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IMPACT OF “GREEN” FINANCIAL INNOVATIONS  
ON THE DEVELOPMENT OF THE CHINESE ECONOMY

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Yuliana V. SOLOVIEVA<sup>a</sup>, Mingjun HE<sup>b</sup><sup>a</sup> – Peoples’ Friendship University of Russia  
(RUDN University), Moscow, Russia

ORCID: 0000-0002-1437-0008; solovyeva-yuv@rudn.ru

<sup>b</sup> – Kunming Polytechnic University, Kunming, China

ORCID: 0000-0001-9700-2077; minzun.xe@yandex.ru

**Abstract:** The article focuses on the impact of “green” financial innovations on the economic development of various regions, as well as “green” transformation and modernization of the Chinese economy. The purpose of the article is to identify the impact of “green” financial innovations on the qualitative development of the Chinese economy. The concepts of “green” finance have been developed in all leading world powers and are an integral ideology of sustainable development, which determines the relevance of the work. General methods were used as research tools: analysis, synthesis, induction, deduction and analogy, as well as the systemic method. The article identifies problems associated with the formation of “green” financing system in China, both of regional and national scope. The authors show that the achievements of digital technologies, new areas of financing for small and medium-sized enterprises, creation of zones for the development of “green” financing, “smart” cities, organization of “green” financing clusters on the basis of international financial centers, including various “green” instruments, are becoming priority development strategies for leading countries, including China. Achieving environmental (including low-carbon) goals is currently one of the basic principles of China’s financial technology development. The authors conclude that the development of “green” financial instruments and the ongoing Chinese “green” financial policy contribute not only to the improvement of the country’s financial and credit system, but also to the development of innovation, technology and digital economy. Moreover, it allows to revive rural areas, preserve the environment and achieve carbon neutrality.

**Keywords:** “green” finance, China, innovation, ecology, economic development

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## INTRODUCTION

For a long time, China’s economic development was mainly dependent on the contribution of resource factors and emphasized the expansion of production, which caused great damage to China’s environment and seriously threatened the sustainable development of society. All this inevitably pointed to the need for a transition to “green” development. High-quality economic development embodies the unity of five new development concepts: innovation, coordination, sustainability, openness and sharing. This is exactly what China’s new policy is aimed at. According to the current policy, “China has been promoting and advocating the concept of green finance” [Green Finance Supports, 2022].

The essence of green finance is the adoption of policies that take into account the possible environmental consequences when making decisions, the integration of potential revenues, costs, risks associated with environmental conditions into their daily financial activities, and “the management of environmental pollution in financial operations, and promotes the sustainable development of society through the guidance of social and economic resources” [Zhang et al., 2022] by the financial sector.

In terms of China’s relevant policies, planning and action by financial institutions, the Chinese government encourages and promotes the propensity of financial resources towards “green” and low-carbon industries, and supports “green” modernization of traditional high-carbon enterprises. According to the information released by the People’s Bank of China, the first batch of carbon reduction tools was funded at 85.5 billion yuan, prompting financial institutions to issue carbon reduction loans worth 142.5 billion yuan that meet the requirements, and the leveraged effect is significant. Continuous improvement of carbon reduction tools can further boost “green” loans [Green Finance, 2022]. Thus, “fiscal, taxation, financial, investment, and pricing policies and systems of standards will be improved to support green development, and it was necessary to better the system for market-based allocation of resources and environmental factors” [Speech by Governor Yi Gang, 2023].

#### RESEARCH QUESTIONS

There are many studies on green finance. Li [Li et al, 2020], Hao [Hao et al., 2021], Feng and Chen [Feng, Chen, 2018] and other scholars put forward different points of view at the conceptual level, which contributes to the development of green finance from environmental finance to sustainable development. In Guiding Opinions on Building a Market-Oriented Green Technology Innovation System, jointly issued by seven ministries, including the People’s Bank of China in 2019, green financing is defined as economic activity that contributes to the improvement of the environment, overcoming the effects of climate change, as well as saving and making efficient use of resources, energy conservation, clean energy, green transport, green construction and other areas of project investment and financing, project activities, risk management and other financial services.

