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# Research on the Financing Dilemma and Solution Path of Small and Medium-sized Photovoltaic Enterprises

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***Abstract:*** *Under the background of "Double Carbon Strategy", the photovoltaic industry has achieved great development. With the support of policies and capital, the financing environment of China's photovoltaic industry has improved significantly. As an important part of the photovoltaic industry chain, small and medium-sized photovoltaic enterprises have practical significance in the coordinated development of the industrial chain, product technology innovation and social responsibility. However, affected by many factors, for most small and medium-sized photovoltaic enterprises, financing difficulties are still an important factor restricting their further development. This paper analyzes the financing difficulties of photovoltaic enterprises from the perspective of the characteristics of photovoltaic industry, the weaknesses of small and medium-sized photovoltaic enterprises and external constraints, and puts forward targeted countermeasures combined with the "Double Carbon Strategy" background and industry development dynamics, in order to provide reference for solving the financing difficulties of China's small and medium-sized photovoltaic enterprises.*

***Keywords:*** *Photovoltaic industry, SMEs, Double carbon target, Financing dilemma*

## 1. Introduction

The new energy industry represented by the photovoltaic industry plays an important role in the transformation and upgrading of the energy structure. The proposal of the dual carbon goal has brought new opportunities for the development of the photovoltaic industry. According to the forecast data of PV info photovoltaic industry database, the new installed capacity of global photovoltaic industry will reach 366GW in 2030, which is expected to maintain a compound annual growth rate of 20% - 25% in the next 10 years. The market demand of photovoltaic industry is expanding, and the industry has broad prospects for development. However, due to the dual capital and technology intensive characteristics of the photovoltaic industry, financing has always been an important factor affecting the development of the photovoltaic industry. In the photovoltaic industry, the majority of small and medium-sized photovoltaic enterprises have inherent financing disadvantages, and are easy to be ignored in financing.

At this stage, how to solve the financing problems of small and medium-sized photovoltaic enterprises, promote the rapid development of the photovoltaic industry, and make it more suitable for the needs of the dual carbon target is a practical problem that needs to be solved urgently.

Academics have long paid attention to the financing difficulties of SMEs. Lin Yifu et al. (2001) pointed out that most SMEs in China are labor-intensive industries located in the middle and lower reaches of the industrial chain. Compared with large enterprises, SMEs have more obvious financing disadvantages. Sun Xifang et al. (2005) showed that due to the lack of channel information and the support of pledge, the financing cost is much higher than that of large enterprises, SMEs prefer indirect financing rather than direct financing, and informal finance has a stronger attraction for SME financing [1].

In the research on the characteristics of photovoltaic industrial structure, Yuan Bo et al. (2014) analyzed the practical role of small and medium-sized photovoltaic enterprises in industrial collaboration from the perspective of industrial organization reform, pointing out that small and medium-sized photovoltaic enterprises play an important role in the development of multi link specialization and differentiated business [2]. Guo Yigui, Shu Guofan, Liu Yan and others (2017-2021) pointed out that the

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financing of photovoltaic industry has the characteristics of large amount, long cycle and few financing methods. The financing difficulty of small and medium-sized photovoltaic enterprises is high. Under different financing modes, photovoltaic enterprises will face various financing risks [3-4]. Yang Baibing et al. (2022) found that China's advanced manufacturing enterprises were faced with the problem of mismatch between capital supply and demand channels, time limits and products [5].

In terms of financing efficiency of photovoltaic enterprises, Luo Yu et al . Tao Yinhai (2019) found that based on the results of the traditional empirical analysis model, China's capital market has not yet had a significant positive incentive effect on the development of the new energy industry, and further deepening the reform of the new energy industry investment and financing system is needed [6-8]. Li Silin et al. (2022) found that when the investment expenditure in the new energy industry is at a low level, it can promote the transformation of innovation achievements, and when the investment expenditure is too high, it will inhibit the transformation of innovation achievements [9].

