Scholar Publishing Group
International Journal of Social Sciences and Economic Management
https://doi.org/10.38007/IJSSEM.2023.040110
ISSN 2789-715X Vol. 4, Issue 1: 88-96

From "Double-reverse" Policies to Exemptions from Tariffs in States of Emergency-Chinese Photovoltaic Industry's Experience and Future Thoughts

Xiuling Hu

Shanghai University, Shanghai 200444,China

Keywords: China's Photovoltaic Industry, Trade Sanctions, Industry Chain Theory, Diamond Model, Challenges and Countermeasures

Abstract: At present, China's photovoltaic industry patents and exports ranked first in the world, while China's photovoltaic industry has suffered from Europe and the United States "double reverse" sanctions and blockade, the situation is very difficult, and its development can not be separated from the progress of domestic science and technology and policy support. This paper collates the three crises and breakthroughs that China's photovoltaic industry has experienced. The innovation of this paper is to analyze the reasons why China's photovoltaic industry can fight back from the upstream, midstream and downstream characteristics of the industry chain theory, and summarize China's photovoltaic industry's successful experience based on the theory of Porter's diamond model, which provides a certain reference significance to the other industries that are still under the U.S. trade sanction. At the same time, this paper uses pest model to analyze the reasons for Biden's emergency tariff exemption this year, combined with the status quo of photovoltaic development, to analyze the current challenges and coping strategies. Finally, it puts forward policy suggestions for the development of PV and other fields.

1. Introduction

In September 2020, China raised its carbon peak and carbon neutrality targets, ushering in China's "dual-carbon" era. Seventeen of the world's top 20 companies are from China, with only two U.S. companies and one South Korean company. As of May 2022, China's PV patent applications accounted for 80.14% of the total global PV patent applications, and the global share of production capacity of silicon materials, wafers, cells and modules was above 75%.

Photovoltaics as an emerging green industry is not only a way to ensure energy security, protect the ecological environment, and cope with climate change, but also a breakthrough point for industrial transformation and upgrading and the direction of green drive (Mans U, 2014) [3]. However, China's PV industry has experienced a long period of hardship and difficulties behind the bright and shiny. 2011, China's PV industry has been subjected to trade sanctions from Europe and

the United States, the "double-reverse" policy not only raises the threshold of product exports, the compression of China's PV product market scale. The "double reverse" policy not only raises the product export threshold, but also compresses the market scale of Chinese PV products; it hinders the import of raw materials into China and raises the domestic production cost (Ball J et al, 2017) [1], and there is a significant export inhibition effect after receiving the "double reverse" investigation (Blonigen and Prusa, 2015; Xu Jiayun et al, 2021) [2, 10]. Some researchers and scholars have used multiperiod MODELING to examine the effects and mechanisms of U.S. anti-dumping against China on the innovation of Chinese enterprises. It was found that U.S. anti-dumping against China generally inhibited Chinese firms' innovation (Cao et al., 2021) [5], but in the photovoltaic industry, the number of Chinese patents still increased substantially under anti-dumping and countervailing sanctions is shown in Figure 1.

2022 Global Top 20 Photovoltaic Enterprises (Comprehensive Category)			
ranking	Company name	Country	Operating income in USD (millions)
1	LONGi Green Energy Technology Co., Ltd	China	12694
2	Trina Solar Co., Ltd	China	6977
3	Pinao Solar Technology Investment Co., Ltd	China	6478
4	Pinker Energy Co., Ltd	China	6410
5	Tianjin Zhonghuan Semiconductor Co., Ltd	China	6030
6	Tongwei Co., Ltd	China	5989
7	Canadian Solar Power Limited	China	5300
8	GCL (Group) Holdings Limited	China	4274
9	TBEA Corporation	China	3132
10	Sungrow Power Supply Co., Ltd	China	2969
11	Risen Energy Co., Ltd	China	2954
12	FIRST SOLAR.INC.	United States	2924
13	Zhejiang Zhengtai New Energy Development Co., Ltd	China	2854
14	Hanwha Q CELLS	Korea	2634
15	The 11th Design and Research Institute of Science and Technology Engineering Co., Ltd	China	2133
16	Hangzhou Foster Applied Materials Co., Ltd	China	1931
17	Suntech Group	China	1819
18	Shanghai Aiko Xinnengtong Co., Ltd	China	1756
19	The new Daqo New Energy Services Co., Ltd	China	1699
20	SunPower Corp.	United States	1323