Chinese scholars focused on theoretical and empirical studies of the logical link between green finance support and innovation in green technology. So, Jieping and his co-authors [Jieping et al., 2022], having analyzed the impact of Special Economic Zones on carbon emissions in Chinese cities, revealed regional heterogeneity due to the structure of the cities’ industry, stocks of environmentally green technologies and administrative hierarchies of zones.

Xiaomeng and Weidong explained “the compatibility of the composite system that consists of green technology innovation, green finance, and environmental regulation is the decisive factor for whether regional economy can achieve sustainable development” [Xiaomeng, Weidong, 2022]. The authors identified a significant gap in the level of coordination of interaction between different regions of China, while noting great potential for their development. Kai and Yijun [Kai, Yijun, 2021] analyze the concept of green financing, its contribution to the economic development of China. Ma and Chen show that “an innovative financial model that can effectively promote the global economy, green finance is of great significance to the global ecological economy and environmental state” [Ma, Chen, 2022] using the example of the Chinese economy.

The literature review shows that the above mentioned studies mainly focus on the concept, relationship and importance of green finance and innovation in green technology, and the ways to accelerate the development of green technology and green financial innovation. In this regard, our article focuses on the impact of green financial innovations on the economic development of

various regions, as well as green transformation and modernization of production. Accordingly, the purpose of our article is to show the impact of “green” financial innovations on the qualitative development of the Chinese economy.

General methods were used as research tools: analysis, synthesis, induction, deduction and analogy, as well as systemic method.

## FINDINGS

The concepts of “green” finance have been developed in all leading world powers and are an integral part of the ideology of sustainable development. A special place there belongs to China, which has made green finance part of its national strategy, paying significant attention to the creation of an appropriate regulatory framework. In 2016, China also contributed to the creation of the Green Finance Study Group (GFSG) through its G20 chairmanship. The essence of green finance lies in the Chinese concept of “Ecological Civilization” and was outlined in the G20 Green Finance Synthesis Report [*G20 Green Finance*, 2016]. It consists of “identifying institutional and market barriers to the development of “green” financing and developing proposals to expand opportunities to attract private capital to the sphere of “green” investment” [Gavrillo, Shuay, 2019].

The idea that the financial sector can contribute to environmentally sustainable development was formulated in 2007 and formed the basis of the Equator Principles. These Principles included basic provisions on the environmental responsibility of financial institutions: “Large infrastructure and industrial Projects can have adverse impacts on people and on the environment. The Equator Principles (EP) are intended to serve as a common baseline and risk management framework for financial institutions to identify, assess and manage environmental and social risks when financing Projects” [*The Equator Principles*, 2022]. During the same period, green finance has begun to be considered a significant component of the global financial system by most of the world’s leading countries (currently, the Equator Principles are officially adopted by 137 financial institutions in 38 countries).

In 2015, the Central Committee of the Communist Party of China issued the Integrated Reform Plan for Promoting Ecological Progress [*Integrated Reform Plan*, 2015], which for the first time has proposed to create a “green” planning, management and control system, including a financial system. Credit and monetary instruments play a significant role in improving the environmental situation in the country. The “green” lending was initiated in 2007 and in 2012 the China Banking Regulatory Commission (key regulator of the Chinese banking system), published Green Credit Guidelines (GCGs), aimed at stimulating Chinese banks to issue loans on preferential terms to enterprises implementing green projects. In 2016, with the participation of a number of Chinese ministries, a fundamental document for the formation of a “green” financial system was prepared and published – Guidelines for Establishing the Green Financial System.

