therefore, this framework provides a systematic theoretical and methodological foundation to analyse the development of Sino-Russian green cooperation.

Adopting this theoretical perspective, this study constructs a Driving Forces-Resistance System Analysis Model encompassing four major driving forces, namely strategic consensus, economic complementarity, global governance, and institutional building, and three primary forms of resistance, namely structural, institutional, and technical con-

straints. The model guides the empirical analysis through several complementary methods.

Firstly, a textual analysis was applied to study bilateral joint statements, strategic plans and industry standards. This way we assessed, from a qualitative perspective, the strength of bilateral strategic consensus and changes in policy orientation.

Second, a horizontal comparison of the innovation capabilities and institutional environments of China and Russia was conducted. Particular attention was given to WIPO innovation indices to identify asymmetries in technology transfer capacities. In addition, differences between the Russian GOST standards system and Chinese and international standards, particularly in terms of interfaces and certification procedures, were examined to identify specific manifestations of technical barriers to trade, such as increased certification costs.

Third, case studies and descriptive statistics were employed to examine the practical dimensions of bilateral cooperation. Representative projects, including the Tianwan Nuclear Power Plant, the China-Russia Eastern Route Natural Gas Pipeline, and green agriculture initiatives, were selected for analysis. Through case analysis and available data, the study evaluates project outcomes and identifies existing barriers. Case selection prioritizes both representativeness and diversity, covering key sectors such as energy, environment, and agriculture. Descriptive statistics are also applied to selected indicators, including power generation and emission reduction volumes.

Data for these indicators are drawn from project operator reports (e. g., CNNC annual reports), pipeline operator throughput records, the IAEA Power Reactor Information System (PRIS), and publicly available energy-trade statistics.

In total, five representative cases are examined over the period 2006–2025: the Tianwan and Xudabao nuclear power plants, the China-Russia Eastern Route Natural Gas Pipeline, the Yamal LNG project, and green agriculture initiatives.

It should be noted that access to certain micro-level enterprise data in Russia is limited, particularly due to the effects of international sanctions. Consequently, this study focuses primarily on the macro-policy and meso-industry levels. Micro-econometric analysis may be pursued in future research as relevant data become available.

Results

The Driving Forces-Resistance framework conceptualizes China-Russia green cooperation as the outcome of an ongoing interaction between factors that promote cooperation and those that constrain its development. As summarized in Table 1 below, the driving system comprises four dimensions: strategic consensus, economic complementarity, global governance, and institutional development. The

resistance system consists of three dimensions: structural, institutional, and technical and financial resistance. Together, these dimensions provide a systematic basis for examining both the foundations of bilateral cooperation and the factors that may limit its development.

The first driving force is strategic consensus, which derives from the two countries' shared emphasis on green and low-carbon development. This consensus is reflected in the broad alignment between China's "dual carbon" goals and Russia's climate and carbon neutrality objectives. The second is economic complementarity, which arises from differences in resource endowments, technological capabilities, and market demands. For example, China's strengths in renewable energy technologies can complement Russia's abundant natural resources. The third driving force is global governance, reflected in the two countries' shared interests and positions in international climate governance, including their emphasis on the principle of "common but differentiated responsibilities." The fourth is institutional development, supported by established mechanisms for bilateral and multilateral cooperation. These include institutional arrangements such as the Environmental Protection Cooperation Subcommittee under the China-Russia Prime Ministers' Regular Meeting Committee.

Despite these driving forces, several forms of resistance constrain the development of China-Russia green cooperation. Structural resistance primarily arises from differences in the economic structures of the two countries. Russia's continued dependence on energy exports, for example, may constrain the pace of its green transition, with oil and gas revenues accounting for 45 % of its fiscal budget in 2023. Institutional resistance stems from differences in technical standards, certification systems, and policy regulations, which can increase the costs and complexity of bilateral cooperation. Technical and financial resistance is associated with limitations in technology transfer and access to financing. Russia's relatively less developed green finance market, for instance, offers a more limited range of financial products, while financing costs for green projects have been estimated to be 2 to 3 percentage points higher than in Europe.

