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# Research on China-Vietnam Green Power Cooperation under the Global Clean Energy Partnership

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**Abstract:** ***Electricity supply is the foundation of a country's livelihood and industry, and a key area for the country's economic and social development. The rapid economic growth of Vietnam requires matching power supply as a guarantee, and power supply shortage remains one of the urgent problems that Vietnam needs to solve. This provides an opportunity for China Vietnam to carry out green power cooperation. The power cooperation between China and Vietnam in the context of the global clean energy partnership has both historical foundations and practical considerations. The two countries have carried out effective cooperation in the field of green power. With the adjustment of Vietnam's energy laws and policies, the Vietnamese government has increased investment in power infrastructure construction and relaxed restrictions on foreign investment, providing institutional guarantees for promoting more Chinese direct investment in Vietnam's power sector. Chinese enterprises can focus on cooperation in green power fields such as hydro-power, geothermal power, wind power, and photovoltaic power. The cooperation methods can be expanded from power engineering contracting to power project investment, thereby strengthening green power cooperation with Vietnam in international competition and promoting Vietnam's low-carbon energy transformation.***

**Keywords:** China; Vietnam; Green Power Cooperation.

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## 1. Introduction

Vietnam is a close neighbor of China connected by land and sea, and is an important part of the cooperation between China and ASEAN. Due to the huge potential for the development of renewable energy (such as hydropower, wind power, solar energy, biomass energy, etc.), Vietnam has attracted the attention of many investors around the world. In recent years, under the promotion of the governments of China and Vietnam, green electricity cooperation has become one of the important contents of the docking of the "Belt and Road" and the "Two Corridors and One Circle," strengthening and developing the comprehensive strategic partnership between China and Vietnam. Green electricity mainly refers to electricity produced by renewable energy. In the process of producing electricity, its carbon dioxide emissions are zero or close to zero. Compared with electricity produced by other methods such as thermal power generation, it has a lower impact on the environment. Green electricity can not only reduce dependence on fossil energy, but also reduce greenhouse gas emissions.

At present, there are few systematic studies on the issue of green power cooperation between China and Vietnam in the Chinese academic community. They are scattered in the comprehensive cooperation research between the two sides in energy security, environmental protection and climate governance. The research results focusing on the independent topic of green power cooperation in the ASEAN region are also relatively limited. However, by sorting out and analyzing the overall green power cooperation process between China and ASEAN, we can deepen our understanding of China-Vietnam green power cooperation to a certain extent. The cooperation between China and other ASEAN countries in related fields can also serve as inspiration and reference for the development of China-Vietnam green power cooperation. Liu Jianwen and Liao Xin (2016) pointed out that based on the common energy security interests of China and ASEAN, the construction of the China-ASEAN energy security system should promote the construction of energy trade and energy interconnection between the two sides, form an energy

common market, and ultimately build an energy community of interests [1]. Li Xinlei, Sheng Xuemin and Li Yanwen (2023) focused on analyzing the basis of China-ASEAN clean energy interaction and cooperation from the perspective of "green connectivity," exploring the new trends in China-ASEAN clean energy cooperation in terms of policy mechanisms, economic industries, standards and norms, and technical management. They proposed that China can use its structural advantages as a world-leading clean energy producer and green investment country to flexibly avoid or even resolve various risks and challenges when carrying out "green connectivity" cooperation with ASEAN countries, and build a new regional clean energy governance order that is clean, beautiful, equal, inclusive, prosperous and stable [2]. Deng Xiujie (2022) reviewed the status of cooperation between China and Vietnam in hydropower, wind power, photovoltaics and biomass energy, and pointed out that there are opportunities for China-Vietnam clean energy cooperation, such as frequent high-level interactions, strong economic complementarity, multi-layered and diversified cooperation mechanisms, and a warming world economic situation. At the same time, there are also challenges such as insufficient funds, backward technology, imperfect legal system and fierce international competition. She also believes that China's rich experience in the development and utilization of renewable energy can help Southeast Asian countries eliminate energy poverty and achieve regional sustainable development [3]. Gu Baihe (2023) and other scholars analyzed the degree of clean energy cooperation between China and the Southeast Asian power sector by collecting and sorting out data such as the installed capacity of clean power invested by Chinese companies in Southeast Asia, and pointed out that China's investment in renewable energy power in Southeast Asia has shown a clear upward trend, especially the photovoltaic industry will become the focus of China's future investment. Thanks to Vietnam's policy support for renewable energy, China's clean power investment in Vietnam is significantly higher than that in other ASEAN countries [4]. Zhang Ruining and Li Hui (2022) believe that China-ASEAN energy cooperation should be strengthened from the aspects of energy enterprise competitiveness, infrastructure construction, information sharing and risk control platform, and green financial cooperation [5]. Mo Yalin (2024) and other scholars analyzed the basic conditions and risks and challenges of China-ASEAN clean energy cooperation and believed that the proposal of the "dual carbon" goal has brought historical opportunities for international clean energy cooperation, but the deep dependence of ASEAN countries on fossil energy, the uncertainty of the local political and social environment, and the differences in regional development and public perception have constrained the development of China-ASEAN clean energy cooperation [6].

International academics have studied the ASEAN region as a typical case of regional energy transformation. The results mainly focus on the clean energy development strategies, plans and goals of ASEAN and its member states, and analyze the potential of China-ASEAN clean energy cooperation. Anna Fünfgeld (2019) believes that regional cooperation is an effective means to enhance energy security. The overall plan for infrastructure connectivity in the ASEAN region has promoted cooperation in energy such as electricity. However, Southeast Asia, with its different national conditions, also faces challenges such as different needs and priorities of member states, strong dependence on external funding sources, and competing connectivity agendas [7]. Han Phoumin, Fukunari Kimura, and Jun Arima (2021) proposed through scenario analysis of energy modeling that ASEAN needs assistance from developed countries to support its deployment of clean coal technology, provide attractive financing loan programs, carry out international cooperation to accelerate the construction and investment of smart grid infrastructure, and strive for developed countries to share their experience in energy system integration [8]. Hon Chung Lau (2022) conducted a data analysis on energy consumption, energy structure and energy carbon emissions in the ASEAN region, pointing out that fossil energy will remain an important part of the ASEAN energy structure for a long time to come. ASEAN's rapid decarbonization requires not only increasing the share of renewable energy in power generation, but also strengthening coordination and cooperation among governments, such as establishing a regional CCS (carbon capture and storage) corridor [9]. Scholars such as Joao Aleluia (2022) also emphasized the key role played by governments and public policies in accelerating the clean energy transition in the ASEAN region [10]. Scholars such as Khairul Eahsun Fahim (2022) believe that Southeast Asia has excellent natural conditions and great potential for the development of clean energy. The decline in the cost of renewable energy technology provides ASEAN countries with great potential to increase the use of renewable energy. Increasing renewable energy production capacity can help economies affected by the COVID-19 pandemic. However, most ASEAN countries are heavily dependent on fossil energy. Coupled with weak infrastructure, there are many obstacles to the transformation of their energy structure [11]. Scholars such as Roman Vakulchuk (2022) believe that legislation, governance reform and business environment are three factors that affect ASEAN renewable energy investment. Except for Malaysia and Vietnam, other ASEAN countries have failed to effectively implement major renewable energy governance reforms [12].

