

European Solar PV Manufacturing: Terminal Decline or Hope for a Rebirth?

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► Key Takeaways

- Installed solar photovoltaic (PV) capacities are experiencing an unprecedented increase in Europe: in two years, they have been multiplied by two with 60 GW added in 2023. However, local solar PV manufacturers are not benefiting from it as the Chinese competition is knocking them down.
- Structurally much more competitive, prices of Chinese solar panels have further decreased by 42% in 2023 – making it difficult even for some Chinese companies to survive and forcing many of the remaining European manufacturers out of the market.
- This situation fragilizes Europe's strategic autonomy and decarbonization. Covid-19-like disruption or an aggression against Taiwan would leave the continent without any supply. American manufacturers are also flexing their muscles with the aggressive Inflation Reduction Act.
- Europe's answer, the Net Zero Industry Act (NZIA), a tougher approach to China's imports and national support measures, could create a new generation of solar PV manufacturers in Europe.

Introduction

While solar photovoltaic (PV) installations are booming in Europe (and in other parts of the world), the local industry is closing down. In 2023, an estimated total of nearly 60 gigawatts (GW) of new solar capacities were added to the grid in Europe, a 40% increase compared to 2022. In two years, the European installed solar PV capacity has been multiplied by two.¹ On the other hand, the remaining European manufacturers of solar PV panels are dying: in August 2023, Norwegian Chrystal went bankrupt, and NorSun temporarily stopped its activities. A few months later, Energetic Industries (Austria) and Exasun (Netherlands) filed for insolvency. In February 2024, Meyer Burger announced it would close its Freiberg (Germany) factory to move to the United States (US) to benefit from better conditions and support. In April, the French Systovi went into liquidation. Many actors involved in the field expect many new names to be added to this list in the coming months.

How did the European Union (EU) come to this situation? The current crisis is mostly the result of different factors: 1) a dependence on Chinese solar panel prices, 2) a lack of European production capacities, and 3) high production costs. This situation is concerning, as it threatens Europe's reindustrialization plans, its strategic autonomy, and its decarbonization: the supply of elements that are essential for solar panels could be interrupted by many events, for instance, a new Covid-19 lockdown or a war in Taiwan that would cut Europe from the Chinese panels and would impact its low-carbon plans. Moreover, at stake is also the ability to retain some know-how in key equipment and machines.

A booming sector, an industry in crisis

Solar PV installations have experienced an unprecedented increase over the past years in the world, including in Europe. The 60 GW new capacity added in 2023 in Europe means 306,000 solar panels are installed per day, resulting in 263 GW of cumulative installations. The addition of new installations is, however, expected to slow down and should remain below +20% until 2027, with "only" +11% for 2024.²

Table 1 shows that Germany has the largest installed capacity in the EU. In 2023, the demand was equally spread over residential, commercial, industry, and utility-scale segments, but the residential sector is steadily rising, moving from 21% of the overall demand in 2019 to 1/3 in 2023.

1. "EU Market Outlook for Solar Power 2023-2027", *SolarPower Europe*, December 2023, available at: www.solarpowereurope.org.

2. "EU Market Outlook for Solar Power 2023-2027", *SolarPower Europe*, *op. cit.*

Table 1. 2023 Total solar capacity in 10 selected European countries

Country	Total Capacity (GW)	Share of the European Solar Market
Germany	82.1	25%
Spain	35.6	15%
Italy	29.5	9%
Poland	16.8	8%
France	18.7	5%
Netherlands	22.5	8%
Belgium	9.5	3%
Greece	7.2	3%
Austria	5.9	4%

Source: "EU Market Outlook for Solar Power 2023-2027", SolarPower Europe, December 2023.

Table 2. Main European objectives and targets related to solar power in Europe

Plan/Initiative	Ambition	Year	Sectors
Green Deal & European Climate Law	Carbon neutrality	2050	All
Fit for 55	-55% emissions with 1990 as a baseline	2030	All
Renewable Energy Directive (2023)	At least 42,5% of RE in the energy mix, with non-binding additional 2,5%	2030	Renewables
REPowerEU	320 to 400 GW of PV installed capacities	2025	Solar PV
	600 to 750 GW of PV installed capacities	2030	Solar PV
NZIA	40% of local production for a selected number of low-emissions industries	2030	Net-zero technologies

Adapted from Thibaud Voita, "Can Europe Become a Solar Power Again? An Analysis of Solar PV Supply Chains in Europe" [available in French and German], DFBEW – OFATE, December 2023, available at: <https://energie-fr-de.eu>.

