# Comparison And Analysis of The Photovoltaic Industry Between China and the US

Yuzhe Han *, Yuting Teng and Zilin Xiao

Shenghua Zizhu Academy, Shanghai, 200241, China

* Corresponding Author Email: 1912100315@mail.sit.edu.cn

**Abstract.** Nowadays, the world is increasingly recognizing the limitations of non-renewable energy resources such as oil and fossil fuels. The continued reliance on these finite resources poses a significant risk of energy shortage in the future. As a result, there is a growing emphasis on promoting renewable energy sources like wind energy, solar energy, and other non-polluting alternatives. In this article, the focus is on the development of the photovoltaic (PV) industry in China and the United States, with a specific emphasis on photovoltaic energy. The aim of this study is to analyze and compare the current state of the PV industry in both countries, taking into account various factors such as PV power generation, installed PV capacity, and policy support. By conducting a comprehensive assessment of these aspects, the research findings reveal that the PV industry in China has experienced remarkable growth and has surpassed the United States in terms of competitiveness. China has emerged as a global leader in the PV industry, with significant advancements in technology and manufacturing capabilities. The country's PV power generation has witnessed substantial expansion, contributing significantly to its renewable energy targets. Moreover, China's installed PV capacity has experienced rapid growth, supported by favorable government policies and incentives that have stimulated investment and innovation in the sector. In contrast, the United States, while still a prominent player in the PV industry, has faced certain challenges in keeping pace with China's progress.

**Keywords:** Photovoltaic industry; cooperation; policy.

## 1. Introduction

As a green renewable energy, solar energy is vital to human survival and social development, so in recent years, Countries are actively pushing the adhibition of renewable energy, The photovoltaic industry is progressing very rapidly. Photovoltaics (Photovoltaics; The abbreviation of "photo" light, "voltaics" volt) is a solar photovoltaic system, which uses semiconducting material to convert solar energy into direct current electricity facilities. At the heart of the photovoltaic facility are solar panels. By comparing the two countries with the largest photovoltaic production capacity, China and the United States, Industry development history, policies, frictions, etc., this paper hopes to guide the point of view that although China has become the leader of the photovoltaic industry, it still needs to learn from the strengths of the United States and other countries in technology and laws and regulations, through mutually beneficial cooperation. Further push the better development of the photovoltaic industry, which is beneficial to all mankind. This paper summarizes the views of this paper by consulting more domestic and foreign professional institutions and insiders and citing industry data through qualitative and quantitative methods. This paper explores for the first time the opportunities brought by the Chinese government's policy promotion for the future Chinese photovoltaic industry. However, due to space constraints and future market expectations are not the main arguments of this paper, it is not reviewed. The main issues discussed in this paper are: The comparison of photovoltaic industry between China and the United States; Competitiveness comparison; Policy comparison; Sino-US trade friction; Challenges facing China's photovoltaic industry. This paper first introduces the development background of the photovoltaic industry, explains the importance and necessity of the development of the photovoltaic industry for human society, and then enumerates the comparison of power generation cost, installed capacity and power generation between China and the United States in the photovoltaic industry, and concludes that China's current photovoltaic output has been significantly ahead of the United States, resulting in

trade friction between the two sides. The fifth chapter also explains that although China's photovoltaic production capacity is leading, the fact is that there are still many defects and deficiencies. The vigorous development of China's photovoltaic production capacity cannot be separated from government policy support, but the standardized development of the photovoltaic industry still needs to further establish and improve laws and regulations.