The establishment of a number of organizations influenced the formation of the “green” financial system in China. First of all, this is The Green Finance Committee of the China Society of Finance and Banking, The International Institute of Green Finance in Beijing, The International Institute for Sustainable Development. All of them have a significant impact on the development of “green” financing in the country.

Speaking of financial instruments used by the “green” financial system of China, we will highlight “green” lending, “green” bonds, “green” stock indices, as well as related products. We will focus on the most developed ones.

The developed policy of “green” lending in China is implemented by a number of financial structures. Thus, China Development Bank was one of the first to begin implementing a

corporate strategy for environmental conservation and sustainable development. The Agricultural Development Bank provides financial support in the field of land restoration, forest resources, the forest industry as a whole. The Commercial and Industrial Bank of China was one of the initiators of the development of a green lending strategy and introduction of an “environmental veto” system, which is a ban on financial support for projects that harm the environment. At the same time, the State Environmental Protection Administration of China annually forms a “black” list of polluting companies in order to limit the financing of polluting enterprises.

Since 2015, Chinese financial institutions have begun issuing “green” bonds as a new source of financing in order to expand green loans. At the same time, the state developed uniform rules and norms governing the issue and circulation of “green” bonds. In accordance with these norms, government agencies support the registration of the issue of “green” bonds, and institutional investors assist “green” enterprises with a confirmed standard in the placement of bonds under Initial Public Offering. Also, institutional investors carry out a number of measures, including re-lending, budget subsidies for interest payments, etc. as support for “green” lending.

In 2017, according to the decision of the State Council of China, the country created the first experimental zones for the development of “green” financing in the provinces of Zhejiang, Jiangxi, Guangdong, Guizhou and Xinjiang Uyghur Autonomous Region. Plans for the development of the local “green” financial system at different levels were outlined and implemented for each of the zones, taking into account different models of their development. In addition, an important area of development is the creation of “smart” ecological cities. Thus, the “Zhuzhou Yunlong district has great potential for the development of high-quality landscape resources. To protect an excellent natural environment, Yunlong Region prioritizes the green concept in resource use, green transport, environment, renewable energy, etc. In terms of environmental projects, wetland, forest, agricultural and green land are priorities. Energy sources based on the efficient use of traditional energy, as well as renewable sources using solar, geothermal and biomass energy, have been developed. As a result, carbon emissions have been significantly reduced. In China’s unified transport system, green transport is leading the way. Thanks to the tiered public transport system, the natural landscape is well protected” [Asaul, Shaun, 2021]. In China, almost 800 programs are currently being implemented (more than half of the total number of such projects in the world) aimed at creating and supporting “smart” cities. For example, “Hangzhou launched the City Brain project using Big Data and artificial intelligence, which is a system for monitoring, managing and fixing problems with urban traffic. City Brain has already managed to reduce traffic congestion in Hangzhou by 15%. This program was developed and implemented by Chinese tech giant Alibaba in conjunction with municipal authorities in 2016” [Asaul, Shaun, 2021].

Integration between the state institutions and the private sector plays a key role in the development of smart cities in China, when “enterprising governments looking for new ways of local economic development and digital firms that make market profits join forces to capitalize urban development in China. The Smart Cities market in China is “anticipated to witness a significant increase in revenue, with projections indicating that it will reach a staggering US\$ 16,86 bn by 2024. ... this market segment is expected to exhibit a compound annual growth rate (CAGR) of 8,83% between 2024 and 2029, resulting in a substantial market volume of US\$25,74bn by the end of 2029” [*Smart Cities – China*, 2024]. At the opening of the Communist Party Congress (CPC) on October 17, 2022, Xi Jinping noted that “China is the world’s largest emitter of greenhouse gases”. He “electrified climate activists two years ago when he vowed to reach carbon neutrality by 2060 after peaking emissions before 2030. The announcement sparked a massive surge in investment in clean energy by local governments and state-owned firms” [*China Won’t Rush Its Clean Energy*, 2022].