Since green power cooperation has not been developed into an independent topic in academia for a long time, and the time span of China-Vietnam cooperation in the field of green power is relatively short, the research results

specifically targeting this new field are limited. Although existing research fails to provide an overall picture of China-Vietnam green power cooperation, single cooperation topics such as hydropower, photovoltaics, and wind power in renewable energy cooperation have received much attention from academia. Scholars from various countries have approached this topic from multiple angles, such as mechanism construction, industrial risks, and great power games. Their theoretical and contemporary academic achievements provide important reference value for the in-depth development of this topic. With the continuous improvement of Vietnam's comprehensive national strength in recent years, in the context of addressing climate change and promoting low-carbon development, it is not only timely but also promising for China and Vietnam to strengthen green power cooperation. This article intends to analyze the opportunities and challenges of cooperation on the basis of sorting out the current status of China-Vietnam green power cooperation, and explore the realistic path for China and Vietnam to deepen green power cooperation in the context of jointly building a global clean energy cooperation partnership between China and Vietnam.

## 2. Current Status of China-Vietnam Green Power Cooperation

Vietnam has good endowment conditions for renewable energy and great potential for the development of the green power industry. However, due to factors such as technical limitations, financing constraints and ineffective policies, the utilization of renewable energy in Vietnam is still in its early stages. In recent years, in order to meet the energy needs of economic and social development, driven by the government and foreign investment, Vietnam's green power market has entered a period of rapid development. The "Renewable Energy Data 2021" released by the International Renewable Energy Agency (IRENA) shows that Vietnam's total green power installed capacity in 2020 was 35.6 GW, accounting for one-third of Southeast Asia and ranking first in Southeast Asia: from 2011 to 2020, Vietnam's green power installed capacity grew by 14.7% annually, higher than the world average (8.4%) during the same period [13]. As a hot spot for green power industry investment, Vietnam has become one of the important target countries for Chinese companies. With the deepening of China-Vietnam cooperation under the "Belt and Road" initiative, more and more Chinese companies are investing in Vietnam's green power industry through equity investment, equipment exports, engineering general contracting (EPC) and investment in factory construction. At present, the cooperation between China and Vietnam in the field of green electricity has begun to take shape. In the fields of hydropower, wind power, solar power and biomass power generation, Chinese companies are becoming important partners in the development of renewable energy in Vietnam (see table 1 for details).

**Table 1:** Major China-Vietnam green power industry cooperation projects

| ***Category*** | ***Geographical distribution*** | ***Cooperation projects*** |
|---|---|---|
| Grid interconnection and clean electricity trade | Southwestern provinces of China and northern provinces of Vietnam | ·2004 Hekou-Lao Cai 110 kV interconnection transmission project<br>·2006 Shengou-Mong Cai 110 kV interconnection transmission project<br>·2006 Honghe-Lao Cai 220 kV interconnection transmission project |
| Water Energy | Concentrated in the northern mountainous areas, the Red River Basin and the Mekong River Basin | ·2003 Nam Mu Hydropower Station Project<br>·2008 Seo Chong Ho Hydropower Station Project<br>·2010 Song Bung 4 Hydropower Station Project<br>·2014 Trung Son Hydropower Station Project |
| Wind Energy | Central and southern Vietnam, coastal areas, and various islands | ·2015 Phu Lat Wind Power Project in Binh Thuan Province<br>·2016 Tay Nguyen Wind Power Project in Dak Lak Province<br>·2020 Bac Lieu Offshore Wind Power Project<br>·2021 Ca Mau offshore wind power project |
| Solar | Most of the country is rich in resources, with more concentrated areas in the south | ·2018 Youting Photovoltaic Power Generation Project<br>·2019 Da Mi floating photovoltaic project<br>·2020 Fuan Huahui Photovoltaic Power Generation Project<br>·2021 Fumei Photovoltaic Power Generation Project<br>·2022 Tianxin 3.1 photovoltaic project |

### 2.1 Hydropower Cooperation is the Earliest Green Power Cooperation Field Between China and Vietnam

Since the establishment of diplomatic relations between China and Vietnam in 1950, the two countries have started infrastructure cooperation related to hydropower facilities. However, due to the tension in Sino-Vietnamese relations in the 1970s, the cooperation on hydropower projects between the two countries was suspended. Since the beginning of the new century, Chinese companies have strong international competitive advantages in the construction of hydropower projects. Chinese companies have strong funds and leading technology. They first opened up the market in Vietnam by exporting equipment, gradually penetrated into the field of hydropower engineering contracting in Vietnam, and the scale of cooperation has continued to expand.

In February 2003, China Yunnan Machinery Equipment Import & Export Co., Ltd. signed a contract with Vietnam Song Da Company to build a hydropower station for Nam Mu provided power station equipment and supporting installation guidance services. This was the first power project that a Chinese company won in Vietnam through international bidding. The project completed all the construction works including design, manufacturing, installation and commissioning of power station equipment in just one year and one month. Chinese hydropower enterprises have vigorously expanded their overseas contracting business and gradually increased their share in the Vietnamese hydropower market. Among them, China Power Construction Group Co., Ltd. has been deeply involved in the Vietnamese hydropower market and won many power projects. In April 2014, the Songbang 4 Hydropower Station, which was constructed by China Hydropower No. 8 Bureau under China Power Construction Group, was completed and put into operation. This project has established a good brand image for China Power Construction Group in Vietnam. At the same time, China Power Construction Group also participated in the construction of the 2,400-megawatt Son La Hydropower Station and the 1,200-megawatt Lai Chau Hydropower Station, two of the three super-large hydropower stations on the Song Da River in Vietnam. In particular, the Son La Hydropower Station, which is Vietnam's largest and most advanced in technology, "provides electricity to the whole country, ensures social security, and prevents floods and stores water. It also solves the problem of domestic water for 20 million people in the north and the irrigation of hundreds of thousands of hectares of rice fields, and plays a positive role in poverty alleviation and the improvement of living standards in the three provinces of Son La, Lai Chau, and Mo Bien." [14] China-Vietnam hydropower cooperation is not limited to hydropower development in Vietnam, but has also expanded to the field of green power trade. In September 2004, the 110 kV interconnection project between Hekou, Yunnan, China and Lao Cai, Vietnam was successfully put into operation. It was China's first power transmission project to Vietnam, marking a breakthrough in the power cooperation between the two countries. Since 2005, China Guangxi Power Grid Co., Ltd. has transmitted electricity to Vietnam through the "110 kV Shengou-Mong Cai single-circuit line." "Currently, the China Southern Power Grid has three 220 kV lines that transmit electricity to seven provinces in northern Vietnam, namely Lao Cai, Ha Giang, Tuyen Quang, Phu Tho, Yen Bai, Son La and Thai Nguyen, with a maximum transmission capacity of 1.1 million kilowatts. Since the first 110 kV line was put into operation, the total electricity trade between China and Vietnam has reached approximately 36.7 billion kWh." [15] The electricity trade between China and Vietnam has not only effectively alleviated the power supply pressure in Vietnam's northern border provinces, but also helped to absorb the excess hydropower in China's southwest region.