## 2. Background and Industry Comparison

Nowadays, energy is an important factor for the survival of human beings. It is not only the basis for industrial and economic development, but also one of the necessities in human daily life. The development, utilization and sustainable development of energy are crucial to human survival and social development. Fossil fuels, natural gas and coal, as one of the important energy resources for human beings, have a limited number of reserves on the earth, indicating that these non-renewable energy resources will be exhausted in the future. In China, oil production has been heavily exploited to the point that it is difficult to continue to produce large quantities. Its per capita natural gas holdings are also well below the world average. Coal production is expected to be mined only until 2050. Therefore, many countries will face energy shortages in the future if they continue to rely on non-renewable energy sources as their main energy supply. So, the development of green and renewable energy is an important factor in maintaining energy supply. The vigorous development of renewable energy can not only effectively solve the problem of energy shortage faced in the future, but also reduce the pollution damage to the environment. [1] Solar energy as one of the renewable energy sources has been vigorously developed. The principle of photovoltaic power generation is to utilize the photoelectric conversion principle to turn solar radiation into electricity. Pollution-free and renewable are the main advantages of photovoltaic power generation. But at the same time, it also has the disadvantages of large footprint and unstable energy supply. However, in today's situation of increasing greenhouse effect, the PV industry and other non-polluting and renewable energy sources are highly popularized, and governments have enacted a lot of policies to support the development of this industry. For example, the Interim Measures for the Administration of Financial Subsidies for the Application of Solar Photovoltaic Buildings and the Golden Sun Demonstration Project promulgated by China in 2009 not only encouraged the development of the PV industry, but also subsidized it on an economic level, reducing development costs. In 2009, in order to promote the development and utilization of renewable energy, increase energy supply, and protect the environment, China issued the Renewable Energy Law, which contains a series of development strategies, application promotion, and economic subsidies to promote the development of energy, etc. In 1978, the United States also issued the "Public Utility Regulatory Policy Act of 1978", which not only encourages the development of PV industry, but also subsidizes the development cost from the economic level. Policy Act of 1978", providing tax credits and other preferential policies to give the development of renewable energy economic level of support, while the number of investments to improve also stimulate the establishment of module factories. The "Energy Policy Act 2005 (ITC)" issued by the United States in 2005 is considered to be one of the most important policies to effectively promote the development of the PV industry. It not only provides a 30% tax credit, but also grants a tax benefit of nearly 26%, which saves about 56% of the system cost. the Solar America Initiative (SAI) issued in 2007 funds up 13.7 million for the projects to stimulate the development of PV technology [2].

### 2.1. Industrial Comparison

In terms of research efforts and development level, it can be seen through the average PV module price between China and the US. Overall, PV module prices in both China and the U.S. have decreased due to advances in PV technology and the expansion of PV production capacity. Until 2010, U.S. PV module prices were lower than in many countries. In contrast, even though China's PV industry had a large production scale, the average price module remained higher than that of the

United States because of the lower capital investment in PV R&D in China prior to that time. However, after 2010, with the favorable tax policy, Chinese manufacturers increased investment in large quantities, making PV module prices fall rapidly, reflecting the rapid development of China as a developing country in the field of PV technology. In terms of productivity, before 2012, the U.S. combined level was much higher than that of China. In 2013, China's installed photovoltaic capacity gradually surpassed that of the United States, and since the "18th National Congress", China's installed solar energy capacity and installed photovoltaic capacity have far exceeded that of the United States. For PV power generation, China also caught up with the United States in 2014. In 2012, China's installed photovoltaic capacity was 3628MW, much lower than the United States' 8137MW. With China's rapid development, since 2013 China's installed photovoltaic capacity has surpassed the United States, reaching 16,188MW, which is 4,429MW higher than the United States. in 2015, China's installed photovoltaic capacity increased to 42,988MW, which is nearly double the United States installed photovoltaic capacity of 21,684MW. 21684MW. Meanwhile, in terms of photovoltaic power generation, in 2012, China was only about 4,391GWh, which is also much lower than the United States rich 9,186GWh.China's photovoltaic power generation data exceeded that of the United States in 2014, which was 23,751 GWh, while the United States was 21,915 GWh.After that, it has been maintaining a rapid increase in the state of affairs, and in 2015, it reached 38,978GWh, which is also higher than the United States' 32,091GWh [3]. The export competitiveness of the Chinese and U.S. photovoltaic industries can be seen by analyzing the product market holdings of the Chinese and U.S. photovoltaic industries. Between 2006 and 2010, the international market holdings of Chinese PV products continued to increase, from approximately 12.08% international market holdings in 2006 to 44.46% in 2010. After reaching 27.16% in 2008, China's international market share in 2008, 2009, and 2010 was the world's highest. In contrast, the U.S. figure is not only much lower than that of China, but also shows a decreasing trend from year to year, from 7.98% in 2006 to 5.74% in 2010 [4]. Through the above series of analysis, it can be seen that China's PV industry is more competitive compared to the United States.