It should be noted that the country's environmental policy is already yielding significant results. The analysis of statistical data showed the following: firstly, with an increase in capacity for all types of energy, we can see an increase in the share of renewable energy sources (fig. 1)<sup>1</sup>; secondly, there is a noticeable decrease in the share of investments in fossil energy, with a significant increase in renewable energy (fig. 2).

The 14<sup>th</sup> five-year plan for renewable energy development, adopted in 2022, aims to accelerate the development of renewable energy and implement measures to promote the energy revolution, build a clean, safe and efficient energy system. A few months earlier, the Chinese government adopted the Circular of the State Council on an action plan for peaking carbon emissions before 2030 (Action Plan). As highlighted in the Action Plan, "over the 14<sup>th</sup> five-year plan period, notable progress will be made in adjustment and optimization of the industrial structure and the energy mix. Energy efficiency will be largely improved in key industries, strict controls will be placed upon coal consumption growth, construction of new electric power systems based upon new energy resources will speed up, new progress will be made in the R&D and broad application of green and low-carbon technologies, environment-friendly production modes and living patterns will become widespread, and further improvement will be made in the policy framework for green, low-carbon and circular development. By 2025, the share of non-fossil fuels in total energy consumption will reach around 20%, while energy consumption and carbon dioxide emissions per unit of GDP will drop by 13.5% and 18%, respectively, compared with 2020 levels, laying a solid foundation for carbon dioxide peaking" [*Circular of the State Council*, 2021].

China's 14th five-year Plan, determining the development of the country's energy sector, suggests that maximum CO<sub>2</sub> emissions will be reached by 2025 with a further decrease at a rate of about 2.3% per year until 2050. At the same time, in 2050 China will remain not only the largest issuer, but also "the leader in deployment of several clean energy technologies on the back of average investment in clean energy technologies of well over USD 650 billion per year, and by 2050 it accounts for half of global solar PV capacity, 40% of wind capacity, one-third of all nuclear power capacity and 40% of the global electric car fleet. In addition, China is set to be a leader in electrolytic hydrogen production and heat pump manufacturing. ... The unabated use of coal is cut by two-thirds by 2040 and almost 90% by 2050" [Raimi D., Yuqi Zhu, Newell et al., 2023].

In order to form China's new power system, the State Energy Group is taking numerous steps to achieve "the 'dual carbon' goals, and has made comprehensive efforts to develop new energy in a diversified, rapid, large-scale, efficient and scientific manner. It has adhered to regional coordinated development, centralized and distributed development, and offshore and land development. It has grasped the "two joint operations" to strive for high-quality new energy projects, planned large base projects in a coordinated manner, and promoted the development of offshore wind power clusters, driving the rapid growth of wind and solar power installed capacity, and achieved the first start of large base construction, the continuous leading of the wind power industry, and the leapfrog development of the photovoltaic industry. In the first half of this year, the total construction scale of new energy projects of the State Energy Group was 45.54 million kilowatts, an increase of 10.37 million kilowatts over the same period last year. It is expected that the installed capacity of new energy will exceed 120 million kilowatts by the end of this year" [*The installed capacity*, 2024].

Thus, the capacities that cause the greatest damage to the environment are decommissioned. As some researchers note, China "wants to have a digitized, intelligent, green and equitable fintech sector that can provide powerful support for the implementation of strategies such as innovation-based development, digital economy, rural revival, carbon footprint reduction and achieving carbon neutrality" [Goryan, 2022]. In this regard, China's Fintech Development Plan

<sup>1</sup> For figs. 1–2, see color insert.

for 2022–2025 (Fintech Plan) sets tasks and proposes specific measures to achieve environmental (including low-carbon) goals, which is currently one of the basic principles for the development of the country's financial technologies:

- Improving governance of fintech;
- Fully unleashing the potential of data as a production factor;
- Building new digital infrastructure;
- Deepening the application of core technologies;
- Activating new drivers of digital operation;
- Reshaping financial services with intelligence;
- Strengthening prudential regulation of fintech;
- Consolidating the foundation for the sustainable development of fintech.