Figure 1: Top 20 Global PV Companies 2022 (General)

This paper studies from two aspects, firstly, briefly reviewing the bumpy road of the photovoltaic industry over the years and summarizing the lessons learned from the study. It is of great significance to study how PV can find its own way of development in the midst of siege and sanctions on China's new energy trade as a whole. In addition, there are still many industrial fields in China that are still in the unfavorable situation of being sanctioned by the U.S. trade sanctions, such as semiconductor chips, and the research in this paper hopes to provide some reference opinions to these fields. Secondly, although China's PV has taken 20 years to take the lead in the world, how to maintain the leading position and how to sustain the development is a problem that we should think about immediately. This paper will study the current challenges and coping strategies in combination with the new policies of the United States for the photovoltaic industry.

2. Relevant Literature and Theory

The research and analysis in this paper mainly use the industry value chain theory, PEST model, and Porter's diamond model.

The upstream extension of the industrial chain generally leads the chain to the basic industry and technology research and development, while the downstream extension leads to the market

expansion. According to the principle of "Smile Curve", the upstream and downstream are high value-added links, while the midstream has the lowest value added. From the perspective of industry chain links, the intensity of the demand for competitive intelligence of PV enterprises in different industry segments is related to the industry chain links in which they are located, and upstream, midstream, and downstream enterprises have the highest degree of demand for technology, competitors, and markets, respectively (Geng Zhe, 2016) [6]. In 2017, PV enterprises at this stage were backward in their development strategies, mainly competing in the global market by utilizing the advantages of manpower, cost, and scale, and were in the middle and downstream of the industry chain, and most of them lacked core processes. middle and lower reaches, and most of them lack core processes (Sun Jing, 2017) [7]. The empirical results of the multiperiod double-difference model show that:For those high supplier concentration enterprises with close relationships with suppliers, the export amount of their sanctioned products is not significantly affected (Tan Na et al., 2022) [8], which reflects the importance of having close ties with the upstream. Based on the panel data of 59 photovoltaic listed companies in China for 11 years, it is found that government subsidies can significantly promote the overall R&D investment level and innovation output capacity of China's photovoltaic industry (Wang Hongwei et al., 2022) [9]. This article will also analyze how China Photovoltaics turned over against the wind under the containment and sanctions of European and American countries in the upper, middle, and lower reaches of the industrial chain.

PEST model is one of the common methods used internationally to study the common external macroenvironment, which mainly analyzes and discusses four types of elements, to grasp the overall external macroenvironment of business operations, which contains political factors (Political), economic factors (Eco-nomic), social factors (Social) and technological factors (Technological) (Chen Xiaoqian and Chen Yong, 2022) [4].

Porter proposed the theory of national competitive advantage, also known as the national diamond model, the theory that the country is the basis for enterprises or industries to participate in international competition, the theory of national competitive advantage depends on four basic factors: factors of production, demand factors, related and supporting industries, business organization, strategy and competitive status, and two auxiliary factors: opportunity and government . Using the diamond model to analyze the national competitive advantage of China, the United States, Japan and Germany, it is found that China started late and there are many domestic and international constraints on our factors (Sun Jing, 2017) [7]. This paper analyzes the success of China's photovoltaic industry using the diamond model again in the current situation, and summarizes its lessons.

3. China's Photovoltaic Industry and New U.S. Policy

3.1 Three Rounds of Games, Three Breakthroughs

20 years ago, the upstream polysilicon materials and downstream market are in the hands of Europe and the United States, China is mainly involved in the middle of the module link, the use of cheap labor for profit. the 2008 financial crisis severely hit the European and American economies, making the PV market shrink rapidly, coupled with a number of Chinese companies that were previously forced to sign long-term contracts, the domestic enterprises to reduce rapidly, from nearly 400 to less than 50.

