

2024 Photovoltaic Listed Companies

Climate Action Transparency (CATI) Evaluation Report

May 2024

Executive Summary

Currently, China's photovoltaic (PV) industry has been the global leader. As an industry of “manufacturing green”, the PV industry faces increasingly stringent “green manufacturing” requirements in the market. To quantitatively assess the progress of PV enterprises in low-carbon transition and promote the construction of a green supply chain, the Institute of Public & Environmental Affairs (IPE) and Lvse Jiangnan (PECC) launched the PV Listed Companies CATI Index Evaluation Project at the beginning of 2024, evaluating 42 listed companies in the PV industry with manufacturing process of polysilicon, silicon rods, silicon ingots, wafers, batteries, modules, and inverters.

The initial evaluation results show that many PV enterprises are actively responding to the dual carbon policy requirements, implementing energy-saving and emission reduction projects, and promoting green transformation of the industrial chain. Leading enterprises are responding to the market demand for low-carbon PV products by conducting product lifecycle assessments and advancing green supply chain development. However, most PV enterprises still need to benchmark against the advanced and improve their corporate climate governance levels.

1. Opportunities and Challenges of China's PV Industry

In the past decades of economic development, China's PV industry has experienced ups and downs, and has overcome numerous difficulties. Currently,

China's PV industry has become the global leader: from technology research and development to production and manufacturing, it dominates the global supply chain of this important industry, effectively supporting the growth of China's domestic PV market and the global demand for new energy¹. Moreover, several leading Chinese PV enterprises are expanding their overseas production capacity, further capturing market share in PV products². The government work report issued at the opening meeting of the second session of the 14th National People's Congress (NPC) emphasizes strengthening the construction of wind and solar power bases, and energy transmission channels. This brings continued growth to the PV market and indicates that the installation capacity for PVs still has room for upward expansion³.

However, the PV industry, which is crucial to the success of the global energy transition, inevitably becomes the focus of global industrial competition. Many countries have successively introduced corresponding industrial incentive mechanisms aimed at increasing investment and financing, and creating local PV value chains. Some regions have tightened the entry barriers of the PV market through green market rules such as carbon footprint limits for PV products, eco-design, and eco-labels.

The production and manufacturing of products such as silicon materials and wafer modules in the PV industry, as well as the upstream and downstream transportation, distribution, and disposal of waste PV modules, consume a large amount of energy and water resources, generate significant carbon and pollutant

¹ https://www.gov.cn/xinwen/2023-02/17/content_5741877.htm

² <http://finance.sina.com.cn/jjxw/2022-05-09/doc-imcwipii8873366.shtml>

³ https://www.gov.cn/yaowen/liebiao/202403/content_6936357.htm

emissions, and produce a large amount of waste. Regarding green supply chain management in the PV industry, in 2020, Dr. Mao Tao from the Center for International Economic and Technological Cooperation of the Ministry of Industry and Information Technology pointed out: "Guide core enterprises to build a green supply chain, and shift focus from 'manufacturing green' to both 'manufacturing green' and 'green manufacturing'." ⁴ In the context of global green and low-carbon development, Chinese PV enterprises need to pay more attention to domestic and international ecological environment and climate-related regulations and standards, and accelerate the green and low-carbon transition of their own industrial chains.

2. PV Listed Companies Climate Action Transparency (CATI) Evaluation

(1) Corporate Climate Action Transparency Index (CATI)

With technical support from the Chinese Research Academy of Environmental Sciences, IPE upgraded the Supply Chain Climate Action Index (SCTI) developed in 2018 to the Corporate Climate Action Index (CATI). This index quantitatively evaluates the climate actions of domestic and international enterprises across five dimensions: governance mechanisms, measurement and disclosure, carbon target setting, carbon target performance, and emission reduction actions. In 2023, IPE once again upgraded the CATI Index, adding the indicator of 'measuring and disclosing product carbon

⁴ MAO Tao, LV Fang, 2020, Suggestions for Improving Green Supply Chain Management in the PV Industry

footprint,' aiming to guide enterprises to focus on greenhouse gas emissions at each stage of its lifecycle, from raw material extraction, production, distribution, storage, and use to disposal or recycling.

To facilitate investors' understanding of the evaluation results, we categorize the evaluation results of listed companies' CATI Index into three levels and nine grades, with scores represented as AAA, AA, A, BBB, BB, B, CCC, CC, and C. Level A indicates high levels of information disclosure and greenhouse gas emission reduction in their operations and supply chain, Level B indicates a certain degree of information disclosure and emission reduction, and Level C indicates significant deficiencies in information disclosure and emission reduction.