### 2.2 Wind Power Generation is a Priority Area for China-Vietnam Green Power Cooperation

According to the 7th National Power Development Plan (PDP7) adjusted in 2016, Vietnam plans to increase wind power generation to about 800 MW by 2020, 2,000 MW by 2025, and 6,000 MW by 2030 [16]. However, as of June 2020, only 11 wind power projects have been completed and put into operation, with a total installed capacity of only 429 MW [17]. In terms of development potential, current scale and development goals, Vietnam's wind energy still has a lot of room for development and is the most attractive wind power market in Southeast Asia. China is a major wind power country in the world and has initially established a foothold in Vietnam's wind power market. In June 2015, Sinohydro Engineering Consulting Group Co., Ltd. won the Phu Lat Phase I wind power EPC project through international bidding. In November 2016, the project was completed and put into operation. The first-class equipment, advanced construction level and operation and maintenance management capabilities of the Phu Lat wind farm have won a good reputation for Chinese companies. Starting with the Phu Lat Phase I wind power EPC project, Chinese companies have continuously expanded their share in the Vietnamese wind power market. For example, among the many Chinese companies involved in Vietnam's wind power development, China Energy Engineering Group (CEEC) has implemented and promoted innovative financing models through the "headquarters+" model, "successively winning bids and signing contracts for 15 wind power projects, including the Cho Long 155 MW onshore wind power project, the Gia Lai 150 MW onshore wind power project, the Yang Trung 145 MW onshore wind power project, the Tai Phu 120 MW onshore wind power project, the Ninh Thuan 117 MW onshore wind power project, the Ca Mau 50 MW offshore wind power project, and the Soc Trang-2 30 MW offshore wind power project in Vietnam, with a total installed capacity of 1,350 MW and a contract value of nearly US$2 billion." [18] Chinese companies attach great importance to cooperation with multinational companies to achieve complementary advantages. In June 2019, China Energy Engineering Gezhouba International Company and South Korea's Landville Energy formed a consortium and successfully signed the EPC contract for the 117 MW Hambaram wind power project in Vietnam. The project is a successful example of cooperation between Chinese wind power companies and foreign multinational companies in a third country. At the same time, Chinese companies are also actively working together to develop the Vietnamese wind power market. In December 2020, China Energy Engineering Guangdong Institute, Shanxi Institute and Vietnam IPC Company formed a consortium and signed the Yang Trung 145 MW wind farm and Cho Long 155 MW wind farm

EPC general contracting contract with Vietnam T&T Group.

Vietnam is one of the important destinations for China's wind power equipment exports. After more than 30 years of efforts, Chinese wind turbines have achieved "Made in China" and are moving towards "Created in China." In September 2016, China Southern Power Grid International Corporation signed a memorandum of cooperation on the Tay Nguyen wind power project with its Vietnamese partners. "The project uses all Chinese wind power equipment, which is a cooperation example of Chinese wind power equipment, design, construction and capital going global." [19] However, due to the need to adopt Vietnamese standards or international standards, the export of Chinese wind turbines in Vietnam is subject to certain restrictions. As a potential important market for offshore wind power, Vietnam is the only country in Southeast Asia that can develop offshore wind power and has already operated it. Since the end of 2019, Chinese wind power companies have begun to get involved in Vietnam's offshore wind power projects, but are currently limited to engineering general contracting and offshore construction. In December 2019 and June 2020, China Energy Engineering Planning and Design Group formed a consortium with Shanxi Institute and Consulting Company respectively, and successively won the Xinshun 75MW offshore wind power EPC project and VPL 30MW offshore wind power EPC project. After winning the bids for the 141 MW Bac Lieu Phase III and 30 MW Soc Trang Phase I offshore wind power projects in January 2020, China Harbour Engineering Company won the 350 MW Ca Mau-1 offshore wind power project in October.

### 2.3 Photovoltaic Cooperation is the Most Promising Part of China-Vietnam Green Power Cooperation

In recent years, with the increase in grid-connected electricity prices, the introduction of supporting preferential policies, and the reduction of equipment and operating costs, Vietnam's photovoltaic market has flourished. At the same time, facing domestic overcapacity and trade barriers in Europe and the United States, Chinese photovoltaic companies have actively explored the Vietnamese photovoltaic market, and through the construction and operation of photovoltaic power stations, they have driven photovoltaic products such as components and inverters to "go global." China Power Construction has a relative advantage in the Vietnamese photovoltaic market. In July 2018, through international bidding, China Power Construction undertook the construction of Vietnam's Dau Tieng Phase I, II and III photovoltaic projects in the "EPC+F" cooperation model. "The project uses a Chinese general contractor, Chinese standards, Chinese equipment and Chinese funds. It was the largest photovoltaic project EPC contract signed by a Chinese company overseas at the time." [20] In September 2019, the project was completed and put into operation. After the signing of this project, China Power Construction successively signed 13 photovoltaic projects in the Vietnamese country market, with a total installed capacity of 1,500 megawatts, ranking first with a market share of nearly 40% [21]. At the Second Belt and Road Forum for International Cooperation Entrepreneur Conference, China Trina Solar and Vietnam Song Da Group 11 Joint Stock Company signed a cooperation agreement for the 42 MW Phong Phu photovoltaic power station project. Construction began in August 2018 and the project was connected to the grid in May 2019. With its stable and efficient power station performance and outstanding contributions to environmental protection and local employment, the project was selected by the Vietnam Chamber of Commerce and Industry (VCCI) as the "2020 Vietnam Outstanding Renewable Energy Project."

In addition to the general contracting of photovoltaic project engineering, capacity cooperation is also an important part of China-Vietnam photovoltaic cooperation. Since 2014, many leading Chinese photovoltaic companies such as Trina Solar, GCL and JA Solar have set up factories in the Van Trung Industrial Park in Bac Giang Province, Vietnam to produce photovoltaic modules and solar cells. As the production cost is lower than that in China, these OEM products are selling well in the European, American and Chinese markets. In early 2017, Trina Solar built the largest solar photovoltaic cell factory in Vietnam at that time, which not only enhanced Trina Solar's overseas supply capacity, but also improved Vietnam's position in the international photovoltaic market. At present, the photovoltaic industry is not only an important pillar industry in Vietnam, but also a new highlight of China-Vietnam capacity cooperation. Chinese photovoltaic companies have not only provided more employment opportunities for local people, but also brought various construction standards such as technology, environmental protection, and intellectual property rights to Vietnam.