### 2.2. Competitiveness Comparison

Both China and the U.S. are developing quickly in PV industry, but China is now significantly ahead of the United States in this area. This is primarily because China's industrial competitiveness has improved dramatically over the past decade, and the government was very supportive during this period, making China's PV industry a world leader. First, the cost of PV in China is lower than in the U.S. and is still decreasing in recent years. China's residential levelized cost of electricity was about $0.162 per kWh in 2012, and it will be only about $0.06 per kWh in 2020, and the difference between the commercial levelized cost of electricity and the residential one is slight (the data comes from the research center of Anxin Securities). In 2018, China's PV A-weighted levelized cost was $0.08 per kWh, already $0.03 lower than that of the United States. China's investment cost was $1,058 per kilowatt, compared to $1,869 per kilowatt in the United States. [5] The low cost of PV in China is due to a number of factors. For example, the Chinese government has been a strong supporter of the PV industry and has introduced many policies to subsidize this industry, which has resulted in lower costs. Also, China's PV industry is very large, and with the cooperation of the government, the industry continues to develop and costs will continue to decrease.What is more, China has had breakthrough innovations and developments in PV equipment R&D in recent years. For example, in polysilicon, Chinese enterprises have realized low-energy, low-cost and high-quality polysilicon production through technological transformation, breaking the foreign monopoly. In silicon wafers, Chinese enterprises have realized large-size, low-loss, ultra-thin wafer cutting technology through the introduction, digestion and absorption of foreign technology, and upgraded the quality and efficiency of silicon wafers. In terms of cells, Chinese enterprises have realized the development and breakthrough of high-efficiency solar cells through independent innovation and international cooperation, and improved cell conversion efficiency and performance.

Second, the PV industry can provide more employment in China.In 2018, the solar PV industry provided 3,365,000 jobs globally, of which China accounted for 65.85 percent and the United States only 0.69 percent. The trend from 2015 to 2018 shows that the PV industry has provided China with an increasing share of global jobs, while the PV industry has provided the United States with a decreasing share of global jobs. [6] The fewer jobs provided, the fewer people contributing to the PV industry, which is why China's PV industry was able to overtake the United States.

Third, China's PV production capacity has been catching up with that of the U.S. for several years; prior to 2012, the U.S. had much higher installed solar capacity, installed PV capacity, solar power generation and PV power generation than China. "Since the 18th National Congress, after the growth of the 12th FYP period, China's installed solar capacity and installed PV capacity have far exceeded that of the United States. In terms of power generation capacity, China's solar power generation capacity surpassed that of the United States for the first time in 2015, and PV power generation capacity surpassed that of the United States for the first time in 2014. By the end of 2018, China's installed PV power generation reached 174 million kW, adding 44.26 million kilowatts compared with the previous year, a year-on-year increase of 34%. Among them, 123.84 million kilowatts of centralized power plants, 23.3 million kW added from the previous year, up 23% year-on-year ; distributed PV 50.61 million kilowatts, 20.96 million kilowatts added from the previous year, up 71% year-on-year .In 2018, the country's photovoltaic power generation capacity of 177.5 billion kilowatts of time, an increase of 50% year-on-year ; the average number of hours of utilization of 1,115 hours, up 37 hours year-on-year. [5] Such production capacity has allowed China to surpass the United States and even lead the world. On top of that, the size of enterprises in China's photovoltaic industry is expanding, while the United States is shrinking. Between 2011 and 2017 the world's top ten production scale enterprises, Chinese polysilicon production enterprises grew from 4 to 6, silicon wafer production enterprises grew from 6 to 10, battery wafer production enterprises grew from 4 to 8, and the formation of production enterprises grew from 4 to 7. U.S. companies in this period but has been falling out of the world's top ten, polysilicon production from 3 to 1, silicon wafer production, cell production and the formation of production enterprises are reduced from 2 to 0. [6] U.S. companies are not large enough; the development of the photovoltaic industry naturally lags behind China. However, China should also note that the U.S. PV power generation operating capacity factor is higher than China, that is to say, the U.S. equipment operating efficiency, if the number of U.S. equipment to keep up with China, then China's leading position in the world of the photovoltaic industry will likely be shaken.

## 3. China-US PV Trade Friction and Cooperation

### 3.1. Friction

The trade dispute between the China and the U.S. originated in October 2011, when U.S. solar energy company giant SolarWorld, in conjunction with seven U.S. photovoltaic companies, filed a petition with the U.S. government requesting that the Department of Commerce impose tariffs of more than 100 percent on solar photovoltaic panels imported from China to offset Chinese government unfair pricing practices, as well as an unspecified amount of countervailing duties to offset the Chinese government's subsidization of solar panels. Subsidies. In the end, the U.S. Department of Commerce announced a ruling that was still lower than the 250% anti-dumping duty imposed by the U.S. double-reverse investigation applicant at the time, but much higher than the U.S. countervailing duty of 2.9% to 4.73% in March. [7] In the same year, the United States filed and launched an anti-dumping investigation of Chinese solar energy companies, at the same time, China also launched a PV trade barrier to the United States investigation, the U.S. and China PV trade war officially began. In the near future of the U.S. case, the election is about to begin, Obama at the beginning of his term of office on the development of renewable energy in the US has great expectations. After the outbreak of the financial crisis, the United States also hopes that the new energy industry to promote the recovery of the United States economy. However, the election is about