The relationship between these driving forces and forms of resistance is not static but dynamic and potentially mutually transformative. The balance between them influences both the direction and pace of China-Russia green cooperation. When driving forces are stronger than resistance, cooperation is more likely to deepen and expand; when resistance becomes more significant, cooperation may slow or stagnate. At the same time, resistance does not necessarily have a purely negative effect. In some circumstances, constraints may encourage

Table 1

Driving Forces and Barriers to China-Russia Green Cooperation

System	Dimension	Key manifestation	Impact Level
Power system	Strategic consensus	Green development is a shared national priority in both countries.	High
	Economic complementarity	Complementary resource endowments, technological capabilities, and market demands.	Medium to high
	Global governance	Shared interests and positions in international climate governance.	Moderate
	Mechanism building	Gradual development of multi-level and multi-sector cooperation mechanisms.	Moderate
Resistance System	Structural resistance	Russia's energy-dependent economic structure constrains the pace of green transition.	High
	Institutional resistance	Differences in standards, regulations, and market access requirements increase cooperation costs.	Medium to high
	Technical and financial resistance	Limited technology transfer capacity and restricted access to green financing constrain project development.	Moderate

Source: Compiled by the author based on policy documents, WIPO GII 2025, and project data.

the two countries to develop new technologies, institutional arrangements, or financing mechanisms, thereby transforming existing resistance into new sources of cooperation. This dynamic interaction helps explain the fluctuations and phased development of China-Russia green cooperation and provides a framework for assessing its future trajectory.

Driving Forces of China-Russia Green Cooperation

China-Russia green cooperation is driven by four interconnected factors: strategic consensus, economic complementarity, shared interests in global climate governance, and the development of institutional mechanisms. Together, these factors create both the motivation and the institutional capacity for expanding bilateral cooperation.

Strategic Consensus

China and Russia share significant strategic consensus in the field of green development, serving as the core driving force for cooperation. In 2020, China formally proposed its “dual carbon goals”: achieving carbon peak by 2030 and carbon neutrality by 2060. Russia also approved its Strategy for Low-Carbon Socio-Economic Development until 2050 in 2021, setting a target of achieving carbon neutrality by 2060 (Chu, 2020).¹ Russia subsequently approved its Strategy for Low-Carbon Socio-Economic Development through 2050 in 2021, which also establishes a long-term pathway toward carbon neutrality (Chu, 2020). Russia has further promoted low-carbon and carbon-free technologies, enhanced the carbon sequestration capacity of forests and ecosystems, and developed supporting policies for green finance and

fiscal measures (Zhang & Qu, 2016; Xu et al., 2025; Xu & Zou, 2024). Although the two countries differ in their economic structures and policy approaches, their shared emphasis on green development creates a common strategic basis for cooperation.

This consensus is also reflected in bilateral and multilateral policy coordination. At the bilateral level, China and Russia have strengthened environmental cooperation through high-level dialogue mechanisms. The 2024 Joint Statement on Deepening the Comprehensive Strategic Partnership of Coordination for a New Era called for enhanced environmental cooperation, while the 2025 Joint Statement further emphasized efforts to address plastic waste pollution. At the multilateral level, coordination within the United Nations, BRICS, and the Shanghai Cooperation Organization provides additional platforms for aligning positions and promoting cooperation on environmental and climate-related issues. These developments indicate that strategic consensus extends beyond broad policy objectives to concrete areas of policy coordination.