Table 3. China's Dominance of Solar PV Production

Year		Poly-silicium	Wafers	Cells	Modules
2021	Capacity	203 GW	355 GW	349 GW	344 GW
	Global share	80%	97%	85%	75%
2024, estimates	Capacity	968 GW	831 GW	1,094 GW	931 GW
	Global share	93%	95%	88%	83%

Source: "Solar PV Manufacturing Capacity by Component in China, 2021 – 2024", IEA, May 24, 2023, available at: www.iea.org.

China: Boosting exports of solar panels against a looming overcapacity crisis

This important surge in solar power in the EU has come at a cost borne by the European solar manufacturing industry and is, to a certain extent, the result of a looming overcapacity crisis in China. This Chinese supremacy is based on a complex web of driving factors, mixing a strong political leadership aiming to build up local industry, fierce domestic competition encouraging innovation, highly efficient, large-scale production in value chain ecosystems, and generous public financial support.

The Chinese industry took over in the second half of the 2000s and benefited from massive support from governments, both national and local. This support included loans

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at preferential rates, special electricity tariffs, and preferential conditions to manufacturers for land attribution – all these next to cheap local and, most likely, forced labor. In 2015, the “Made in China 2025” strategy, followed by the two subsequent five-year plans, added support and included solar as a top national industry. These conditions allowed China to emerge as a global player in the solar industry, while European pioneers (typically, from Germany) had to close their factories.³ China is now responsible for more than 90% of the world's production in some segments, as **Table 3** shows, and is also home to the then-biggest solar PV manufacturers with global heavyweights such as LONGi, Jinko Solar, and JA Solar.

The Chinese solar PV industry became a victim of the country's success. Chinese companies have managed to improve their efficiency, notably by streamlining and integrating their production chains, and benefiting from downward trends in terms of

3. H. Tan, “Solar Energy in China: The Past, Present, and Future”, *China Focus*, University of San Diego, February 16, 2021, available at: <https://chinafocus.ucsd.edu>; X. You, “The ‘New Three’: How China Came to Lead Solar Cell, Lithium Battery and EV”, *China Dialogue*, November 7, 2023, available at: <https://chinadialogue.net>.

polysilicon prices.⁴ As a result, manufacturers suffer from excess production capacity that further drags prices down. The price of solar PV components in China fell from approximately 7 renminbi (RMB) in 2022 to 2 in early 2024. At the beginning of 2023, Chinese solar panels were already about 1/3 cheaper than European ones, but their prices went further down by 42% during the year.⁵ Some Chinese manufacturers are also experiencing difficulties preserving their profits, with layoffs and production cuts, which led LONGi, the biggest manufacturer, to ask for the government to set a minimum price for solar panels.⁶

One of the ways to address this overcapacity has been for the Chinese to sell their goods abroad. However, many markets, such as the US, suspecting Chinese PV to involve forced labor or India, have put restrictions on Chinese imports, leading the manufacturers to flood the European market, which remained open with cheap products, exceeding its absorption capacity. In Spring 2023, solar panels started piling up in European storage houses. A year later, some Europeans had so many solar panels that they would turn these into... fences.⁷ About 80 GW were said to be waiting for installation by the end of 2023, though this number is probably vastly exaggerated as it takes into account old panels or panels waiting to be delivered abroad.⁸ This flood led many European companies to stop their activities, as mentioned above, and the EU to launch investigations into potential excessive subsidies that benefited two Chinese companies in a tender in Romania.⁹ It could be followed by other cases. At the same time, in March 2024, the EU reached a provisional agreement for the creation of a new instrument to ban products made with forced labor from entering the EU market.¹⁰

How do we stay in the manufacturing segment?

The 2022 US Inflation Reduction Act (IRA) “aims to catalyze investments in domestic manufacturing capacity, encourage procurement of critical supplies domestically or from free-trade partners, and jump-start R&D and commercialization of leading-edge”. It gathers an estimated amount of 500 billion dollars (USD) in subsidies (spending and

4. Opis, “Polysilicon Prices Persist in Potential Trend Downward, Governed by Unfavorable Factors”, *PV Magazine*, March 22, 2024, available at: www.pv-magazine.com.

5. Spot price of M10 panel chips. See A. Hayley, “China Solar Industry Faces Shakeout, But Rock-bottom Prices to Persist”, Reuters, April 2024, available at: www.reuters.com.

6. “China’s Top Solar Panel Maker Calls on Beijing to Control Prices”, *Bloomberg*, March 4, 2024, available at: www.bloomberg.com.

7. “Global Glut Turns Solar Panels into Garden Fencing Option”, *Financial Times*, April 2, 2024, available at: www.ft.com.