to start, Obama's expectations, I am afraid it is difficult to realize. At this time to put forward the "double reverse" case, there is a possibility that the United States want to take this opportunity to kick Chinese enterprises out of the domestic market. Of course, does not rule out the United States want to use trade protectionism to protect their own purposes. This dispute just started the United States is in a dominant position, China so as to ensure the development of the photovoltaic industry, and actively respond to the war, increase subsidies, increase solar energy utilization, while ensuring the normal import and export of photovoltaic, and now it has been more and more frustrated. The global market share of China's PV industry has risen from 40% in 2010 to more than 70% in 2018. On the contrary, the United States, the trade protection policy it adopted did not protect its own photovoltaic industry, production capacity instead declined year by year, and photovoltaic enterprises have gone bankrupt or moved out of the country [7].

### 3.2. Cooperation

As a renewable energy source, solar energy is naturally of close interest to the two energy powers, China and the United States. In order to improve the global climate change, the United States and China have launched a formal bilateral cooperation since 1979. 1979 January, the then U.S. President Jimmy Carter and China's then Vice Premier Deng Xiaoping signed the "U.S.-China Agreement on Science and Technology", which belongs to the early energy agreement, has not been deeply involved in the photovoltaic industry. More systematic cooperation between China and the United States began in 2008 with the U.S.-China Ten-Year Framework for Cooperation on Energy and the Environment. [8] During the third U.S.-China Strategic Economic Dialogue in late 2007, the two countries had already agreed to cooperate on a wide range of energy sectors to promote technological innovation, efficiency and natural energy sustainability. [9] The document identifies five major goals for U.S.-China cooperation: electricity production and transmission, water, atmosphere, transportation, and ecosystem protection. [10] In December 2008, energy efficiency was added to the document, and the U.S. and China formed teams to advance each goal. In the past decade, the U.S.-China cooperation has gone through policies such as the Green Partnership Program, the U.S.-China Energy Efficiency Action Plan and the U.S.-China Joint Statement on Climate Change, etc. The basis for U.S.-China cooperation in the PV industry has already been laid through governmental cooperation, enterprise cooperation and scientific research cooperation, etc. Due to the uncertainties of climate change, it is hoped that the U.S.-China cooperation will be even more strengthened in the future. [8] China and the United States in the field of photovoltaic cooperation has two major benefits, one is that cooperation can expand the scale of photovoltaic projects, and the second is that it can promote the two countries to learn from each other and learn from each other and reduce costs. At the same time, cooperation can also promote mutual trust and information sharing between the two countries. Of course, there are certain obstacles to cooperation between China and the United States at present. For example, policy and financial support is not enough. U.S. policy in all aspects of the larger defects, China's financial subsidies, although increased year by year, [10] but still not enough. Also, China and the United States are often referred to as cooperative competitors. There is cooperation between China and the U.S., but at the same time the competitive nature is also very strong, which makes the two countries can no longer be fully exchanged in various aspects such as technology, and in the bilateral discussions, the two countries are full of political coloring in the discussion, neither of them is willing to fully disclose or share their own data and technology. Such behavior is understandable, but such behavior is undoubtedly a major obstacle to U.S.-China cooperation. In order to expand cooperation opportunities, China and the United States should concentrate on basic research as well as joint technological research and sharing in the future, try to control the number of PV trade frictions, and more cooperation is necessary for the future of the photovoltaic industry in both countries. [11]