Economic Complementarity

Economic complementarity provides a second major driving force for bilateral green cooperation. This complementarity is evident in technological capabilities, resource endowments, and market demand. China has developed substantial capabilities in technological innovation, manufacturing, and the commercialization of renewable energy technologies, while Russia retains considerable strengths in fundamental research and clean energy sectors such as nuclear power and hydrogen. The WIPO Global Innovation Index 2025 illustrates the difference in their innovation capabilities, with China ranked 10th and Russia 60th overall. The gap is particularly pronounced in innovation infrastructure and knowledge and technology outputs, where China ranked 6th and 1st, respectively, compared with

¹ Government of the Russian Federation. (2021, October 29). Strategiya Sotsial'no-Ekonomicheskogo Razvitiya Rossiyskoy Federatsii s Nizkim Urovnem Vybrosov Parnikovykh Gazov do 2050 Goda [Strategy for the Socio-Economic Development of the Russian Federation with Low Greenhouse Gas Emissions up to 2050] (Decree No. 3052-r). URL: <http://government.ru/docs/43708/> (Date of access: 12.11.2025). (In Russ.)

Russia's 76th and 62nd positions.¹ These differences suggest potential for technological complementarity, particularly where Chinese commercialization and manufacturing capabilities can be combined with Russian scientific and technical expertise.

Resource endowments further strengthen this complementarity. Russia possesses substantial renewable energy potential, including solar, wind, biomass, and other resources, but their development is constrained in some regions by limited electricity demand and inadequate infrastructure. China, by contrast, has developed a relatively complete renewable energy industrial chain and extensive experience in large-scale project development. Its capabilities in photovoltaic and wind power manufacturing, together with experience in integrating renewable energy development with ecological restoration and rural development, provide potential areas for cooperation with Russia. This combination of Russian resource potential and Chinese technological and project implementation capabilities creates opportunities for mutually beneficial cooperation.

Market complementarity reinforces these technological and resource linkages. Russia faces demand for technological upgrading and green infrastructure development, while Chinese enterprises possess expanding capabilities in green technologies and experience in international project cooperation. The convergence of these supply and demand conditions provides an economic basis for expanding bilateral cooperation in renewable energy, energy efficiency, green infrastructure, and related sectors.

Global Governance

Shared interests in global climate governance constitute a third driving force. As major economies and significant greenhouse gas emitters, China and Russia face international pressure to reduce emissions while maintaining economic development. Both countries therefore emphasize the principle of "common but differentiated responsibilities" and the need to reconcile climate action with the right to development (Jiang, 2012). This shared position creates opportunities for coordination in international climate negotiations and strengthens their common interests in shaping global climate governance.

The development of international trade and climate-related measures has further reinforced these shared interests. The European Union's Carbon Border Adjustment Mechanism, for example, creates additional carbon-related costs for exporters from both countries and highlights the growing interaction between climate policy and international

trade. Given the importance of energy and other carbon-intensive products in China-Russia trade, these developments create incentives for both countries to coordinate their responses to emerging green trade measures. Their broader support for multilateralism and opposition to unilateral coercive measures also provides a basis for cooperation in promoting a more inclusive international climate governance system.

Cooperation in biodiversity and environmental governance provides another example of this alignment. At the fifteenth Conference of the Parties to the Convention on Biological Diversity in 2021, China and Russia expressed support for strengthening biodiversity conservation and addressing climate change through coordinated approaches. Such shared positions at the multilateral level can reinforce bilateral cooperation by providing a broader diplomatic and policy context for environmental collaboration.

Mechanism building

The development of institutional mechanisms provides the organizational foundation for China-Russia green cooperation. Cooperation has gradually expanded from bilateral mechanisms to regional and multilateral frameworks, creating channels for policy coordination, project implementation, and information exchange.

At the bilateral level, the Environmental Protection Cooperation Subcommittee under the China-Russia Prime Ministers' Regular Meeting Committee, established in 2006, provides a regular mechanism for environmental cooperation and facilitates the implementation of bilateral projects. At the regional level, environmental cooperation under the Shanghai Cooperation Organization has also developed progressively. The establishment of the China-SCO Environmental Protection Cooperation Centre in 2014 and the adoption of the Concept of Environmental Protection Cooperation among SCO Member States in 2018 provided an institutional basis for regional environmental collaboration. More recently, China and Russia participated in environmental initiatives under the SCO framework, including activities associated with the "Ecological Year" and the 2025 SCO Tianjin Summit's emphasis on green industry cooperation.