8. J. Chirol, “Un stock européen de panneaux photovoltaïques surestimé et peu adapté au marché français”, *PV Magazine*, January 29, 2024, available at: www.pv-magazine.fr.

9. F. Y. Chee, “Exclusive: EU Investigates Chinese Bidders Over Romania Solar Tender”, Reuters, April 3, 2024, available at: www.reuters.com.

10. “Deal on EU Ban on Ban Products Made with Forced Labour”, European Parliament, March 5, 2024, available at: www.europarl.europa.eu.

tax breaks) targeted in the clean energy and healthcare sectors.¹¹ Recently, the US Department of Energy (DoE) announced additional support for a USD 4 billion tax credit that could potentially benefit the solar industry.¹² The US also implemented a ban on Chinese PV product materials potentially tied to forced labor,¹³ and Treasury Secretary Janet Yellen adopted an aggressive rhetoric about the cheap Chinese solar panels in preparation for her April 2024 trip to China and brought up the topic in Beijing.¹⁴

The IRA resulted in an important surge of new PV industrial projects

The IRA resulted in an important surge of new PV industrial projects. The US Solar Energy Industries Association (SEIA) reported that projects representing a total of 155 GW of manufacturing capacity have been announced during the first IRA year and that USD 565 billion shall be invested until 2032, bringing the capacities to 669 GW.¹⁵ The SEIA also estimates that by 2026, the capacity should reach 108.5 GW, which is approximately ten times what it was in 2022 (10.6 GW).¹⁶ It seems, however, quite likely that, as it usually goes after such announcements, many projects will not be completed for various reasons. By late 2023, it was estimated that the total national manufacturing capacity would reach 35 GW by the end of 2024¹⁷ – far from the 108.5 GW planned by the SEIA for 2026 but still representing a quadrupling in 24 months. The IRA has been compelling enough to lead the solar PV manufacturer Meyer Burger to relocate a German factory to the US.¹⁸ While the IRA has shown rapid and impressive results during its first months of implementation, the International Monetary Fund (IMF) believes that some obstacles, especially in terms of permitting, may result in a slowdown of new projects.¹⁹

Major policies from other countries include India's 2020 Production-Linked Incentive (PLI) scheme, which dedicates USD 800 million to the solar industry and complements import restrictions voted in 2018.²⁰ India's manufacturing capacities had reached 64.5 GW by the end of 2023 and are expected to rise to more than 75 GW by 2026.

11. "Summary of the Energy Security and Climate Change Investments in the Inflation Reduction Act of 2022", Senate Democrats, available at: www.democrats.senate.gov. Quote taken from "The Inflation Reduction Act: Here's What's in It", McKinsey & Company, October 2022, available at: www.mckinsey.com.

12. "Qualifying Advanced Energy Project Credit (48C) Program", *Clean Energy Infrastructure*, US Department of Energy, 2024, available at: www.energy.gov.

13. N. Groom, "Exclusive: U.S. Blocks More Than 1,000 Solar Shipments over Chinese Slave Labor Concerns", Reuters, November 11, 2022, available at: www.reuters.com.

14. "Yellen Warns China Against Flood of Cheap Green Energy Exports", *New York Times*, March 27, 2024, available at: www.nytimes.com.

15. "Celebrating One Year of the Inflation Reduction Act", Fact Sheet, Solar Energy Industries Association (SEIA), August 2023, available at: www.seia.org.

16. "Solar Market Insight Report 2023 Q3", SEIA, September 2023, available at: www.seia.org.

17. J. T. Jacobo, "US Module Capacity to Reach 35GW by Year's End, Says CEA", PVTech, 2024, available at: www.pv-tech.org.

18. "Meyer Burger Calls EGM to Approve CHF 200 to 250 Million Rights Issue to Finance the Completion of its Colorado and Arizona Manufacturing Facilities", *The Financial Times*, February 23, 2024, available at: <https://markets.ft.com>.

19. S. Voigts and A.-C. Paret, "Emission Reduction, Fiscal Costs, and Macro Effects: A Model-Based Assessment of IRA Climate Measures and Complementary Policies", *IMF Working Papers*, February 9, 2024, available at: www.imf.org.

20. J. Gulia, S. Prabhakar *et al.*, "India's Photovoltaic Manufacturing Capacity Set to Surge", Institute for Energy Economics and Financial Analysis (IEEFA), April 4, 2023, available at: <https://ieefa.org>.

During the year 2023 alone, it added 20.8 GW of solar modules and 3.2 GW of cell production capacities.²¹ Other Asian countries, typically Malaysia and Vietnam, are also increasing their industry base, or Türkiye, with the industry branch of its Kalyon group.