## 4. Policy Comparison

The United States has more legislative norms, China's policy is more complete but lack of legislation. Since the release of the 1987 Energy Tax Act, the United States has lifted the control of the non-public power generation industry and developed a variety of tax incentives to encourage enterprises and individuals to use renewable energy and opened the policy support for the renewable energy economy. In 1997, 2010, 2018, and 2020, the "Solar Million Roof Plan", "Ten million Solar Roof Plan", "Photovoltaic 201 Act," Epidemic Relief Plan "[12] were successively introduced, and the capacity target of the solar panel industry in the country was set. Provide tax relief for industry investment, increase tariffs on imported products of the industry, encourage domestic capital to provide sufficient funds for the development of the photovoltaic industry at the same time, and further through the setting of barriers to avoid the impact of foreign industry products on the domestic industry. The development of China's photovoltaic industry is relatively late. In 2013, the "Several Opinions of The State Council on Promoting the Healthy Development of the Photovoltaic Industry" for the first time raised the development of the photovoltaic industry to a national strategy, and clearly gave policy subsidies will last for 20 years. After that, an industry development plan or industry guidance will be issued every year. For example, in 2016, the Development plan of Solar energy" was launched, setting the overall goal of solar thermal power installation five years later. In 2017, it clarified the strategic positioning of energy storage and proposed the goals of China's energy storage technology and industry in the next 10 years. It is because of the late development of the industry, and continue to increase policy promotion efforts to encourage the development of the photovoltaic industry, China suddenly realized that the renewable new energy economy is not only the photovoltaic economy, if the blind development of the photovoltaic industry, will affect the start and development of other green energy economy; At the same time, the rapid development of the photovoltaic industry will also bring a series of secondary environmental problems. Therefore, since 2018, people have halted the indicators of ordinary photovoltaic power stations, reduced the price of online purchase, and gradually reduced the number of subsidies. At the same time, starting from 2020, we will encourage wind power, smart grid, microgrid, distributed energy and other photovoltaic and photovoltaic supporting upstream and downstream industries to join the emerging strategic industries, and introduce more policies to encourage and enhance the policies, industries, and financial support for the renewable energy industry. Therefore, from a policy point of view, the development of China's photovoltaic industry started relatively late, but it is developing rapidly. While promoting the development of the photovoltaic power generation industry through development planning, subsidy policies, institutional norms, etc., it is also binding, and takes into account the common development and progress of photovoltaic supporting upstream and downstream and other renewable energy sources, making the industry form a healthy and sustainable development process. Although the United States photovoltaic industry started earlier, in the entire development process through policies to administrate the progress of the industry, through legislation and other means to urge the healthy development of the industry, is the reason for the high cost of the photovoltaic industry in USA. Formed a high barrier market environment.

## 5. Challenges Facing China's Photovoltaic Industry

According to statistics from the Prospective Industry Research Institute, a think tank service organization, from 2014 to 2022, the proportion of photovoltaic power generation in China's total social electricity consumption has increased year by year. In 2022, China's photovoltaic power generation accounted for 5.1% of the total society's electricity consumption. According to the prediction of the ERI of the National Development and Reform Commission, by 2025, China's total installed capacity of photovoltaic (DC side) will reach 730 million kilowatts (that is, 730GW, equivalent to 2.9 times that of 2020). In the future, photovoltaic will be one of the important engines to promote China's energy transformation. In recent years, the rapid change in the layout of photovoltaic power generation is the result of the intervention of administrative means. The

optoelectronic industry still relies on government policy support, government subsidies, capacity electricity price mechanism, ancillary service prices and other factors. The policy direction has a significant impact on the income of the optoelectronic industry, which may affect the future industry demand and development space. The level of intelligence of China's distribution network is not high, and the decline in the industrial chain and the rise in energy prices stimulate industrial demand. At present, the intelligence level of the distribution network is not high, and the construction speed cannot meet the needs of the rapid development of distributed photovoltaic power generation. At the same time, affected by the continuous decline in the price of photovoltaic raw material lithium carbonate, as well as the rising price of traditional energy such as oil, clean energy such as photovoltaic has further stimulated China's photovoltaic industry Growth in demand. Sino-US trade competition and friction affect the progress of China's photovoltaic industry. The rapid progress of the photovoltaic industry has spawned many new entrants, and the competition has intensified, bringing the photovoltaic storage parity market while also compressing the profitability of companies in the industry. IGBT, battery cells for photovoltaic inverters, energy storage PCS, etc. are important raw materials in the photovoltaic industry, due to the supply chain pressure caused by Sino-US trade frictions, and the decrease in demand for photovoltaic storage market brought about by the US interest rate hike, will become the bottleneck of the development of China's photovoltaic industry [13].