At the broader multilateral level, China and Russia also use platforms such as BRICS and the Belt and Road Initiative to expand cooperation in areas related to digitalization, technology, and sustainable development. Bilateral initiatives in digital infrastructure and emerging technologies, including the 2020 China-Russia Digital Economy Demonstration Project and the 2022 Agreement on Cooperation in the Fields of Informatization and Digitalization, provide additional channels that may support the digital and technological dimensions of green development.

Taken together, these mechanisms reduce coordination costs, facilitate policy dialogue, and pro-

¹ World Intellectual Property Organization. (2025). Global Innovation Index 2025: GII 2025 Results. URL: <https://www.wipo.int/web-publications/global-innovation-index-2025/en/gii-2025-results.html> (Date of access: 24.05.2026).

Table 2

Key Mechanisms and Achievements of China-Russia Green Cooperation

Type	Representative mechanism	Year of establishment	Key Achievements
Bilateral mechanism	Subcommittee on Environmental Protection Cooperation under the China-Russia Prime Ministers' Regular Meeting Committee	2006	Facilitated cooperation in areas such as transboundary water management and biodiversity conservation.
Regional mechanism	China-Shanghai Cooperation Organization Environmental Protection Cooperation Center	2014	Implemented initiatives such as the Green Silk Road Ambassador Program, training more than 200 officials and experts.
	Concept for Environmental Protection Cooperation Among Member States of the Shanghai Cooperation Organization	2018	Provided an institutional framework for regional environmental cooperation.
	Declaration of the Member States of the Shanghai Cooperation Organization on Cooperation in Green Industries	2025	Established an action framework for green industry cooperation among SCO member states.
Multilateral Mechanism	BRICS Green Cooperation Framework	2020	Promoted cooperation in areas such as green finance and renewable energy.
Emerging Mechanism	China-Russia Digital Economy Demonstration Project	2020	Promoted the application of 5G, AI, and other digital technologies in green development.

Source: Compiled by the author based on relevant materials.

vide institutional channels for translating strategic consensus and economic complementarity into concrete cooperation. The progressive development of bilateral, regional, and multilateral mechanisms therefore not only supports existing cooperation but also strengthens the capacity of China and Russia to respond collectively to emerging opportunities and challenges in green development.

Systemic Barriers to China-Russia Green Cooperation

While China and Russia possess significant potential for green cooperation, its development is constrained by structural, institutional, and technical and financial resistances. These constraints operate at different levels but are closely interconnected, affecting both the incentives for cooperation and the efficiency of project implementation.

Structural resistance

Following the dissolution of the Soviet Union, the oil and gas sector became the cornerstone of Russia's economy, with its dominant position steadily cementing. This resource-dependent economic structure has diminished Russia's intrinsic motivation to vigorously develop green energy. Although Russia has set a goal of achieving carbon neutrality by 2060, it remains inclined in the short term to maintain fossil fuel exports while limiting investment in renewable energy development. Following the escalation of the Russia-Ukraine conflict, Western sanctions have prompted Russia to reorient energy exports toward Asia, particularly China. In this context, maintaining hydrocarbon revenues has become a priority in Sino-Russian energy engagement, which has limited the relative space allocated to green technology and industrial cooperation.

Regional disparities in Russia constitute an additional structural constraint. Western regions generally benefit from better infrastructure and stronger institutional capacity, while many eastern regions possess substantial natural and renewable energy resources but face infrastructure deficiencies and higher investment risks (Xiao & Ge, 2022). The Russian Far East illustrates this challenge. Despite its considerable renewable energy potential, inadequate infrastructure and an uncertain investment environment can limit the implementation and scalability of green projects (Xiao & Ge, 2022). These regional disparities therefore affect the geographical distribution and feasibility of bilateral cooperation.