The NZIA stands as the EU's answer to the IRA, intending to (re)develop the European clean tech manufacturing industry. It targets approximately 40% of the European solar PV that needs to be covered by the local industry by 2030, i.e., about 30 GW of industrial capacity.²² The following measures are relevant for the solar PV industry: the identification of Net-zero Strategic Projects, the lowering of administrative burden for developing net-zero manufacturing projects and simpler and faster permitting procedures, the implementation of sustainability and resilience criteria in procurement procedures and auctions to boost the renewable energy market, the establishment of regulatory sandboxes to help develop and test innovative net-zero technologies and create a level-playing field for innovation, and the creation of Net-Zero Industry Academies, with the support and oversight of the Net-Zero Europe Platform.²³

The NZIA is the result of compromises between the different Member States. Some countries, especially France and, to a lesser extent, Spain and Italy, wanted the act to promote a type of “buy European act”. They, at least openly, did not call for trade restrictions. Others have a more nuanced position. In Germany, there are open disagreements on the question within the ruling coalition: the Social Democratic Party (SPD) favors more support to the industry, but the Free Democratic Party (FDP) is against it. The Scandinavian countries remain opposed to any measure that could be seen as trade restrictions. SolarPower Europe (SPE) and Eurelectric, two very influential industry associations in Brussels, as well as the think tank Bruegel Institute, are also opposed to trade restrictions.²⁴ Most of them fear that the NZIA would result in retaliation from the Chinese and would also stop imports of wafers and ingots, two components for which China enjoys a quasi-monopole (see **Table 3**).

The NZIA has been preceded and complemented by policies such as the 2022 Temporary Crisis and Transition Framework (TCTF), which was revised in March 2023 and is supposed to run until the end of 2025, with a possible further extension.²⁵ It loosens

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21. “State of SolarPV Market In India 2024 – 20.8 GW Added in 2023”, Mercom, 2024, available at: www.mercomindia.com.

22. “Net-Zero Industry Act”, European Commission, 2024, available at: <https://commission.europa.eu>.

23. *Ibid.*

24. See the 2023 “Statement Opposing Trade Defence Measures”, signed by 433 companies and available at www.solarpowereurope.org; “Electricity Industry’s Concerns on the ‘Buy European’ Act”, Eurelectric, February 5, 2024, available at: www.eurelectric.org; B. McWilliams, S. Tagliapietra and C. Trasi, “A Smart Solar Strategy for Europe”, First Glance, February 6, 2024, available at: www.bruegel.org.

25. “State Aid: Commission Adopts Temporary Crisis and Transition Framework to Further Support Transition Towards Net-zero Economy”, European Commission, Press Corner, March 9, 2023, available at: <https://ec.europa.eu>.

European rules on state aid to allow the Member States to support its activities related to decarbonization. By September, it had resulted in 742 billion euros (EUR) of State aid.²⁶ The newly created Strategic Technologies for Europe Platform (STEP) was also meant to benefit net-zero technologies, including solar PV manufacturers, yet it was ultimately watered down from an initial proposed amount of EUR 10 billion to only an explicit 1.5 billion dedicated now to the European Defence Fund and the possibility of re-directing existing funds (notably cohesion funds). Finally, the sector can also receive support from the Innovation Fund, whose total firepower over the period 2020-2030 could amount to EUR 40 billion (based on a carbon price of EUR 75/t CO₂).

The NZIA has attracted many critics, especially when compared to the IRA. Among these, some regret the absence of significant financial support from the NZIA, which focuses mostly on non-budgetary measures, as compared to the IRA. This criticism is partially wrong, as it ignores the EU's historical support for clean techs: between 2021 and 2027, the EU budget is dedicating EUR 578 billion to climate action (national financial support excluded).²⁷ These climate policies, consisting of a combination of CO₂ emissions taxation and targeted industrial interventions, tend to be considered more efficient than IRA's measures and deemed to have a longer-lasting effect than production and investment incentives such as IRA's.²⁸

The NZIA still suffers from important limitations, especially when compared to the IRA. First, the IRA has allowed US solar manufacturers to temporarily bring down the price of their products to a level or even lower than their Chinese competitors (before the 2023 fall of Chinese prices), which is approximately 1/3 cheaper than European ones.²⁹ European companies also regret that contrary to the IRA, the NZIA does not include support for OPEX. They also criticize the complexity of the EU administration, for instance, when bidding for Horizon fundings, and would wish for an administrative "one-stop-shop". Finally, the non-price-based criteria in the public procurements are also the result of a compromise, as it is only limited to 30% of the auctions, while some Member States called for a bigger percentage.