In general, in terms of research on financing difficulties of photovoltaic industry, most domestic and foreign scholars regard photovoltaic industry as a branch of new energy industry or focus on research on financing efficiency of large photovoltaic enterprises, lacking targeted research on small and medium-sized photovoltaic enterprises. On the other hand, practical financing constraints and financing risks restrict the further development of small and medium-sized photovoltaic enterprises. As an important part of the photovoltaic industry chain, small and medium-sized photovoltaic enterprises lack their due financing support, which affects the growth and development of enterprises and technological innovation. This paper selects small and medium-sized photovoltaic enterprises in China as the research object. Starting from the overall characteristics of the industry, it analyzes the causes of their financing difficulties around their own weaknesses and external constraints. Combining the era background of dual carbon goals and the development trends of the photovoltaic industry, it puts forward targeted suggestions to provide reference for policy formulation and enterprise decision-making.

## 2. Analysis of financing difficulties of small and medium-sized photovoltaic enterprises

### *2.1 Internal factors of the industry*

#### *2.1.1 Constraints of historical factors*

The development history of China's photovoltaic industry has encountered several major setbacks, such as the global financial crisis in 2008 and the European debt crisis in 2009, which severely hit photovoltaic enterprises that were highly dependent on product exports at that time. In 2012, China's photovoltaic enterprises were subject to the external economic sanctions of the dual anti policy, resulting in huge losses, and a large number of small and medium-sized photovoltaic enterprises were closed down. In 2018, the "513 New Deal" restricted the scale of photovoltaic industry and accelerated the decline of subsidies, resulting in imbalance between supply and demand in the domestic photovoltaic industry, intensified competition among enterprises, and further increased the financing cost and difficulty of the photovoltaic industry.In the past decade, bad credit events of photovoltaic enterprises represented by Jiangxi GCL, Baoding Tianwei Group and Jiangsu Shunde PV have always restricted the solution of the financing problem of the photovoltaic industry. The banking industry has been in a state of weak support for the credit of photovoltaic enterprises, especially for small and medium-sized photovoltaic enterprises, and the phenomenon of loan aversion and loan restriction occurs from time to time. The historical development dilemma has a certain negative impact on the current financing of photovoltaic enterprises.

#### *2.1.2 Characteristics of photovoltaic industry*

The photovoltaic industry is an asset-heavy industry with highly concentrated capital and technology, featuring typical high investment, high risk, low return on investment and long investment recovery cycle [10]. Take photovoltaic module manufacturing enterprises as an example, each additional 1GW of capacity, the investment capital is 400 to 600 million yuan, for the leading enterprises in the photovoltaic industry, it is often tens of billions of investment layout, for small and medium-sized photovoltaic enterprises is difficult to raise and bear the capital. The photovoltaic industry is in the process of high-speed iteration, and small and medium-sized photovoltaic enterprises are prone to be eliminated by the market due to their financial weakness, which inhibits their scale expansion and technological

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innovation. From the perspective of the industry chain, the upstream silicon wafer manufacturing belongs to the high-profit link of the photovoltaic industry chain. Small and medium-sized photovoltaic enterprises in the middle and downstream are highly sensitive to the price rise and fall of the upstream silicon wafer, and the high proportion of the cost of raw materials such as silicon wafer seriously affects the profit and development of small and medium-sized photovoltaic enterprises. If photovoltaic enterprises want to avoid being eliminated in the fierce competition, they must vigorously promote technological innovation and scale expansion, so that the financing demand of enterprises is always high. In addition, the photovoltaic industry is an asset-intensive industry, and there is a long time lag between the investment and construction of new production lines and their use, so the photovoltaic industry has certain cycles and uncertainties. Enterprises have a high demand for reliable financing support, and stable cash flow also plays an extremely important role in the healthy development of the photovoltaic industry.