In the face of such a situation, CLP joined hands with GCL to establish a technological position to promote China's monocrystalline silicon and polycrystalline silicon cell conversion rate to 18% and 17%, ascending to the world's first echelon. Secondly, in 2010, the international demand suppressed by the financial crisis was released, and the industries in Europe and the United States

shrunk their production capacity for self-protection and were unable to expand temporarily, and the Chinese PV, which preserved its production capacity in the Golden Sun Project, became the only choice for the world PV industry. In addition, nicknamed "private electricity king" Zhu Gongshan founded in the silicon industry, a breakthrough in polysilicon cold hydrogenation process research and development, breaking the monopoly of European and American technology is shown in Figure 2.

Golden Sun Project Demonstration Project				
Number of phases of the project	Phase 1	Phase 2	Phase 3	Phase 4
year	2009	2010	2011	2012
Number of projects	98	50	140	
Planned installed capacity (MW)	201	272	690	1709

Figure 2: Results of the first breakout Golden Sun demonstration project

In 2011, the U.S. Department of Commerce launched anti-dumping and countervailing investigations on Chinese PV products, followed by the EU the following year. Chinese companies were levied 23%-254% of the high double reverse tax, resulting in Chinese PV products exports to the United States fell nearly 50%.

In the face of the crisis, the Chinese government, once again to save the market, held a national energy work conference, decided to compress China's excess production capacity, collection of industry upstream and downstream in the west with the construction of photovoltaic power plants, pulling the transformation of the market structure, and build the strategy of returning to the west. In 2015, the frontrunner program will be the latest technology in the eastern coastal region directly to the western part of the country, to achieve the technology and production of the internal cycle. At the same time, China began to take advantage of the location advantage to invest and build factories in Southeast Asia, using the local cheap labor, and the already formed Chinese model to build China's photovoltaic manufacturing industry to take over the place is shown in Figure 3.

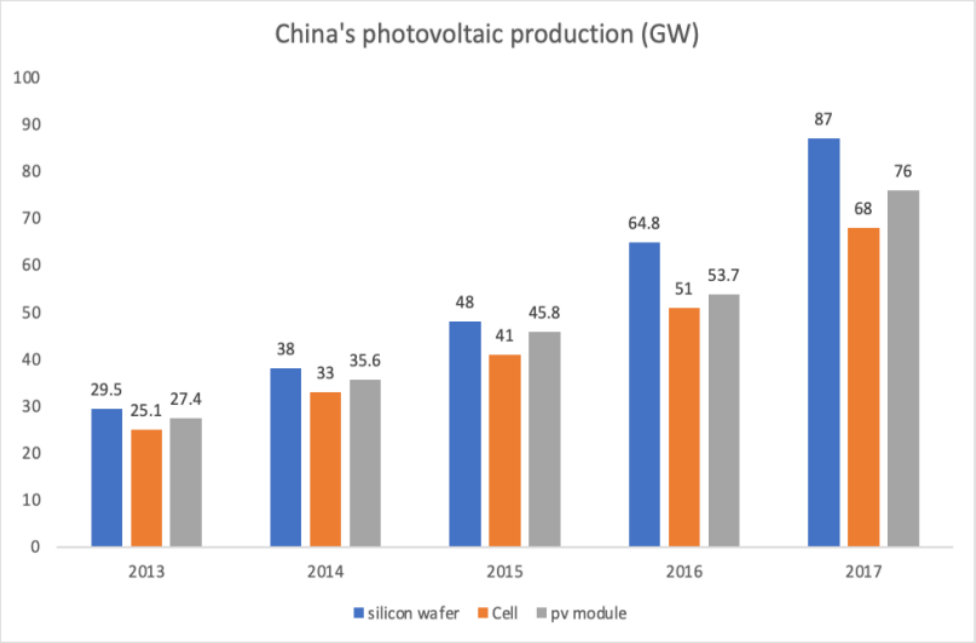

Figure 3: Results of China's second PV breakout

The industrial transfer back to the west has made Xinjiang the largest polysilicon producer, while the West recklessly claimed that the low price of Chinese PV comes from forced labor of Xinjiang

people, called for the international market to reject the use of Chinese PV, and ignored the rebuttal of Xinjiang people. Under the influence of public opinion, European and American enterprises began to exert pressure in an attempt to realize the technology blockade again.