Are gigafactories the future of the EU solar PV industry?

Despite the alarming situation of the European manufacturers, the European solar industry is not doomed. New projects are rising and enjoying broader support, at least in a few countries. These include the gigafactories developed by Enel, CARBON, or

26. T. Bourgerie-Gonse, "Analysis: EU Subsidy Race Is On – and Germany Is Winning It", Euractiv, November 8, 2023, available at: www.euractiv.com.

27. D. Keating, "The EU Is Offering as Much Green Funding as the US IRA. So Why Aren't Innovators Getting It?", *Energy Monitor*, October 25, 2023, available at: www.energymonitor.ai.

28. M. Fajean, N. Garnadt, V. Grimm *et al.*, "The US Inflation Reduction Act: How the EU Is Affected and How It Should React", *Vox EU CEPR*, October 17, 2023, available at: <https://cepr.org>.

29. "United States c-Si Manufacturing Costs with and without the IRA Manufacturing Production Credit Incentives, Compared to China and ASEAN", International Energy Agency (IEA), November 21, 2022, available at: www.iea.org.

HoloSolis. These projects have planned capacities of several GWs and integrated production for the whole value chain, allowing them to significantly reduce their costs. Their solar panels are unlikely to be cheaper than the Chinese's, but the cost difference shall be absorbed by a premium that customers could be willing to pay for "Made in Europe" products and by the overall solar installation kit (solar panels only represent 10 to 15% of the overall cost).³⁰

In addition, some national governments are ramping up to support their industry: in 2024, the Meloni government provided EUR 90 million to the 3 GW 3Sun project developed by Enel and branded as a symbol of "Made in Italy".³¹ In France, companies benefit from fiscal incentives (*crédit d'impôt industrie verte*), and the government announced in April a "Solar Pact": starting from 2025, its 30 signatories are committed to buying at least 30% of their solar panels from manufacturers whose conducted at least one phase of the production in Europe. It also sets the establishment of an "Induscore". It also announces new assessments of the carbon content of the projects with a low-carbon bonus, as well as the implementation of the resilience criteria starting in 2025.³² Finally, on April 15, 2024, 23 EU Energy Ministers and representatives from the European solar sector signed the EU Solar Charter in a sign of support for the European solar manufacturing sector, vowing to maintain and, where possible, to further expand production capacity in Europe and promote innovative forms of solar power deployment.

The European solar industry is not doomed

Ideally, the new generation of solar manufacturers will be able to address most of the current supply chain weaknesses with an integrated production that will allow them to reduce their production costs and be less dependent on exports. However, more needs to be done. The EU and the Member States should adopt a proactive approach to support the industry instead of simply passing new regulations as a reaction to multiple crises. This could be done by:

- Accelerating the adoption of non-budgetary measures – for instance, by increasing the percentage of auction shares under the "resilience criteria" that allows the selection of bidders based on non-price criteria.
- Creating a "Solar PV Bank" under the model of the Hydrogen Bank, as suggested by Solar Power Europe.
- Ensuring that the EU keeps a historical competitive advantage in R&D by supporting next-generation and more efficient solar PV (e.g., perovskite) or the inverter industry.

30. Interview and McKinsey & Company, "Building a Competitive Solar-PV Supply Chain in Europe", McKinsey & Company, December 13, 2022, available at: www.mckinsey.com.

31. "The Energy Transition in Europe: 3Sun, the Symbol of 'Made in Italy'", *Enel*, February 2024, available at: www.enel.com.

32. "Pacte de solidarité industrielle photovoltaïque", Press release, French Ministry of Economy, April 5, 2024, available at: <https://presse.economie.gouv.fr>.

- Protecting the industry from potential new cost increases, especially in the energy sector.
- Use the French induscore to promote the equivalent of the Battery Passport for PV, with information about the production, the CO₂ content, etc.

Additionally, actions are needed in terms of solar PV panel recycling to secure the availability of raw materials (silver, copper, etc.). Finally, the EU should adopt a more aggressive trade policy towards goods from forced labor, with a high environmental footprint or simply low-price imports from China, but also potentially in the future from India and the US.

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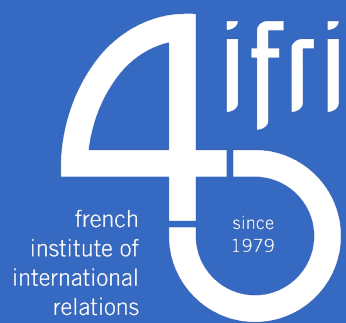
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