Institutional resistances

Institutional differences between China and Russia increase the costs and complexity of green cooperation. In the renewable energy sector, Russian support policies may require a certain degree of local equipment production, which can conflict with the equipment export and market entry models commonly adopted by Chinese enterprises. Such requirements may increase investment costs and reduce the flexibility of cross-border cooperation.

Differences in technical standards and certification systems represent another institutional barrier. Russia predominantly applies its national GOST standards in equipment manufacturing and engineering, whereas Chinese enterprises often operate according to Chinese, European, or international standards. These differences may require additional testing, certification, and technical adaptation for Chinese equipment entering the Russian market. In the wind power sector, for example, differences in cable interfaces and supporting materials may re-

quire additional adaptation, contributing to reported increases in certification costs of 15 % to 30 %.

Administrative complexity and policy uncertainty further increase institutional risks. Complex approval procedures and frequent adjustments to environmental and related policies may increase uncertainty for long-term investors. These challenges are particularly relevant to green finance, where Russia's regulatory framework remains relatively underdeveloped and is supported largely by environmental policies and selected provisions adopted by commercial financial institutions (Wu & Ge, 2024). Limited regulatory development may therefore constrain the expansion and diversification of green financial instruments.

Technical and financial resistance

Technologically, while Russia possesses strong basic research capabilities, its capacity for technology transfer remains inadequate. According to the Global Innovation Index, Russia ranks 76th in innovation infrastructure—significantly below China's 6th place. This gap impedes technological innovation and its widespread adoption.

At the management level, corporate governance standards in Russia vary widely, and project management experience is limited. This results in low project execution efficiency and weak cost control capabilities. Delays and cost overruns have occurred in some cooperative projects. (Xu, H., & Yi. 2022)

Financial constraints further reinforce these technical and institutional barriers. Green projects typically require substantial upfront investment and involve relatively long implementation and repayment periods. The impact of Western sanctions has further restricted Russia's access to international financing channels, increasing the difficulty and cost of financing green projects. At the same time, Russia's green finance market remains relatively small and concentrated in a limited range of instruments, particularly green bonds. Although China and Russia have begun exploring cooperation in areas such as ESG bond certification (Dai et al., 2024) and green infrastructure investment and financing (Xie et al., 2025), the scale of these initiatives remains limited relative to existing financing needs (Xu et al., 2025).

Discussion

Prospects of Cooperation between China and Russia under the Green Belt and Road Initiative

The Green Belt and Road Initiative provides an important framework for advancing sustainable development and strengthening China's participation in global environmental governance. Since the issuance of the Guiding Opinions on Promoting the Construction of a Green Belt and Road in 2017, green development has become an increas-

ingly important component of the Belt and Road Initiative.¹ At the Second Belt and Road Forum for International Cooperation in 2019, China further emphasized green infrastructure, green investment, and green finance as key elements of high-quality Belt and Road cooperation (Xi, 2019). Against this background, China and Russia have expanded cooperation in environmental protection, energy transition, clean energy, green industrial technologies, green finance, and agriculture.

Based on the shared interests of China and Russia, and under the framework of the green Belt and Road Initiative, China and Russia are cooperating in areas such as environmental protection, green energy transition, clean energy cooperation, green industrialization technology, green finance, and green agriculture. Let us consider each of these areas in more detail.

First and foremost, it should be noted that environmental cooperation between China and Russia has a relatively long history, beginning with cooperation on transboundary rivers and lakes in the 1980s. A series of bilateral agreements subsequently established a foundation for cooperation in transboundary water management, biodiversity conservation, and environmental protection².