(2) CATI Evaluation Results of PV Listed Companies

Among the top ten companies in 2024 CATI evaluation of PV listed companies (Fig. 1), **LONGi (601012)** received an Grade A. LONGi has not only started accounting and disclosing Scope 3 emissions data, setting and tracking Scope 3 emission reduction targets, but also collaborates with major supplier partners in emission reduction projects and guides its suppliers to conduct carbon disclosure. **JinkoSolar (688223)**, **Canadian Solar (688472)**, **Trina Solar (688599)**, and **JA Solar (002459)** received a Grade BB. These leading companies have begun to establish green procurement requirements and are gradually implementing supply chain emission reduction actions. Additionally, **TONGWEI (600438)**, **TZE (002129)**, **SUNGROW POWER SUPPLY**

(300274), GCL TECH(03800), and XINYI SOLAR (00968) rated as Grade B, also performed well in designing low-carbon transition paths for the supply chain and empowering suppliers in carbon accounting. The proportion of companies rated Grade B and above reached 24% of the total evaluation companies.

A 601012	BB 688223	BB 688472	BB 688599	BB 002459
				
B 600438	B 002129	B 300274	B 03800	B 00968
				

Fig 1. 2024 CATI TOP 10 PV Listed Companies

While leading companies have made progress, more than 60% of the PV listed companies were rated as Grade C, with an average score of only 3.38. This indicates that most PV enterprises need to improve their climate performance. Most companies are currently still primarily focused on the calculation and reduction of Scope 1 & 2 emissions, and the low-carbon transition path of the value chain remains unclarified.

3. Findings from PV Listed Companies CATI Evaluation

Finding 1: 8% of PV listed companies have made climate commitments, but the overall climate disclosure performance of the industry is still insufficient to meet new domestic and international disclosure regulations.

The evaluation shows that, in terms of governance and management, 33 PV listed companies have begun to formulate and publish corporate policies regarding decarbonization and 17 PV listed companies have integrated climate-related issues into board-level oversight. In terms of measurement and disclosure, 18 PV listed companies have accounted for and disclosed their Scope 1 & 2 emissions, and 6 of them have already started accounting for and disclosing their Scope 3 emissions.

In terms of target setting, 8 PV listed companies have set and disclosed Scope 1 & 2 emission reduction targets, and 3 companies have included Scope 3 in their climate goals. **LONGi (601012) and JinkoSolar (688223)**'s emission reduction targets have approved by the Science Based Targets Initiative (SBTi); 3 PV listed companies have committed to achieving carbon neutrality for Scope 1 & 2 by 2050; **JinkoSolar (688223)** commits to achieving net-zero emissions across the entire value chain by 2050. Also, 6 companies have committed to using 100% renewable energy for their operations by 2030.

Despite the proactive climate actions of the aforementioned companies, the disclosure of climate information in the PV industry is still insufficient to meet the increasingly stringent new disclosure regulations both internationally and within China.

In recent years, organizations and institutions such as the International Sustainability Standards Board (ISSB), the European Commission, and the U.S. Securities and Exchange Commission (SEC) have successively issued or further enhanced standards for the corporate climate change-related information disclosure, especially for listed companies. These standards also gradually expand climate disclosure requirements to Scope 3 related information. For example, the IFRS S2 Industry-based Guidance issued by the ISSB also recommend that PV enterprises disclose indicators such as total energy consumption, renewable electricity consumption, and purchased grid electricity consumption⁵.

However, the evaluation results show that more than half of the PV listed companies have not yet conducted accounting and disclosure of carbon emissions and energy consumption. More than 80% of PV listed companies have not yet incorporated supply chain emission reductions into their corporate decarbonization strategies and have not disclosed Scope 3 emissions and emission reduction targets. These enterprises urgently need to assess their own operational and value chain carbon emissions, set climate goals, and implement emission reduction projects to comply with the aforementioned new regulations.

⁵ <https://www.ifrs.org/projects/completed-projects/2023/climate-related-disclosures/appendix-b-industry-based-disclosure-requirements/>

Finding 2: 10 PV listed companies have calculated and disclosed product carbon footprint, actively responding to the “green constraints” in the international PV market.

The evaluation shows that **JinkoSolar (688223)**, **JA Solar (002459)**, **Canadian Solar (688472)**, and other 10 leading PV listed companies have accounted for and disclosed PCF-related information for multiple products, such as monocrystalline and polysilicon PV modules, batteries, and wafers. Among them, 7 companies have obtained Environmental Product Declaration (EPD) certification.