As emphasized in the Fintech Plan, "China is now the world's leading fintech investor since 2018. In 2018, China's fintech investment reached US\$25.5 billion, a 900 percent growth year-on-year, accounting for over 50 percent of the global total. According to CCID Consulting, in 2019, China's fintech sector had a market value of RMB 375.3 billion (US\$59.2 billion); its fintech market size is projected to reach RMB 543.4 billion (US\$85.7 billion) by 2022" [Zhou, 2022].

A distinctive feature of China's environmental and green financing strategy is the formation of a planned policy "from above" rather than a market approach "from below". This is manifested in significant public investment in a number of projects financed by "green" financial instruments. However, at the moment, the share of "green" funding, showing the number of projects aimed at environmental protection and sustainable development, is still lower than in developed countries. At the opening of the CPC on October 17, 2022, "president Xi Jinping has promised a slow and steady end to the growth of planet-warming emissions in China, with energy security taking top priority as the country contends with a flagging economy and tumult on global fuel markets" [*China Won't Rush Its Clean Energy*, 2022].

## CONCLUSIONS

The formation of an effective financial system in current conditions involves the use of the latest "green" technologies, including financial ones. Advances in digital technologies, new areas of financing for small and medium-sized enterprises, creation of zones for the development of "green" financing, "smart" cities, organization of "green" financing clusters on the basis of international financial centers, including various "green" instruments, are becoming priority development strategies for leading countries, including China.

China's updated Nationally Determined Contributions aim to achieve carbon neutrality by 2060 and are reflected in the Active Plan. Under this scenario, "China's total CO<sub>2</sub> emissions peak before 2025, with faster progress on energy efficiency, renewables and nuclear power leading to an earlier peak in coal use, and faster deployment of EVs helping to curb oil demand" [Raimi D., Yuqi Zhu, Newell et al., 2023]. Achieving environmental (including low-carbon) goals is currently one of the basic principles of China's financial technology development. Development of green financial instruments contributes not only to the improvement of the country's financial and credit system, but also to the development of innovative and technological sphere, digital economy, revival of rural areas, enhancement of the environment and achievement of carbon neutrality.

Having a large territory with vastly different regions (economic and geographical features, traditions and customs, etc.), China strives to develop and implement measures and strategies that

take into account these regional specifics. As some experts note, “One city, one policy” should remain the integral principle of regional development [Asaul, Shaun, 2021].

Despite the successes achieved in the formation of the “green” financing system in China, some problems can be noted both on regional (lack of qualified specialists and structures involved in the “green” financing at the regional level, weakness of the coordination system between various local institutional structures) and national (formation of the necessary regulatory framework taking into account the “green” financial component, etc.) level. Adoption of “green” financial policy, taking into account regional differences in the implementation of measures and strategies, will contribute to the effective economic development of the country.

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#### ИНФОРМАЦИЯ ОБ АВТОРАХ / INFORMATION ABOUT THE AUTHORS

СОЛОВЬЁВА Юлиана Владимировна – кандидат экономических наук, доцент кафедры национальной экономики экономического факультета Российского университета дружбы народов им. П. Лумумбы, Москва, Россия.

Yuliana V. SOLOVIEVA, PhD (Economics), Associate Professor, Department of National Economics, Faculty of Economics, Peoples' Friendship University of Russia (RUDN University), Moscow, Russia.

ХЭ Минцзюнь – кандидат экономических наук, старший преподаватель юридического факультета Куньминского политехнического университета, Куньмин, Китай.

Mingjun HE, PhD (Economics), Senior Lecturer, Faculty of Law, Kunming Polytechnic University, Kunming, China.