## 3. Opportunities for China-Vietnam Green Power Cooperation

As economic and social development enters the fast lane, ensuring energy security has become a common issue facing China and Vietnam. In the context of addressing climate change and promoting low-carbon economic development, China's participation in Vietnam's renewable energy development is not only timely, but also promising.

### 3.1 Frequent High-Level Interactions are an Important Guarantee for China-Vietnam Green Power Cooperation

**Table 2:** Important government documents related to China-Vietnam green power cooperation

| ***Release time*** | ***documents*** | ***Main content*** |
|---|---|---|
| December 2000 | China-Vietnam Joint Statement on Comprehensive Cooperation in the New Century | Scientific and technological cooperation in the fields of meteorology, oceanography and environmental protection, information exchange and cooperation; jointly committed to the development and cooperation of the Mekong River Basin. |
| November 2015 | China-Vietnam Joint Statement | Connect the "Belt and Road" Initiative with the "Two Corridors and One Circle" concept, strengthen capacity cooperation in industries, electricity, renewable energy and other fields, and make good use of the Joint Committee mechanism for science and technology cooperation. |
| March 2016 | Joint Statement on Capacity Cooperation among Lancang-Mekong Countries | Expand capacity cooperation in engineering, building materials, machinery and equipment, electricity, renewable energy and other fields, build a sub-regional comprehensive industrial chain, and jointly respond to the economic challenges faced by member countries. |
| May 2017 | China-Vietnam Joint Communiqué | Promote cooperation in water resources, environment, science and technology, etc. Carry out cooperation on sustainable use of Lancang-Mekong water resources, and promote joint research, technology transfer and talent training. |
| November 2017 | China-Vietnam Electricity and Renewable Energy Cooperation | cooperation on environmental protection, climate change response, and water resources management and protection under bilateral and multilateral cooperation mechanisms such as the Lancang-Mekong Cooperation Mechanism. |
| December 2017 | Joint Press Communiqué of the Third Lancang-Mekong Cooperation Foreign Ministers' Meeting | Joint working groups in six priority areas, including connectivity, production capacity, cross-border economy, water resources, agriculture and poverty reduction, were established; the Water Resources Cooperation Center, the Lancang-Mekong Environmental Cooperation Center and the Global Mekong Research Center were established. |
| January 2018 | Five-Year Action Plan for Lancang-Mekong Water Resources Cooperation (2018-2022) & Lancang-Mekong Environmental Cooperation Strategy (2018-2022) | Promote water conservancy technology cooperation, carry out joint research and development and protection of water resources and climate change. Policy dialogue, carry out exchanges on application models such as green industrial parks, low-carbon and green communities; design and promote new energy vehicles. |
| December 2019 | Joint Statement of the Lancang-Mekong Water Resources Cooperation Ministerial Meeting | Personnel exchanges and technical exchanges on water resources development and utilization, cooperation on water conservancy capacity |
| February 2020 | Joint Press Communiqué of the Fifth Lancang-Mekong Cooperation Foreign Ministers' Meeting | Carry out cooperation plans on water resources, agriculture and environment, and formulate plans for production capacity, interconnection and cross-border economic cooperation |
| November 2021 | Joint Statement of the China-ASEAN Summit Commemorating the 30th Anniversary of the Establishment of Dialogue Relations | Strengthen cooperation in areas such as climate change, environmental protection, low-carbon solutions, clean energy, and sustainable cities, support the implementation of the China-ASEAN Environmental Cooperation Strategy and Framework for Action (2021-2025), and promote green, sustainable recovery and high-quality development in the region. |
| July 2022 | Joint Press Communiqué of the Seventh Lancang-Mekong Cooperation Foreign Ministers' Meeting | Water resources cooperation plays a fundamental role in climate resilience, energy security, ecological protection, sustainable economic development, and serving people's livelihood and well-being. |
| November 2022 | Joint Statement on Further Strengthening and Deepening the China-Vietnam Comprehensive Strategic Cooperative Partnership | Explore exchanges and cooperation in areas such as green development, climate change response, and digital economy, and create more growth points for China-Vietnam cooperation. |
| December 2023 | Joint Statement on Further Deepening and Enhancing the Comprehensive Strategic Cooperative Partnership and Building a Strategic Community of Shared Future between China and Vietnam & Memorandum of Understanding between China and Vietnam on Cooperation in Green Development, Climate Change and Environmental Protection | Encourage enterprises of the two countries to cooperate in green electricity and other infrastructure fields, and strengthen investment in energy green development and other fields. Participate in building a global clean energy partnership, and cooperate and exchange experiences in areas such as climate change and new energy vehicles. China welcomes Vietnam to participate in related activities of the Belt and Road International Green Development Alliance. |
| August 2024 | Joint Statement on Further Strengthening the Comprehensive Strategic Cooperative Partnership and Promoting the Building of a Community with a Shared Future between China and Vietnam | Encourage and support strong, reputable and technologically advanced enterprises to invest in each other's countries and strengthen cooperation in areas such as infrastructure, clean energy and green development. |
| October 2024 | China-Vietnam Joint Statement | Promote cooperation in clean energy, water resource management, flood and drought prevention, etc. |

**Source:** Ministry of Foreign Affairs of the People's Republic of China, https://www.mfa.gov.cn/web/gjhdq_676201/gj_676203/yz_676205/1206_677292/1207_677304/
**Note:** Between 2000 and 2015, China and Vietnam issued joint statements almost every year, but the content directly related to green power cooperation was relatively small.

Over the past 70 years since the establishment of diplomatic relations between China and Vietnam, the two countries have peacefully resolved the land border issue left over from history through negotiation and consultation, and have legally confirmed their good-neighborly friendly cooperative relationship and comprehensive strategic cooperative partnership. In recent years, "through bilateral visits, the dispatch of special envoys, hotlines, annual meetings and meetings on multilateral occasions, etc." [22] High-level contacts between the two parties and the two countries have been frequent, and political mutual trust has been continuously strengthened. (See Table 2 for details) In November 2015, President Xi Jinping paid a state visit to Vietnam. China and Vietnam issued a joint statement to promote the docking of the "Belt and Road" and the "Two Corridors and One Circle" and strengthen capacity cooperation in the fields of electricity and renewable energy. Two years later, President Xi Jinping visited Vietnam again. The two countries signed a series of intergovernmental cooperation agreements involving green electricity, including the "Memorandum of Understanding on Cooperation in Electricity and Renewable Energy," the "Memorandum of Understanding on the List of China-Vietnam Capacity Cooperation Projects in 2017" and the "Memorandum of Understanding on the Exchange of Banking Regulatory Information." These agreements have become the legal basis and important pillars for the two countries to carry out green power cooperation. With the strong support of the two governments, the number of green electricity cooperation projects between the two countries has continued to increase, and the scope of cooperation has also expanded from traditional hydropower cooperation to other areas of renewable energy.