The demand for green and low-carbon products in the international market is increasingly rising, and several countries are tightening requirements on the green attributes of imported products to protect the competitiveness of domestic enterprises. Regarding PV products, French ECS Carbon Footprint imposes the product carbon footprint limits of PV modules that enter the French market. The United States and the European Union encourage companies to engage in emission reduction and information disclosure through environmental labels and Type III Environmental Product Declaration (EPD) systems. These all pose challenges to the export of Chinese PV products.

In China, multiple policy documents have repeatedly proposed tasks such as “green and environmentally friendly transformation of the entire product lifecycle”, “establishing carbon footprint standards for key products throughout their lifecycle”, and “establishing a carbon emissions database for key products throughout their lifecycle”. Social organization standards such as the “Technical Specification for Green

Design Product Evaluation—PV Wafer” and “Technical Specification for Green Design Product Evaluation—PV Modules” have also been released. These efforts will help accelerating the mutual recognition between China's and international standards, including carbon accounting and verification standards and data collection rules, and emission factors database. This also will promote enhanced communication and exchange among all parties, and assist Chinese PV enterprises in meeting the data requirements of overseas stakeholders.

Finding 3: 70% of PV listed companies actively apply renewable energy and improve production energy efficiency. However, with insufficient carbon management in the supply chain, the PV industry chain still faces challenges in aligning with the Paris Agreement targets for low-carbon transition.

29 PV listed companies are actively engaging in the utilization of renewable energy. These companies have increased the proportion of renewable energy use through rooftop PV panel installations, power purchase agreements with suppliers, and purchasing energy attribute certificates. On-site investigation conducted by Lvse Jiangnan on 61 subsidiaries of PV listed companies shows that, 70% of subsidiaries have built rooftop PV projects within their facilities, with 95% of them having a rooftop PV coverage rate exceeding 50%, and 78% having a coverage rate exceeding 80%⁶. 28 PV listed companies are undertaking emission reduction actions such as energy

⁶ The PV coverage rate is estimated by Lvse Jiangnan based on the roof area of the enterprise's factory and the PV coverage area. It does not represent the actual PV coverage area of the enterprise. The data is for reference only.

efficiency improvements, advanced process substitution, or targeting emissions from mobile sources, while 18 PV listed companies are implementing systematic energy management for energy saving and carbon reduction. In promoting the construction of a low-carbon supply chain, 6 PV listed companies have publicly disclosed initiatives to encourage suppliers to undertake corporate carbon accounting or energy management projects. Among them, **LONGi (601012)**, **JA Solar (002459)**, and **TZE (002129)** have disclosed emission reduction projects in collaboration with product manufacturing and logistics suppliers.

Although PV listed companies are actively engaging in emission reduction actions within their operations under the guidance of climate goals, the evaluation shows that most PV listed companies still score significantly low, with a slow progress in low-carbon transition along the value chain. Achieving climate goals in line with the Paris Agreement remains challenging. 80% of PV listed companies have not yet implemented green supply chain management. A number of PV listed companies that have already committed to Scope 3 climate goals have not yet effectively undertaken supply chain emission reduction actions. As an industry of 'manufacturing green,' PV power generation is far from 'zero emissions' from a full lifecycle perspective. PV enterprises need to quickly collaborate with upstream and downstream partners to implement energy-saving and efficiency-enhancing projects at various stages of the industrial chain, increase the renewable proportion of its energy consumption, and enhance the technological research and development and large-scale application of low-carbon PV products.

Finding 4: The recycling of obsolete PV products offers significant emission reduction potential. Enterprises urgently need to focus on end-of-life emissions of products and promote the standardization and scaling of recycling mechanisms.

Based on the lifecycle analysis results of PV modules, recycling PV modules can reduce the negative environmental impacts caused by upstream raw material extraction, energy consumption and process emissions during production, and upstream and downstream transportation. The full lifecycle environmental and carbon footprint with waste recycling is significantly smaller than that with landfill disposal. 2024 CATI evaluation found that the PV industry as a whole still lacks sufficient attention to the waste product recycle and reuse. Some of the listed companies have independently established end-of-life recycling mechanisms for PV products, but further disclosure of quantitative product recycling performance and the destination after recycling is still needed. A few companies have disclosed their product disassembly and recycling rates that remain at the laboratory stage, and the extent to which they can be commercially applied in the market is still unclear.⁷

The market prospects for the recycling and reuse of PV modules are enormous. In recent years, the State Council, the National Development and Reform Commission, and other departments have issued policy documents such as the “Guiding Opinions on Promoting the Recycling of Decommissioned Wind Power and PV Equipment” and the “Opinions on Accelerating the Construction of a Waste Recycling System”, aiming to promote the recycling of decommissioned wind power and PV equipment and to