#### *2.1.3 Fierce competition in the industry*

The photovoltaic industry is a strategic emerging industry with rapid technological update and iteration. The industry is in a rising period, with rapid technological iteration and rapid product replacement and elimination. Data show that the semiconductor technology of photovoltaic panels is upgraded every 1 to 2 years on average, and the high degree of standardization and homogenization of photovoltaic products further intensifies the competition within the industry. At the same time, photovoltaic industry as the current hot plate, is attracting a lot of cross-border capital to join the competition. As early as 2013, Huawei has been positioning itself in the photovoltaic industry, while leveraging its advantages in communication technology. For seven consecutive years, Huawei has ranked first in the shipment of photovoltaic inverters. In recent years, traditional enterprises represented by TCL and Zhengbang Technology have entered the photovoltaic industry with a high profile by relying on their own capital advantages, which further intensifies industrial competition and pattern differentiation, and is more unfavorable to the financing of small and medium-sized photovoltaic enterprises. In addition, most small and medium-sized photovoltaic enterprises are at the bottom of the industrial pyramid, with highly concentrated labor and resources and relatively low added value of products. Some small and medium-sized photovoltaic enterprises have excess capacity and fierce competition in low-end capacity. Therefore, under the circumstance of relatively limited financing supply, the financing demand of most photovoltaic enterprises, especially small and medium-sized photovoltaic enterprises, is difficult to be met.

### *2.2 Enterprise's own weaknesses*

#### *2.2.1 Nature and scale constraints*

State-owned enterprises can obtain credit at a lower financing cost by virtue of their relatively sufficient pledges and implicit guarantees from the government. Leading enterprises in the photovoltaic industry are more likely to be favored by financial institutions due to their large scale and strong solvency. For the small and medium-sized photovoltaic enterprises, which account for the majority of photovoltaic enterprises, the nature of private economy and relatively weak, corporate strength leads to their inherent disadvantages in financing conditions, and it is difficult to compete with state-owned enterprises and large photovoltaic enterprises for limited financing resources. On the other hand, small and medium-sized photovoltaic enterprises lack available pledges, so in the absence of institutional endorsement and other guarantee conditions, the success rate of photovoltaic enterprises in obtaining financing support is relatively low. Therefore, small and medium-sized photovoltaic enterprises have to bear higher capital use costs and additional guarantee conditions, which is not conducive to the normal realization of their reasonable financing needs.

#### *2.2.2 Internal management weaknesses*

Scientific enterprise management is an indispensable part of the healthy development of large enterprises and small and medium-sized enterprises. Chinese small and medium-sized photovoltaic enterprises themselves are small, the management structure of most photovoltaic enterprises is not scientific enough, the characteristics of the enterprise is more obvious, the internal management decision-making of the enterprise is often the dominant power, the lack of clear division of power and responsibility and standardized regulatory checks and balances system, which is not conducive to the photovoltaic enterprises in the rapid development of complex industry competition to gain advantages.

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From the perspective of enterprise operation and management, constrained by the market environment and their own technical level, small and medium-sized photovoltaic enterprises are more inclined to scale expansion rather than technological innovation. Small and medium-sized enterprises lacking core competitiveness will be gradually eliminated by the market in the competition. From the perspective of enterprise financial management level, some photovoltaic enterprises are relatively lack of internal control, the financial report is not open, the use of financing funds and enterprise operation situation investors can not know, financial institutions are difficult to assess the financing risk of enterprises, so they are reluctant to lend. On the other hand, for most enterprises, limited by the high threshold of financing channels, they are more inclined to informal financing, or bear high debt financing costs. The relatively single financing structure and high interest burden limit the further development of enterprises.

#### *2.2.3 Weak credit concept*

According to existing research data, the life cycle of small and medium-sized private enterprises in China is generally short. Some enterprise owners blindly follow the trend of investment hot spots and pursue profits, lacking due entrepreneurship. When faced with major interest temptations and real business crises, individual enterprise owners may cheat for financing funds and maliciously evade debt obligations, affecting the rights and interests of creditors. In addition, as an important symbol to measure the credit level of enterprises, the credit rating of small and medium-sized enterprises is often low, and even most enterprises can not meet the relevant standards of credit rating, lacking the evaluation of credit indicators and the credit endorsement of authoritative institutions, small and medium-sized photovoltaic enterprises are also difficult to carry out relevant investment and financing activities.