### 3.2 The Differences in Economic Conditions between China and Vietnam Provide Opportunities for Green Power Cooperation between the Two Countries

According to the factor endowment theory (H-0 theory), the relative differences in factor endowments between countries and the differences in the intensity of using these factors when producing various commodities are the basis of international trade. China is in the middle and late stages of industrialization development, with sufficient capital reserves, advanced technical equipment and good management experience. Vietnam is in the early stages of industrialization development, with rich natural resources, low labor costs and many preferential policies. At present, the prospects for trade and investment between China and Vietnam are optimistic, and economic and trade cooperation is deepening. China is Vietnam's largest trading partner, and Vietnam is China's largest trading partner in ASEAN. Green power cooperation is an important part of the close economic and trade relations between China and Vietnam. China's renewable energy development and utilization scale ranks first in the world. Its sufficient funds, advanced technology and rich experience are very consistent with Vietnam's needs, and it has become an important partner in Vietnam's renewable energy development. According to the China-Vietnam Five-Year Development Plan for Economic and Trade Cooperation (2012-2016) and the Five-Year Development Plan for Economic and Trade Cooperation (2017-2021), the two countries will strengthen mutually beneficial cooperation in energy and other fields, and include green power in the list of key cooperation projects. The implementation of these green power projects has become a new growth point in the economic and trade relations between the two countries, and has improved the quality and level of bilateral economic and trade cooperation.

### 3.3 The Cooperation Mechanisms at Different Levels Established and Participated by the Two Countries Provide an Important Platform for China-Vietnam Green Power Cooperation.

China and Vietnam are both important energy consumers. With the changes in the international energy situation and pattern, it has become a consensus for China and Vietnam to solve the energy security dilemma and accelerate the low-carbon transformation of energy through bilateral cooperation or multilateral cooperation mechanisms. (See Table 3 for details) At present, China and Vietnam have established many cooperation mechanisms and dialogue platforms such as the Bilateral Cooperation Steering Committee, the Infrastructure Cooperation Working Group, the Financial and Monetary Cooperation Working Group, the Maritime Joint Development Consultation Working Group, and the China-Vietnam Economic and Trade Cooperation Committee. At the same time, China and Vietnam are also carrying out international energy cooperation at different levels in the Greater Mekong Subregion (CMS), the Association of Southeast Asian Nations (ASEAN) and the Asia-Pacific Economic Cooperation (APEC). In order to implement the consensus of the leaders of the two countries in a timely and effective manner, the relevant departments of China and Vietnam have actively carried out docking, negotiated specific work through mechanisms or platforms, and promoted the implementation of a batch of practical cooperation results. With the implementation of the Regional Comprehensive Economic Partnership Agreement

(RCEP), China and Vietnam face more opportunities in deepening green power investment cooperation, capacity and technology exports, and opening up third-party markets.

**Table 3:** The multi-layered green power cooperation network

| | | *Intergovernmental cooperation* | *Cooperation between government and private sectors* | *Cooperation between NGOs and enterprises* |
|---|---|---|---|---|
| ***Bilateral cooperation*** | | ·China-Vietnam Joint Committee on Science and Technology Cooperation<br>·China-Vietnam Infrastructure Cooperation Working Group<br>·China-Vietnam Economic and Trade Cooperation Committee<br>·China-Vietnam SASAC Ministerial Dialogue | ·China-Vietnam State-owned Enterprise Energy Symposium<br>·China-Vietnam New Energy Summit<br>·China-Vietnam Economic and Trade Cooperation Forum | ·China-Vietnam Energy and Engineering Machinery Enterprises Symposium<br>·Vietnam Power Green Transformation Forum<br>·China- Vietnam Eco-Friendly Cities Partnership<br>·China-Vietnam Business Forum |
| ***Multilateral cooperation*** | ***Asia-Pacific cooperate*** | ·Lancang -Mekong Water Resources Cooperation Ministerial Meeting<br>·International Alliance for Green Development along the Belt and Road<br>·China - ASEAN Clean Energy Capacity Building Plan<br>·ASEAN "10+3" Clean Energy Policy Roundtable Dialogue<br>·East Asia Summit (EAS) Clean Energy Forum<br>·APEC Energy Ministers' Meeting<br>·APEC Sustainable Energy Centre (APSEC) | ·China-ASEAN Environmental Cooperation Forum<br>·Green Lancang-Mekong Initiative Roundtable Dialogue<br>·Asian Development Bank<br>·Asian Clean Energy Forum<br>·Asia- Pacific Clean Development and Climate Partnership | ·China-ASEAN Climate Adaptation Community Knowledge Network Cooperation Initiative<br>·China -ASEAN Power Cooperation and Development Forum<br>·Clean Air Asia<br>·Clean Air Initiative Asia (CAI Asia) |
| | ***Global level cooperate*** | ·the United Nations Framework Convention on Climate Change (COP)<br>·Clean Energy Ministerial ( CEM)<br>·Mission Innovation (MI)<br>·International Renewable Energy Agency (IRENA)<br>·Global Clean Energy Partnership | ·International Conference on Environment and Renewable Energy ( ICERE)<br>·Renewable Energy Policy Network for the 21st Century (REN21)<br>·Renewable Energy and Energy Efficiency Partnership (REEEP) | ·International Council for Local Initiatives for Sustainable Development (ICLEI)<br>·C40 Cities Group<br>·RE100 Initiative<br>·Global Alliance for Sustainable Energy (GASE) |

### 3.4 It Provides an Opportunity for the World Economic Recovery and International Energy Low-Carbon Transformation in the Post-Epidemic Era

Under the influence of the COVID-19 epidemic, global electricity demand has seen the largest annual decline since the mid-20th century. Due to rapid action and proper control, the epidemic has little impact on China-Vietnam electricity demand in the short term. In the post-epidemic era, in order to promote low-carbon energy transformation and stimulate green economic recovery, Vietnam has vigorously developed green electricity to meet the rapidly growing electricity demand, and is becoming one of the most active and attractive green electricity markets in Southeast Asia. In February 2021, in accordance with the "Vietnam National Energy Development Strategy to 2030 and Towards 2045" and the updated national independent contribution targets, the Ministry of Industry and Trade of Vietnam (MOIT) announced the 8th National Power Development Plan Draft (PDP8), planning to reduce the proportion of coal-fired power installed capacity from 34% in 2020 to 27% in 2030, and then to 17-18% in 2045. [23] In November, Vietnam attended the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change and signed the Global Declaration on the Transition from Coal to Clean Electricity, pledging to stop approving and building new coal-fired power plants, completely withdraw from coal-fired power generation in the next decade, and strive to achieve a net zero emission target by 2050. Vietnam's energy transition commitment and emission reduction targets (see Table 4 for details) provide a window of opportunity for expanding renewable energy development and also provide broad space for Chinese companies to participate in its renewable energy development.