⁷ Jia Xiaojie et al., 2023, Environmental Impact Analysis of Crystalline Silicon PV Module Recycling Technology

push related policies refinement. However, the domestic PV recycling market and the commercial model for handling waste PV modules are not yet fully built, lacking regulation and a systematic recycling mechanism, and most recycling work is carried out by companies in the metal recycling industry. This leads to the high costs of recycled materials in the market. In addition, the non-standard methods of component dismantling result in low resource recovery rates, with sulfurous exhaust gases and wastewater containing heavy metals being discharged into the environment. To form a green closed loop in the PV industry chain, it is necessary not only to have more comprehensive policies, regulations, and standard guidelines but also to strengthen the supervision and guidance of related industries. Additionally, market mechanisms such as subsidies and green finance should be used to incentivize PV enterprises to participate in the construction of recycling systems.

4. Recommendations for Promoting the Low-Carbon Transition of China's Listed PV Companies

IPE recommends that leading listed companies in the PV sector recognize the importance of carbon emission reduction in the supply chain and effectively integrate it into corporate governance and supplier management mechanisms. This involves shifting the focus from “manufacturing green” to both “manufacturing green” and “green manufacturing”. PV listed companies need to pay attention to and participate in the Guidelines for information disclosure of corporate greenhouse gas emission, calculate and disclose corporate carbon data of scope 1,2 & 3, and gradually calculate

carbon emissions from purchased goods and services in Scope 3, based on supplier-specific data.

In order to meet the increasingly stringent product-level requirements of overseas markets, PV enterprises especially need to carry out the calculation and disclosure of product carbon footprints. IPE also recommends that PV enterprises promote research on industry decarbonization pathways and decarbonization technologies, enhance the power generation efficiency of PV products, and increase the use of clean energy in the production process while improving production energy efficiency; incorporate the climate action performance of suppliers into procurement considerations, encouraging suppliers to conduct carbon accounting, set scientific emission reduction targets, and disclose progress against targets; focus on the carbon emissions at the end of the product lifecycle, collaboratively advancing and gradually improving the scientific dismantling, decomposition, and reuse of waste PV modules in a scalable process to maximize resource utilization. Additionally, PV enterprises need to support the exploration of nature-based supply chain emission reduction solutions, in coordination with biodiversity conservation and climate action.

IPE suggests that financial institutions improve the climate information disclosure requirements for companies seeking for financing supports, guiding these companies to focus on building a zero-carbon supply chain; support the development and application of key technologies for supply chain carbon neutrality, and provide financial support for large-scale projects with long borrowing periods during the zero-carbon transition of the supply chain.

Finally, IPE recommends that stakeholders such as PV industry associations and environmental organizations work together to promote the formulation of policies, regulations, and standards conducive to accelerating supply chain decarbonization. This includes assisting in the improvement of product carbon footprint measurement and disclosure standards, and promoting product carbon footprint disclosure and global mutual recognition; building zero-carbon supply chain data infrastructure, and developing information management platforms and digital solutions; establishing a constraint and incentive mechanism to encourage PV enterprises to play a leading role, to drive core supply chain enterprises to join climate action; conducting data-driven evaluations on supply chain climate action performance, and forming a joint effort among upstream and downstream enterprises to accelerate the green low-carbon transition of the industrial chain.

About IPE

The Institute of Public & Environmental Affairs (IPE) is a non-profit environmental organization based in Beijing, China. Since its establishment in 2006, IPE has developed and operated the Blue Map Database (www.ipe.org.cn), and launched the Blue Map app in 2014, promoting environmental information disclosure, facilitating green supply chain and green finance, empowering the green transition and growth of enterprises, and boosting multi-stakeholder participation in environmental governance.

About PECC

SIP Lvse Jiangnan Public Environment Concerned Centre (PECC) is an environmental public welfare organization registered in Suzhou, Jiangsu Province, China on March 22, 2012. Always adhering to the work attitude of "we eliminate pollution, but not to eliminate polluting enterprises, instead to nudge polluting enterprises for elevated pollution control".

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Note

1. This round of evaluation was performed from September 30, 2023, to March 31, 2024;
2. The information used for evaluation was obtained from official websites of corporations; annual reports, corporate social responsibility (CSR) reports, environmental, social, and governance (ESG) reports, and other regular reports; information released in public channels, such as on official websites; data released by credible sources collected by the Blue Map database.