### *2.3 External financing constraints*

#### *2.3.1 Macro financing environment constraints*

With the continuous promotion of financial deleveraging by the Chinese government, the risk control of financial institutions has been gradually strengthened and accompanied by a strong risk aversion. They have a strong financing preference for state-owned enterprises and large enterprises, which has led to the strengthening of external financing environment constraints for small and medium-sized photovoltaic enterprises. With the reduction of bank credit, small and medium-sized enterprises have to seek informal private finance, which increases the difficulty and cost of financing. On the other hand, the credit crunch caused by the lagging effect of financial deleveraging has brought greater financing constraints to small and medium-sized photovoltaic enterprises. The financing structure highly dependent on bank loans is relatively solidified, which is also not conducive to small and medium-sized photovoltaic enterprises obtaining financing. In addition, China currently adopts a strict application review system for the public offering of funds. For small and medium-sized photovoltaic enterprises, it is difficult to go public or issue corporate bonds.

#### *2.3.2 Differences in the structure of financing products*

Compared with traditional enterprises, the capital-intensive characteristics of the photovoltaic industry determine that it is more dependent on external capital. From the establishment to development of enterprises, a large amount of capital is needed, and it is often difficult for a single financial institution to meet the financing needs of enterprise expansion, while the financing provided by a bank group is usually open to large photovoltaic enterprises. For example, GCL-Poly, and Trina Solar have successively obtained high syndicated loans at low interest rates, while the practice of syndicated loans for small and medium-sized photovoltaic enterprises is relatively small. For some small and medium-sized photovoltaic enterprises with technological innovation and growth potential, the use of equity investment also has certain business risks. Technological innovation of the photovoltaic industry needs long-term deep cultivation and continuous investment. The entry of external equity may interfere with the original decision making and daily management of enterprises, and foreign capital may blindly pursue profits and lead to business failure. On the other hand, the characteristics of the photovoltaic industry determine its financing needs with long-term and low financing costs, and the degree of fit with the user portrait of the traditional financing model of financial institutions is not high enough. Therefore, there is a certain gap between the term of financing loans provided by financial institutions and the development cycle of photovoltaic industry, and the financing needs of financing products and services for photovoltaic industry have structural differences.

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#### *2.3.3 Lack of credit guarantee mechanism*

The relatively weak credit concept is the internal weakness of small and medium-sized photovoltaic enterprises, but the relative lack of external credit system and mechanism and the neglect of small and medium-sized enterprises are objective problems. At present, China has not yet formed an effective credit evaluation system for SMEs. At the same time, most of the utility guarantees for SMEs remain in the credit amplification of stock assets, which makes it difficult to conduct risk assessment and risk control. In addition, financing guarantee institutions often appear as a third party, and financial institutions such as banks have a stronger voice as fund providers. Financing guarantee institutions are often mere formality, unable to play an effective role in guarantee and supervision.

## 3. Countermeasures and suggestions for solving the financing problems of small and medium-sized photovoltaic enterprises