**Table 4:** Official Energy Targets and Policies of Vietnam

| *Sector* | *Official Target* |
|---|---|
| Demand | • By 2025, reduce energy intensity in TFEC by 5%-7% and keep power losses under 6.5%<br>• By 2030, reduce energy intensity in TFEC by 8%-10%, keep power losses under 6%, and reduce fuel and oil consumption by 5% in transportation<br>• Energy saving to 10% in 2030 and 20% by 2050 |
| Supply | • The proportion of RE in the TPES will be 15%-20% by 2030<br>• Green hydrogen production will reach between 100,000 and 200,000 tonnes annually by 2030<br>• Renewables are to account for about 30.9-39.2% of Vietnam's electricity supply by 2030<br>• By 2030, electricity exports should be scaled-up to about 5,000 to 10,000 MW |

| | |
|---|---|
| | • Increase the absorption area of solar hot water rigs in commercial, service, civil, and industrial production, providing about 3.1 Mtoe by 2030<br>• Total RE sources for heat production and co-generation of thermal power in 2030 will be about 8 to 9 Mtoe<br>• Biogas is expected to be about 60 million m3 by 2030 |

**Source:** ACE (2024). 8th ASEAN Energy Outlook (AEO8). ASEAN Center for Energy (ACE), Jakarta. Available for download from https://aseanenergy.org/.

## 4. Challenges of China-Vietnam Green Power Cooperation

Although Vietnam is rich in renewable energy and has a policy of prioritizing the development of green electricity, due to subjective and objective reasons, there are relatively few green power projects in which Chinese companies and financial institutions participate in investment. China-Vietnam green power cooperation still faces some urgent issues that need to be addressed.

### 4.1 Green Power Investment Faces Financial, Technical and Legal Barriers

Although green power technology continues to improve and the installed capacity cost is competitive, most green power projects are still unable to compete with fossil energy power generation projects. To encourage the development of green power, Vietnam has formulated a number of incentive policies, but they have not yet met investors' expectations. For example, Vietnam's current onshore and offshore wind power prices are 8.5 cents/kWh and 9.8 cents/kWh respectively, and the photovoltaic power price is 9.35 cents/kWh. [24] The low on-grid electricity price cannot reflect the actual production cost, resulting in low returns for investors. In addition, the complex administrative approval procedures for projects, low support from local governments, land acquisition compensation and resettlement for projects, and imperfect power transmission and distribution systems have also become obstacles to the development of renewable energy in Vietnam.

Shortage of funds and backward technology are the dual bottlenecks for the development of green power in Vietnam. In terms of funds, Vietnam lacks sufficient funds and suitable financing channels. “At present, various Vietnamese banks have begun to gradually increase the proportion of green credit used to develop renewable energy, but the effect has not yet met expectations.” [25] At the same time, most of Vietnam’s renewable energy power station projects rely on loans from the World Bank or foreign countries. Due to its limited international borrowing capacity, it faces serious financing difficulties. In terms of technology, Vietnam lacks human resources with relevant knowledge and skills in green electricity. Although Vietnam has abundant labor and low cost, most people have not received higher education and their education level needs to be further improved. In recent years, Vietnam has participated in the Renewable Energy Development Project (REDP) funded by the World Bank and the Swiss Federal Office of Economic Affairs (SECO), and has cooperated with countries such as Japan, Russia, the United States, and international organizations to carry out capacity building and talent exchange activities, which has effectively improved the quality of green power industry practitioners, but it still cannot meet the needs of large-scale renewable energy development.

Vietnam’s green power laws and regulations are not sound, and the stability and continuity of green power policies are poor. Although Vietnam has issued a large number of green power policies, there is currently no special green power law to comprehensively regulate the development of the industry. Affected by this, Vietnam’s green power industry policies are uncertain. Taking solar energy as an example, in April 2017, Vietnam launched the FiT policy, setting a 20-year electricity price of 9.35 cents per kilowatt-hour for photovoltaic projects (including utility solar energy and ground solar energy) operating before June 30, 2019. [26] This policy triggered a spurt in the growth of Vietnam’s solar energy market. According to the RENEWABLES 2021 GLOBAL STATUS REPORT released by the 21st Century Renewable Energy Policy Network, Vietnam’s new solar energy installed capacity in 2020 was 11.1 GW, second only to China and the United States, and the total installed capacity ranked eighth in the world. [27] The development of solar energy far exceeded expectations, which not only brought a heavy burden to the power system, but also brought unpredictability and risks to the future development of solar energy. In April 2020, Vietnam passed Prime Minister’s Resolution No. 13, lowering the on-grid electricity price for photovoltaic power. The electricity price for rooftop solar projects was US$83.8/MWh, the electricity price for ground-mounted solar projects was US$70.9/MWh, and the electricity price for floating solar projects was US$76.9/MWh. [28] This has led to a decline in investors’ enthusiasm for photovoltaic power.

### 4.2 Vietnam Has Limited Land resources for Power Facility Construction and Grid Construction is Lagging Behind

Vietnam has serious problems such as grid overload and power abandonment, which seriously restrict the development of green electricity. The development of abundant renewable energy provides an important way for Vietnam to solve the power shortage. However, due to geographical conditions, Vietnam's grid infrastructure has large differences between the north and the south, and the power resources and grid are not synchronized in time and space, and the dispatch capacity is limited, which hinders the increase of green electricity capacity. [29] Vietnam's renewable energy is widely distributed but unevenly distributed. Power generation is concentrated in the north, and renewable energy is mainly hydropower, but electricity consumption is mainly in the south, and renewable energy is mainly solar and wind power. Due to the weak and underdeveloped power grid, the north has to import electricity from China and Laos during the dry season, and the south is unable to cope with the randomness, intermittency and volatility of solar and wind energy, and has been in a state of power shortage for a long time. According to the IEA's classification of the four stages of variable renewable energy (VRE) integration, [30] Vietnam's renewable energy (excluding hydropower) currently accounts for between 3% and 15%. The fluctuation range of variable renewable energy power supply has exceeded the fluctuation of power demand itself, which has a significant impact on power operation. As renewable energy development enters the fast lane, Vietnam's power system is increasingly overwhelmed. For example, since the implementation of the photovoltaic grid subsidy policy in 2017, Vietnam's solar power generation projects have exploded and have been connected to the grid in a short period of time. "However, due to the lack of follow-up on grid construction, in Ninh Thuan and Binh Thuan provinces, where photovoltaic projects are most concentrated, the installed capacity of electricity has reached more than twice the grid capacity, and the problems of photovoltaic power generation and grid system security are very prominent." [31]