However, the Chinese government ignored the ridiculous public opinion and started to promote the upgrade of the entire PV manufacturing industry by releasing new standards for the specification of PV products. The production cost of China's PV modules dropped from $0.5/watt in 2013 to $0.29/watt in 2017, a straight 42% reduction, breaking through for the third time.

3.2 America's Version of "The Emperor's New Clothes", Biden Exempts Tariffs

Since the Obama era has increased tariffs on our photovoltaic products, according to a report provided by Auxin Solar stating that in the first half of 2021, the U.S. photovoltaic market accounted for 80% of photovoltaic products from Malaysia, Thailand and Vietnam. But the so-called Southeast Asian PV panels are packaged by Chinese domestic manufacturers in Southeast Asia and resold to the United States. The U.S. is aware of this market situation, but cost-effective PV products force it to accept.

Some U.S. companies believe that the imports of photovoltaic products from Southeast Asia defeated the U.S. local enterprises is the competitiveness of the market in September 2021 and February 2022, respectively, anonymous and real complaints about the four Southeast Asian countries are China's products, "wash origin". March 28, the Department of Commerce to take the opportunity to launch an investigation, and even add traceability provisions. This clause has directly deterred importers from importing, even requiring them to pay large sums of money in back payments and stalling downstream projects, resulting in letters of protest from the governor and members of the House of Representatives.

Finally, Biden launched an emergency authorization under the Tariff Act of 1930, the four Southeast Asian countries imported photovoltaic products for 24 months "no tariffs", disguised as a release of these four countries to the Chinese photovoltaic products.

Through the correct guidance of China's policy, coupled with its own technological breakthroughs and the development of the western market, Europe and the United States of America's technological blockade or market blockade has been unable to affect China.

4. Discussion of Case Issues

4.1 Calendar Year: Industry Chain Analysis of How China was Able to Turn the Tide Against the Wind

China's PV early pattern is "both ends ", the upstream technology and raw materials downstream market are mastered by Europe and the United States, China can only be responsible for the middle of the component link, the whole industry chain is fragile.

Based on this, China PV has consciously focused on solving the problems of technology, raw materials, and market.

In terms of technology, through the cooperation and efforts of private enterprises and the government. In 2021 alone, China applied for 3,087 patent data, the total number of patents accounted for 80% of the global patents, Europe and the United States can no longer blockade us in technology is shown in Figure 4.

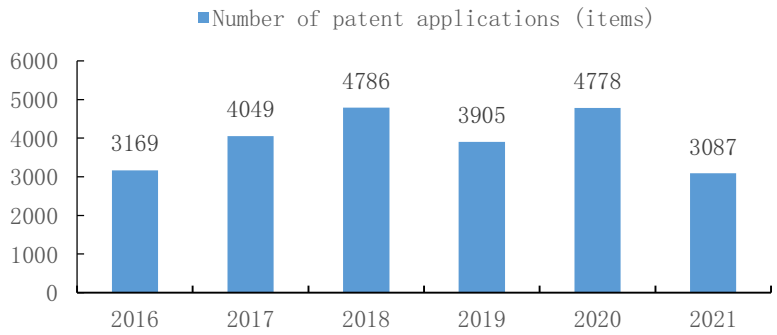

Figure 4: Statistics on the number of patent applications related to photovoltaic power generation in China, 2016-2021

Raw materials. 2005, technical engineer Chen Weiping led the team in less than a year, overcoming the polysilicon cold hydrogenation, core reduction, furnace distillation, and other technical difficulties. 2007, Chen Weiping led the landing of Hualu polysilicon plant, creating three world firsts in one fell swoop, and the cold hydrogenation core technology to the entire industry.