### *3.1 Construct a multi-channel financing support system for small and medium-sized photovoltaic enterprises*

For small and medium-sized photovoltaic enterprises, to solve their financing problems, we must start with channels, enrich the channels that small and medium-sized photovoltaic enterprises can obtain financing support, and build a multi-channel support system focused on serving the development of small and medium-sized photovoltaic enterprises, so as to reduce the high dependence on bank credit and the frequency of using private informal finance, enrich the financing channels of enterprises, reduce the financial risks and financing costs they face, and help them develop better. At present, many innovative measures have been taken for the financing channels of China's photovoltaic industry, such as asset securitization, green bonds, carbon asset pledge financing, etc., but there is still a long way to go before they are applied to the financing practice of small and medium-sized photovoltaic enterprises. The services of financial institutions need to be innovated in form and content. In combination with the characteristics of small and medium-sized enterprises and photovoltaic industry, targeted development of financial products with a longer loan term, relaxation of the review threshold and collateral requirements, so as to open financing channels for small and medium-sized photovoltaic enterprises. For example, through the development of asset backed commercial paper (ABCP) related products, SMEs can be encouraged to directly finance from the money market, reduce the financing threshold and cost, expand the financing scale, and extend the financing cycle by adopting recyclable financing, so as to gradually establish a direct financing system that helps improve the financing environment of SMEs, thus meeting the financing needs of small and medium-sized photovoltaic enterprises [11]. On the other hand, photovoltaic enterprises have different financing needs at different stages of their life cycle, so they can adopt diversified financing methods and flexibly use different financing channels to obtain funds needed for development. The combination of financing modes can further optimize the debt structure of enterprises and effectively disperse risks. When the external financial environment changes, diversified financing modes can maintain the stability of enterprises' financing capacity and meet financing needs, reduce the business risks of enterprises, and provide a new way for the development of photovoltaic enterprises.

### *3.2 Improve the internal management level of small and medium-sized private photovoltaic enterprises*

If small and medium-sized photovoltaic enterprises want to survive in the fierce competition in the industry, the external financing support plays an important role, while the scientific management inside the enterprise has an irreplaceable significance. For most small and medium-sized photovoltaic enterprises, the imperfect establishment of modern enterprise management system is an important factor for their competitive failure. Small and medium-sized photovoltaic enterprises should promote the standardization and modernization of their internal organizational system as soon as possible, gradually get rid of the tendency of family, establish a standardized supervision and restriction mechanism, scientific management decision-making, strengthen internal control, and improve the efficiency of enterprise management. More importantly, to solve the financing problems of small and medium-sized photovoltaic enterprises, we must focus on the improvement of enterprise financial management level, establish a sound and perfect modern financial management system, reasonable planning of the use of

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funds, do a good job in enterprise budget management, and improve the efficiency of fund operation. On the other hand, strengthen the internal control of enterprises, improve the ability and quality of enterprise financial personnel and audit personnel, and constantly improve the internal management level of enterprises.

### *3.3 Promote the improvement of the whole society's credit system and financing guarantee mechanism*

The government should take active measures to establish an effective financing support system for small and medium-sized enterprises, promote the standardization of the business credit environment, build a sound credit rating system for small and medium-sized enterprises, encourage the development of local credit rating agencies, appropriately relax the entry threshold of international credit rating agencies, and promote the improvement of the level and capacity of local credit rating agencies. At present, there is a certain credit asymmetry between SMEs and financial institutions. The existing public service platform for SMEs can be upgraded and improved to form a unified enterprise financial information and utility query platform, establish a good docking channel between enterprises and institutions, eliminate information blind areas, and provide financing convenience for SMEs.

## 4. Conclusions

Through reviewing the financing difficulties of small and medium-sized photovoltaic enterprises, we found that the financing difficulties of enterprises mainly come from three aspects: historical influence, internal factors and external environment, and are comprehensively affected by many factors, such as industrial history, industrial structure, own scale, financial management ability, external financing constraints and macro economic environment. For China's small and medium-sized photovoltaic enterprises, there is a certain structural difference between various financing products and services and their financing needs, and their financing channels need to be further expanded. Secondly, the unreasonable financing structure and high financing costs of photovoltaic enterprises inhibit the long-term healthy development of SMEs, and also affect the industrial coordination of the photovoltaic industry to a certain extent, which is not conducive to the progress of China's photovoltaic industry. Finally, affected by the policy guidance of the national "double carbon" goal and the macro-control of economic policies, the financing environment of photovoltaic enterprises has been greatly improved. While making full use of the existing financing channels, photovoltaic enterprises should also start from their own enterprises, seize the opportunities, promote product technology innovation and enhance their competitiveness. At the same time, we should also improve the level of financial management and the efficiency of financing utilization, strengthen the internal control of enterprises, and take multiple measures to accelerate the development of enterprises.

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