The lag in Vietnam's grid construction is also inseparable from the government's long-term tendency to "focus on power generation development and neglect grid construction." Generally speaking, the time for investment and construction of power grids is longer than that of renewable energy projects, and they need to be arranged in advance. However, according to the draft of PDP8, Vietnam plans to "invest a total of US$128.3 billion from 2021 to 2030, of which US$95.4 billion will be for power sources (generation facilities) and US$32.9 billion for grids (transmission and storage facilities). The average investment capital structure of power sources and grids is 74/26." [32] Compared with power generation construction, Vietnam's investment in the transmission and distribution grid is relatively small and its development is slow, and the proportion of the two is unbalanced. The delay in grid construction will hinder the absorption and further development of renewable energy. In addition, the land area available for green power project construction is limited. In particular, wind power and photovoltaic power generation have high requirements for land area and terrain conditions. Vietnam is currently experiencing a shortage of land for green power project construction (see Figure 1 for details). This is not conducive to the future expansion and development of the green power industry. Land expropriation requires the coordinated relocation and financial compensation of indigenous peoples. Improper handling will also bring many social problems and risks. [33]

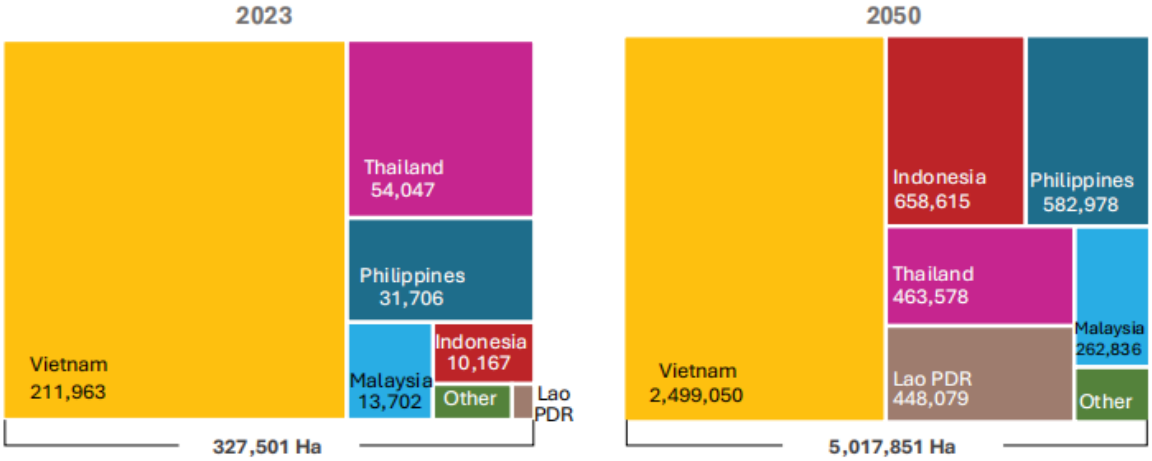


**Figure 1:** Land Used for Wind and Solar Projects by ASEAN Countries in 2023 and 2050, RAS

### 4.3 China's Green Power Cooperation with Vietnam Faces Fierce Competition from Other Countries

Vietnam's important strategic location and abundant renewable energy attract the attention of major powers. Energy issues are often intertwined with geopolitics and competition among major powers. Vietnam is the frontier

barrier of the Indochina Peninsula and controls the main sea routes of the Pacific and Indian Oceans. Its strategic position is very important. Based on both geopolitical and resource considerations, major powers outside the region have intervened in the South China Sea dispute, bringing uncertainty to China-Vietnam green power cooperation. On the other hand, they have encouraged their own companies to participate in Vietnam's energy development and market competition, affecting the development of Vietnam and even the region. Due to its huge potential for renewable energy development, Vietnam attracts global investors and has a significant advantage in the ASEAN region (see Figure 2 for details). [34]

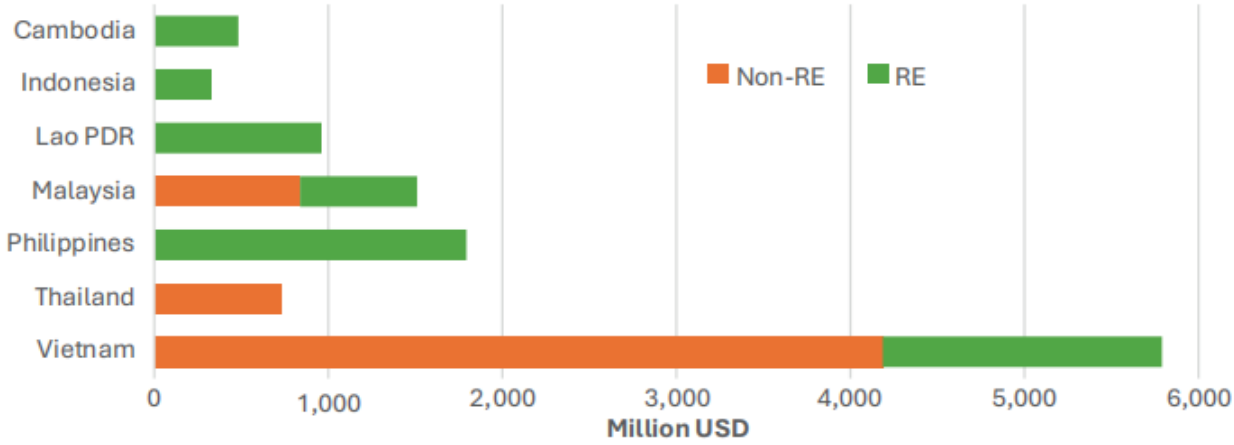


**Figure 2:** Cumulative Investment in Energy Infrastructure by Country and Technology Type

In recent years, companies from Europe, the United States, Japan, South Korea and Singapore have invested heavily in Vietnam's green power sector. Take wind power as an example. Singapore's Janakuasa and Vietnam's Ecotech jointly invested in the Hiep Thanh wind farm, South Korea's UnisoneTech and Vietnam's Asia Energy Petroleum jointly invested in the development of the first phase of the Duyen Hai wind farm, Siemens Gamesa Renewable Energy (SCRE) contracted to install and commission a 39-megawatt wind turbine in Ninh Thuan Province, and a consortium of British renewable energy companies invested in Southeast Asia's largest offshore wind power station in the KeGa waters of Vietnam. European and American countries started early in the development of wind power energy, mastered core technologies and key components, and accumulated rich experience in development concepts, legal environment, policy measures, grid connection management and economic benefits. As a new force in the global wind power industry, Chinese wind power companies have not invested overseas for a long time, lack international business experience, and have relatively weak capital, technology, experience and management levels, which are still a certain distance away from Europe and the United States. Chinese financial institutions have little understanding of the current situation, potential and risks of Vietnam's power development and lack experience, and are unable to provide financial support for Chinese companies' investment in Vietnam, making them lose the first opportunity in the competition for investment in Vietnam.