Иллюстрации к статье Ю.В. Соловьевой, ХЭ Минцзюнь

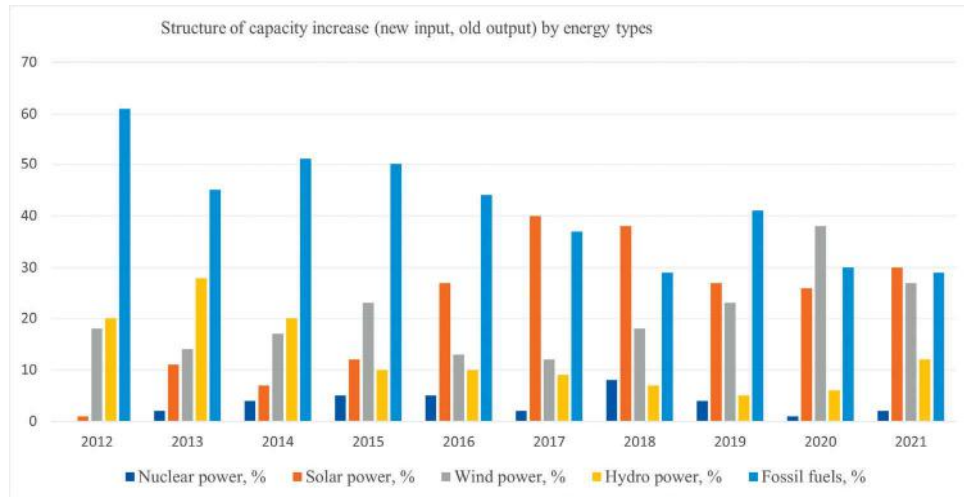


Fig. 1. Structure of capacity increase (new input, old output<sup>1</sup>) by energy types in China.  
(compiled by the authors based on: [China Energy Portal, 2024])

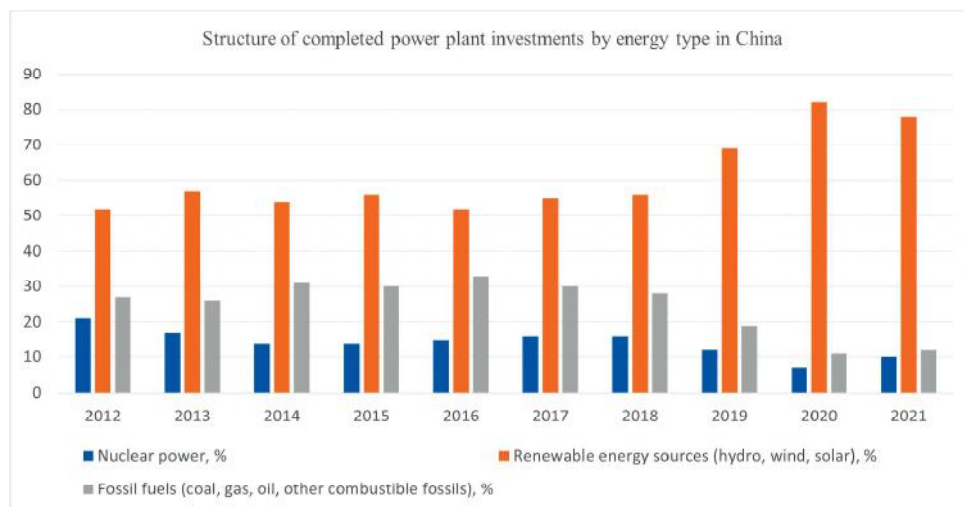


Fig. 2. Structure of completed power plant investments by energy type in China  
(compiled by the authors based on: [China Energy Portal, 2024]).

<sup>1</sup> To implement the strategy to achieve carbon neutrality, China is increasing the introduction of new capacities from non-fossil energy sources (their share in net capacity growth exceeded 70%). Coal power continues to evolve, but older facilities which are the most damaging to the environment are being decommissioned.