The 2005 Songhua River pollution incident highlighted the importance of strengthening bilateral environmental coordination. In 2006, China and Russia established the Environmental Protection Subcommittee under the China-Russia Prime Ministers' Regular Meeting Committee, providing a regular institutional mechanism for environmental cooperation. Since then, the two countries have gradually expanded cooperation in areas such as transboundary water protection, biodiversity conservation, environmental disaster response, climate change, and solid waste management.

Since the launch of the Green Belt and Road Initiative, environmental cooperation has become an increasingly important component of bilateral cooperation. Recent joint statements have further reinforced this commitment. For example, the 2024 China-Russia Joint Statement on Deepening the Comprehensive Strategic Partnership of Coordination for a New Era called for strengthened cooperation in areas including transboundary water protection, environmental disaster response, biodiversity conservation, climate change, and solid waste manage-

¹ Guiding Opinions on Promoting the Construction of a Green Belt and Road Initiative. (2017, May 9). China Environment News, 3.

² The main agreements include the 1986 Agreement on Water Resources Management of Border Waters between China and Russia, the 1994 Agreement on Environmental Protection Cooperation between China and Russia, and the 1996 Agreement between China and Russia on the Establishment of a Fishing Prohibition Zone in Lake Khanka.

ment¹. The 2025 Joint Statement further emphasized efforts to address plastic waste pollution².

These developments demonstrate the gradual expansion of the environmental cooperation between China and Russia from transboundary environmental management toward broader areas of ecological and climate governance. The long-established institutional mechanisms provide a foundation for further cooperation under the Green Belt and Road framework.

Growing global concern over environmental degradation and climate change is accelerating the transition toward a lower-carbon energy system. For oil and gas companies, this transition is creating pressure to improve production efficiency, reduce emissions, and diversify into cleaner energy. Many companies are therefore expanding investment in renewable energy and carbon capture, utilization, and storage (CCUS) technologies while seeking to reduce the carbon intensity of their existing operations.

Over time, the crude oil market is expected to contract, while natural gas and renewable energy are likely to become increasingly important sources of energy-sector growth (Lv, 2021). Against this backdrop, China and Russia have deepened cooperation in natural gas and renewable energy (Guo & Ma, 2025), with projects such as the Yamal LNG project and the China–Russia East Route natural gas pipeline serving as prominent examples (Lu & Song, 2022). China's "dual carbon" goals are also expected to accelerate the development of emissions-reduction and energy-efficiency technologies, facilitate the cleaner transformation of traditional energy sources, and promote the growth of new energy industries (Hou et al., 2023). Green energy cooperation could therefore become an increasingly important component of China–Russia cooperation and the joint development of the green "Belt and Road" (Glazyrina & Zabelina, 2016).

Russia has extensive experience in nuclear energy, and China and Russia have cooperated in this field for many years (Li, 2024). The cases of the Tianwan and Xudabao nuclear power plants are quite illustrative in this respect. Tianwan's first six units have

been brought into operation in three phases since 2007, with Units 5 and 6 entering commercial operation in 2021. By the end of 2025, Units 1–6 had generated more than 500 billion kilowatt-hours of electricity, reportedly reducing carbon dioxide emissions by approximately 400 million tons (Guo & Cai, 2022). Construction and commissioning of Units 7 and 8 are also progressing, with Unit 7 expected to enter commercial operation in 2026³.

Cooperation at the Xudabao Nuclear Power Plant has likewise advanced steadily. CNNC and Rosatom signed a framework contract in 2018 and a general contract for Units 3 and 4 in 2019. Construction of Units 1 and 2 began in 2023, while work on Units 3 and 4 has progressed to the equipment-installation stage. The four units are scheduled to enter operation between 2027 and 2029⁴. Together, the Tianwan and Xudabao projects represent not only major energy infrastructure investments but also important elements of broader Sino-Russian strategic cooperation.