## 5. Path to Deepening China-Vietnam Green Power Cooperation

China is one of the leaders in the world's energy transformation. Through international cooperation in green electricity, it has promoted the development and utilization of renewable energy in Vietnam, accelerated Vietnam's energy low-carbon transformation and economic green recovery, and added new highlights to the China-Vietnam comprehensive strategic partnership. In the context of participating in the construction of a global clean energy partnership, the prospects for China-Vietnam green electricity cooperation are optimistic and promising. In view of the opportunities and challenges faced by Chinese companies in participating in the development and utilization of renewable energy in Vietnam, the deepening of China-Vietnam green electricity cooperation in the future can be carried out in the following three aspects.

### 5.1 Continue to Promote the Docking of the "Belt and Road" and the "Two Corridors and One Circle"

Under the "Belt and Road" initiative, China and Vietnam have signed a series of green power cooperation documents, but lack macro guidance and long-term planning. The specific content of the cooperation needs to be further clarified, and efforts need to be made to transform specific green power cooperation projects into important content of docking. In order to promote sustainable development and achieve green growth, the high-level

governments of China and Vietnam should improve the dialogue mechanism, expand communication channels, optimize the bilateral investment and financing environment, and continue to "escort" corporate energy investment. The competent departments of green power should focus on the future and strive to build a multi-level capacity building, talent training and exchange dialogue mechanism, summarize China's green development experience and local investment experience and lessons, and promote the docking of renewable energy technology standards, joint research and development, technical exchanges, capacity building and information sharing between countries. The financing capacity of enterprises plays an important role in undertaking power engineering projects in Vietnam. Chinese financial institutions, especially policy financial institutions and multilateral development financial institutions, should formulate and publicize detailed industry investment policies and risk management strategies based on Vietnam's green power investment environment and laws and regulations, and on the basis of drawing on the advanced experience of international banks, and develop investment tool combinations to provide important decision-making basis, precise financial services and sufficient credit support for Chinese companies' investment in Vietnam.

### 5.2 Grasp the Development Trend of Vietnam's Green Power Policy and Actively Adjust the Direction of Green Power Investment

Chinese enterprises should do a good job in preliminary research on Vietnam's green power industry laws and regulations, development status and future trends, foreign investment policies and national energy development goals, and verify the economic feasibility of investment in Vietnam and the corresponding operation and management model through small green power demonstration projects, so as to ensure the expected returns of overseas investment and minimize the risk. According to the "Orientation of Vietnam's National Energy Development Strategy by 2030 to 2045," Vietnam will "give priority to the use of wind and solar power generation," "encourage investment in waste power plants that use urban garbage, biomass and solid waste while protecting the environment and developing a circular economy," "establish an intelligent and efficient power grid system that can connect various regions to ensure power supply security," Chinese enterprises should promote the expansion of wind and biomass energy cooperation on the basis of consolidating and developing existing hydropower and photovoltaic cooperation, and focus on strengthening power infrastructure cooperation to solve the problems brought about by intermittent power generation and explosive growth of renewable energy. In order to improve the quality and effectiveness of foreign investment cooperation, Vietnam promulgated Resolution No. 50/NO/TW in September 2019, stipulating that "the strategic priority for attracting foreign investment in the future will mainly be projects with high technology, green technology, modern management, high added value, strong driving force, and important role in building value chains and global supply chains." According to the new changes in Vietnam's foreign investment policy, Chinese companies will establish industrial chain supply chains through technology transfer and knowledge sharing on the basis of mutual benefit and win-win results in the future, so as to promote the green power cooperation between the two countries to produce a significant premium effect.

### 5.3 Combine International Development with Localized Operations to Enhance the International Competitiveness of Chinese Enterprises

In recent years, with the concerted efforts of the government and enterprises, China-Vietnam green power cooperation has achieved initial results. However, facing fierce competition from Europe, the United States, Japan, South Korea and other countries, Chinese enterprises with a single investment method and fewer investment projects are obviously at a disadvantage. Therefore, on the basis of consolidating the existing cooperation results, Chinese enterprises should combine their own investment strategies with the actual situation in Vietnam, combine international development with localized operations, and adjust and improve their renewable energy investment portfolio in Vietnam. On the one hand, domestic design units, equipment manufacturers and construction units with strength and experience are encouraged to form a consortium to jointly participate in market development, focus on engineering general contracting, rely on core technology and management advantages, and accelerate the "going out" of technology, brands and standards. At the same time, take the initiative to carry out third-party cooperation with large multinational companies in Vietnam, learn and draw on their experience in renewable energy development, hire overseas international talents at high salaries, and strive to improve project management capabilities and industry resource integration capabilities. On the other hand, in response to the risks of overseas investment projects, explore and practice the new model of "localized management + localized operation," gradually increase the proportion of local employees in Vietnam, and strive to give full play to the important role of local teams in project bidding, power station operations and crisis response. In addition, we will properly handle and resolve the issue of interest distribution, strive to seek the understanding and support of local governments, partners, employees and other relevant parties, and build and form a reasonable and open interest sharing and

coordination mechanism for renewable energy development.

## 6. Conclusions

Power supply security, sustainable development and affordability of green electricity are three mutually balancing and mutually reinforcing factors that Vietnam needs to consider when developing the green power industry and planning greenfield investment at present and in the future. Promoting the investment and construction of power facilities such as renewable energy power stations and power grids has become a crucial link in the clean energy structure of Vietnam's power and is also the only way to achieve Vietnam's energy transformation goals. Specifically, by adjusting energy policies and revising relevant laws, the scope of opening up in the power and energy sector has been continuously expanded, such as opening up the field of transmission and distribution network investment and construction to foreign capital; the degree of opening up has been continuously deepened, such as reducing the requirements for the localization ratio of equipment procurement for photovoltaic power generation projects; and taking tax incentives, such as the government providing tax exemption periods, tax deductions and tariff concessions for the import of production machinery and raw materials by the manufacturing industry. This series of measures to attract foreign investment into the green power industry also provides a more friendly business environment for the development of Chinese companies in Vietnam's green power industry. Overall, under the background of strategic fit between China and Vietnam in green power cooperation, continuous improvement of cooperation mechanisms, and continuous improvement of overseas investment and construction capabilities of Chinese power companies, the prospects for deeper green power cooperation between the two countries are promising.

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