In terms of market, the global PV market is shrinking rapidly under the impact of the economic crisis, and China launched the Golden Sun Project in 2009 to expand the Chinese market. Under the continuous heating of China's PV industry, there are constantly countries throwing olive branches to China, and in 2018, China's PV module exporting countries reached more than 200, and countries such as India, Japan, Australia, Mexico and other countries replaced the original European and American markets to become the main exporting countries of China's PV industry is shown in Figure 5.

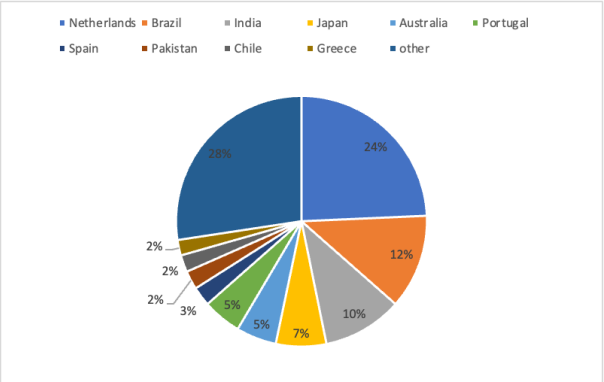

Figure 5: China's PV Module Export Market Share in 2021

Therefore, the industrial chain of comprehensive domestic substitution is China's PV sustained and healthy development of the bottom, the country wants to develop an industry, must be in the industry chain of the upstream and downstream are enjoying absolute control, regardless of the lack of which link, will make an industry by the squeeze of other countries can not continue to develop.

4.2 This Year: a PEST Model Analysis of Why Biden Exempted Tariffs?

On the political front (P), with the midterm elections coming up, Biden's top priority is that he is polling very low on his time dealing with the economy, and the Wall Street Journal did a poll where again 83% of Americans think the U.S. economy is bad, and only 1% say it's good. It is essential for

Biden to confirm the tariff exemption in order to be able to win more support in the midterm elections.

Economy (E), the United States is facing a new energy transition, the United States of America's new energy plan, the future of 2035 photovoltaic power generation will be increased to 40%, the exemption of tariffs may have to continue to be implemented.

Social (S): Biden is under pressure from domestic protests, and the investigation has led to a massive shutdown of downstream grid-connected projects. 19 state governors and more than 80 members of the House of Representatives have written letters to the Department of Commerce and the president stating that the continuation of the investigation will affect 230,000 U.S. jobs and 50 gigawatts of solar energy projects across the country.

Technology (T): 2022 Bloomberg Energy research published photovoltaic modules in the first level of most of the companies are Chinese companies, Chinese companies have applied for the number of patents have reached the world's first, not only in the world's market share accounted for a large proportion of the products, but also the quality of the products at a low price, the United States, if you want to achieve cost-effective in the photovoltaic industry, it is necessary to buy China's photovoltaic products.

Based on the PEST model analysis, Southeast Asian PV modules can continue to be exempted from tariffs in the U.S. thanks to the upcoming U.S. midterm elections, the U.S.'s new energy transition, protests by companies and the Senate, and China's PV technology. However, the root cause is that China's PV technology is able to provide high-quality PV modules at a low price, and the U.S. has to bow down based on its national interests.

5. Summary of Gaming Experience and How China's PV Will Develop in the Future

5.1 summarizes China's PV Jedi Strikeback Experience Based on Diamond Model Theory

According to the theory of diamond model, we analyze the contribution of each factor in the game in China.

(1) Factors of production. China's abundant cheap labor is China's high-quality primary factor, making China's photovoltaics in the initial period of "both ends of the outside" period can also be in the midstream component stage to achieve economies of scale. 2) Demand. Domestic governments actively opened up the western domestic market, Europe and the United States developed countries "first pollution and then governance" road to make the international market more broad. 3) Related and supporting industries. From the above analysis of the industry chain, we can clearly see that the development of upstream and downstream can quickly promote the iteration of the midstream. 4) Enterprise organization strategy and competitive status. China's PV industry has no shortage of corporate pioneers and persistent does.5) Government. The strong support of China's policy is the most important reason why China's PV has been able to fight back time and again. The foresight of the Chinese government's policy guidance and the wisdom of its strategic choices are the solid support for China's PV's continuous success and distance traveled. 6) Opportunity. The "environmental protection tide" in Europe and the United States has brought a large market to the early Chinese PV industry.