China and Russia have also explored cooperation in hydropower. In May 2016, China Three Gorges Corporation and Russian Hydropower Company established a joint venture to develop the Nizhny Breya Hydropower Project in Russia. The project is intended to strengthen flood control in the basin and generate electricity that could potentially be transmitted to China. More broadly, Russia's abundant water and energy resources, combined with China's expertise in renewable-energy technologies such as wind and solar power, suggest further potential for cooperation in clean energy.

Russia is now undergoing re-industrialization while facing the problem of aging industrial infrastructure that contributes to high energy consumption and low efficiency. China's extensive experience in infrastructure electrification and industrial modernization could therefore support efforts to upgrade Russian equipment and improve energy efficiency. The two countries could also leverage their complementary strengths in green and low-carbon technologies through joint research and development, technology transfer, and other forms of technological cooperation.

¹ The full text of the Joint Statement between the People's Republic of China and the Russian Federation on Deepening the Comprehensive Strategic Partnership of Coordination for a New Era on the Occasion of the 75th Anniversary of the Establishment of Diplomatic Relations, can be found on the website of the Chinese government: URL: https://www.gov.cn/yaowen/liebiao/202405/content_6951404.htm?dt_platform=douban_broadcast&dt_dapp=1 (Date of access: 17.05.2024).

² The Chinese government website published the "Joint Statement between the People's Republic of China and the Russian Federation on Further Deepening the Comprehensive Strategic Partnership of Coordination for a New Era on the Occasion of the 80th Anniversary of the Victory of the Chinese People's War of Resistance Against Japanese Aggression, the Great Patriotic War of the Soviet Union, and the Founding of the United Nations," URL: https://www.gov.cn/yaowen/liebiao/202505/content_7023051.htm (Date of access: 11.05.2025).

³ Tianwan Units 1 and 2 began operation in 2007; Units 3 and 4 entered commercial operation in February and December 2018, respectively; and Units 5 and 6 entered commercial operation in 2021. Unit 7 completed its hot performance test on December 30, 2025, and was proceeding toward fuel loading, grid connection, and commercial operation in 2026. Construction of Unit 8 was also underway.

⁴ The Xudabao project has involved several stages of Sino-Russian cooperation. The dome of Unit 4 was installed in June 2024, and key equipment, including the reactor pressure vessel and steam generator, was shipped from Russia in August 2024. The equipment was manufactured by Rosatom's Atomic Machine-Building Company. The total investment for Units 1 and 2 was reported at RMB 48 billion.

Financial cooperation could further support these efforts. As low-carbon development becomes increasingly important worldwide, companies are incorporating emissions reduction into their strategies, while many face difficulties meeting their targets and may seek to offset emissions through investments in external low-carbon projects. Russia's relatively high emissions intensity and substantial potential for emissions reductions could therefore create opportunities for green investment. At the same time, Western sanctions have constrained Russia's access to investment from traditional sources, which contributed to Russia's interest in attracting Chinese capital for green projects.

Russia's green finance market has also developed rapidly. In 2020, Vnesheconombank (VEB) issued Russia's first guidance on green finance, establishing a framework for green projects, loans, and bonds while drawing on China's experience in developing green-finance standards. Cooperation has since expanded into areas such as ESG bond assessment and certification, ESG ratings and disclosure, green infrastructure financing, and local-government green finance.

Agriculture provides another area in which the two countries' complementary strengths could support green cooperation. China has a diverse agricultural sector, while Russia's vast territory, fertile land, and abundant water resources provide favourable conditions for large-scale, mechanized farming. Bilateral agricultural cooperation can therefore leverage these comparative advantages. In recent years, the integration of environmental protection and agricultural technologies has further expanded the potential for cooperation (Zhang et al., 2025).

Demand for Russian agricultural products in China has also contributed to the growth of bilateral agricultural trade. Products such as soybeans, sunflower oil, flour, corn, and honey have gained popularity among Chinese consumers. At the same time, Chinese investment in agriculture has expanded in the Russian Far East, including such spheres as cultivation, processing, and trade. Institutional initiatives have also contributed to this development. For example, in 2020 Heihe established a Sino-Russian Green Agriculture Comprehensive Service Centre to support green agricultural producers and businesses in both countries.