## 6. Conclusion

Overall, this paper discusses the development of the PV industry in the US and China, including the current situation, policies, prospects, and the relationship between the two countries' PV industries,aiming to deepen the comprehension of the knowledge behind the PV industry in China and the United States.Currently, China's PV industry is basically in the first place in the world in terms of production cost, capacity and competitiveness as assessed from various aspects.More than a decade ago, the U.S. PV industry was ahead of China. However, since the U.S. began to pressure China's PV industry in 2011, this once stood in the world's first position of PV power began to retreat.Now, the U.S. relies heavily on China's low-cost PV products. In the past decade, the scale of China's PV industry has grown dramatically, and its international competitiveness has become stronger and stronger.During this period, the Chinese government has alsogiven a lot of support. Although there is trade friction between China and the United States, but the good thing is that the Chinese government that timely response, and did not let the United States get its way,the United States to minimize the damage to their own interests, and through the development of technology over the United States. Although there is strong competition between China and the United States, people still believe that China and the United States should strengthen cooperation in the future. For example,researchers and scholars and system operators in both countries should work more closely together to develop software and models to support more complete supply chains. Or, as two major energy powers, the U.S. and China should establish a bilateral energy cooperation base to facilitate discussion of their respective strategies and the development ofnew technologies. In addition, although China is ahead of the U.S., it needs to learn from the U.S. in specific areas, such as compressed air energy storage systems,where China does not have experience in industrialization, and where cooperation with the U.S.would actually be beneficial to China itself. Moreover,it is necessary for China and the U.S. to ensure stable financing channels to ensure that the partnership between China and the U.S. is fully utilized, and China and the U.S. should work together on more projects in order to enable both countries to develop the PV industry rapidly in the long term. The main limitation is that this paper does not put forward innovative ideas, but mainly for the integration of existing ideas and express its tendency, the significance is to provide the general trend and direction of the development of the photovoltaic industry in the two countries, for the development of China and the United States have a certain reference role.

## Authors Contribution

All the authors contributed equally, and their names were listed in alphabetical order.

## References

[1] Daoyuan Wen, Weijun Gao, Fanyue Qian, Qunyin Gu, Jianxing Ren. Development of solar photovoltaic industry and market in China, Germany, Japan and the United States of America using incentive policies.Energy Exploration & Exploitation, 2020, 39(5): 1429-1456.

[2] Wenjuan Guo,Huifeng Guo. Utilization of Renewable Resources and its Sustainable Development. Xian University of Technology, 2008, 34(4): 23-24.

[3] Yujuan Zhang. Comparative Analysis of the Competitiveness of the Solar Photovoltaic Industry in China and the United States. Modern Business, 2015, 21(29): 177-178.

[4] Jingzhu Yuan. Comparative analysis of the industrial competitiveness of the new energy industry in China and the United States. China Energy, 2019, 12(3): 25-28.

[5] Yuan J Z, Wang J.Comparitive Analysis and Enlightenment of Photovoltaic Industry Competitiveness in China and the United States. China Economic and Trade Guide, 2019, 45(07): 21-24.

[6] Yuan J Z.Comparitive Analsis of Industrial Competitvness of New Energy Industry in China and the United States. China Energy, 2019, 41(03): 25-29.

[7] Shao G H. Analysis of the Impact of Sino-US Trade Friction on China's Photovoltaic Industry. Practice in Foreign Economic Relations and Trade, 2019, 56(12): 7-9.

[8] Xu H F.China-us layout: Clean Energy Cooperation in the Context of addressing global climate change. Social Sciences Literature, 2017, 58(22): 99-133.

[9] U.S. Department of the Treasury.The Third U.S. - China Strategic Economic Dialogue December 12 - 13, 2007, Beijing Joint Fact Sheet. [EB/OL]. (2007-12-13) [2023-08-29]. https://home.treasury.gov/news/press-releases/hp732

[10] U.S. Department of the Treasury.U.S. – China Joint Fact Sheet: Ten Year Energy and Environment Cooperation. [EB/OL]. (2008-12-04) [2023-08-29]. https://home.treasury.gov/news/press-releases/hp1311

[11] Chinese Academy of Sciences, Chinese Academy of Engineering, National Academy of Sciences, United States of America. Renewable Energy Generation: Opportunities and Challenges for China and the United States. Beijing Science, 2012, 67(90): 154-158.

[12] Ming, L. The five major opportunities and risks faced by the national photovoltaic industry. [EB/OL]. (2022-11-23) [2023-08-29]. https://solar.ofweek.com/2022-11/ART-260006-8120-30580012.html

[13] No author. In-depth: Comparative Analysis of the development of photovoltaic power generation industry in China and the United States in 2021 (with analysis of development Differences). [EB/OL] (2021-11-29) [2023-08-29]. https://finance.sina.com.cn/roll/2021-11-29/doc-ikyakumx0883449.shtml