5.2 Challenges and Scope for Future Development

First, the technological progress of the photovoltaic industry is very fast, and we should always be alert to whether we are overtaken.

Second, the protection of intellectual property rights. The number of patents in China ranks first in the world, accounting for about 80% of the total number of patents in the world, so it is necessary

to actively think about systematic intellectual property protection.

Third, the persistent sanctions of the United States. At present, only powerful photovoltaic enterprises in China can directly export, and more enterprises indirectly export to the United States through the strategic base in Southeast Asia. China needs to consider continuously reducing its dependence on the American market.

Fourth, public opinion pressure. The United States requires imported PV to issue a "non-Xinjiang" certificate, and China enterprises can consider transferring responsibility, and enterprises can require payment before shipment.

Fifth, the financial dependence is great. Every stage of the development of photovoltaic industry is inseparable from the strong financial support of the government.

6. Policy recommendations

Combined with the analysis of China's photovoltaic industry policy and development experience at home and abroad, this paper puts forward the following policy recommendations:

Government: First, the government needs to gradually reduce the price subsidies between state-owned enterprises and other enterprises, stimulate domestic enterprises to actively participate in market competition.

Second, improve the legal system related to intellectual property rights of PV industry, think about the protection of intellectual property rights in the external system to avoid the property rights being stolen and copied by other countries.

Third, vigorously introduce scientific and technological talents, and continue to implement the strategy of the developing country through science and education.

Business: First, PV enterprises should actively participate in market competition, increase investment in R&D, and raise awareness of the big picture.

Second, take the photovoltaic industry as an example, enterprises in other fields should improve the awareness of upstream and downstream industry chain, and accelerate the industrial cluster effect of enterprise industrial park.

Third, in the context of economic globalization, enterprises should actively integrate into the global value chain, enhance cooperation between countries, and raise the global importance of the Chinese market and Chinese manufacturing industry.

Funding

If any, it should be placed before the reference section without numbering.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Ball J, Reicher D, Sun X, et al. The New Solar System: Chinas Evolving Solar Industry and Its Implications for Competitive Solar Power in the United States and the World R. USDOE Office

of Energy Efficiency and Renewable Energy (EERE), Solar Energy Technologies Office (EE-4S), 2017-03-08.

[2] Blonigen B A, Prusa T J. Dumping and Antidumping Duties. NBER Working Paper Series, 2015, 21573.

[3] Mans U. Tracking Geographies of Sustainability Transitions:Relational and Territorial Aspects of Urban Policies in Casablanca and Cape Town. Geoforum, 2014, 57: 150 - 161.

[4] Chen Xiaoqian, Chen Yong. PEST analysis of factors influencing the trade of forest products between China and Central and Eastern European countries. Western Forestry Science, 2022,51(03):165-172.

[5] Cao Ping, Xiao Sheng peng, Lin Changqing. Reassessment of U.S. Anti-Dumping Effects on Innovation of Chinese Enterprises. International Economic and Trade Exploration, 2021,37(01):34-49.

[6] Geng Zhe, Chen Feng, Su Ying. Competitive intelligence demand analysis of solar photovoltaic enterprises under the perspective of industrial chain. Journal of Intelligence, 2016,35(08):76-82.

[7] Sun Jing. Research on the international trade competitiveness of China's solar photovoltaic industry. Price Monthly, 2017(12):32-36.

[8] Tan Na, Gao Gaofeng, He Chuantian. Trade Frictions and Chinese Firms' Exports--A Perspective Based on Supplier Relationships. International Trade Issues, 2022(09):35-52.

[9] Wang Hongwei, Zhu Xueding, Li Ping. The impact of government subsidies on innovation in the photovoltaic industry. Economic Management, 2022,44(02):57-72.

[10] Xu Jiayun, Zhang Junmei, Liu Zhuqing. Experiencing anti-dumping and the export behavior of multi-product firms I Evidence from the Chinese manufacturing industry. Financial Research, 2021(5):97-116.