Together, the above-described developments suggest that Sino-Russian green cooperation extends beyond energy to encompass industrial modernization, finance, and agriculture. The two countries' complementary resources, technologies, and investment needs could provide a basis for expanding cooperation across these sectors, although the scale and effectiveness of such cooperation will depend on technological, financial, and regulatory conditions.

Conclusion

This study applies the Driving Forces-Resistance framework to examine the development of China-Russia green cooperation. The findings indicate that bilateral cooperation is shaped by the interaction between four principal driving forces, namely strategic consensus, economic complementarity, global governance, and institutional development, and three major forms of resistance, namely structural, institutional, and technological and financial constraints. The development of cooperation therefore reflects a dynamic balance between factors that facilitate cooperation and those that constrain its depth and scope.

Based on an analysis of bilateral policy documents from 2006 to 2025, the WIPO Global Innovation Index 2025, and selected China-Russia green cooperation projects, four main conclusions can be drawn. First, structural constraints remain a major obstacle to deeper cooperation. Russia's continued dependence on fossil fuel revenues and its existing energy structure may limit the pace of its green transition and, consequently, the scope for cooperation in renewable energy and other emerging green industries. Second, institutional differences increase the costs of bilateral cooperation. Divergences between Russian GOST standards and Chinese and international standards, particularly in certification and technical requirements, create additional transaction costs and may hinder the implementation of green projects. Third, technological asymmetries constrain the potential for green innovation cooperation. The substantial difference between China and Russia in innovation capabilities, particularly in knowledge and technology outputs, suggests that differences in technology transfer and commercialization capacity remain an important constraint on deeper technological cooperation. Fourth, financing remains a significant constraint. Higher financing costs, limited diversity and scale of green financial products in Russia, and the effects of sanctions restrict access to capital for bilateral green projects. Although cooperation in areas such as ESG certification and green infrastructure financing has begun to develop, its scale remains limited.

In response to these constraints, this study proposes a phased set of policy measures based on the existing institutional foundation of China-Russia cooperation. In the short term, from 2026 to 2027, priority could be given to reducing institutional and financial barriers. The two countries could promote mutual recognition of green technology standards, initially focusing on areas such as wind power equipment and green agricultural products, with the aim of reducing redundant certification procedures. A China-Russia Green Cooperation Sub-Fund could also be explored to support small and medium-sized projects, particularly in green agriculture and distrib-

uted solar energy. Such a mechanism could help address financing constraints, although its implementation would need to take into account sanctions, settlement arrangements, and exchange rate risks.

In the medium term, from 2027 to 2028, greater attention could be given to improving project implementation and regional cooperation. A China-Russia Far East Green Projects Information Platform could facilitate project matching, information sharing, and investment coordination, while targeted incentives could support projects in areas such as biomass energy and cross-border ecological conservation. Building on existing regional cooperation mechanisms, such a platform could improve the efficiency of project development, although its effectiveness would depend on the availability of suitable projects and supportive local policies.

In the medium to long term, from 2028 to 2030, technological cooperation could become a greater

priority. Joint green technology laboratories and shared intellectual property mechanisms could be developed in areas where bilateral cooperation already exists, including nuclear power operation and maintenance, smart agriculture, and carbon sink accounting. Although such initiatives face greater coordination requirements concerning research priorities, intellectual property rights, and cost-sharing, targeted demonstration projects could provide a feasible starting point and contribute to strengthening long-term technological cooperation.

Overall, these findings suggest that China-Russia green cooperation may benefit from a phased approach that prioritizes relatively feasible institutional and financial measures in the short term while gradually expanding toward infrastructure and technological cooperation. Such an approach could help reduce existing constraints while strengthening the driving forces underlying bilateral green cooperation.

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