

Strategies to support the scale-up of Europe's solar manufacturing sector

Manufacturing | Europe is home to relatively low solar manufacturing capacities, with just 3% of global module supply in 2020. However, with industry players offering low-carbon products manufactured under robust labour regulations and without the cost of overseas shipping, Europe's PV manufacturing industry finds itself in a very timely position to ramp up, writes Johan Lindahl, secretary general of the European Solar Manufacturing Council.

Politically, Europe is currently focusing on breaking energy dependence on third countries, specifically the fossil dependence on Russia following the invasion of Ukraine. The introduced measures bring welcome investment opportunities to decarbonising the energy sector through the REPowerEU support package. On the other hand, another key dependency remains, one that could risk the large-scale green transition: the import dependency on hardware for renewable energy technologies, including photovoltaics.

Customs data analysis shows that the yearly negative extra-European trade balance of PV modules and cells is in the magnitude order of €10 billion (US\$10.3 billion). The industry organisation, the European Solar Manufacturing Council (ESMC), representing the European PV upstream Industry, envisions a larger portion of these monetary streams captured within the European region in the near future. It would favour the transition to green jobs and contribute with substantial tax revenues to the economic sector. It would also put the European countries in control over their green transition without having to rely on third-party countries that naturally have their own capacity expansion as priority.

It has not always been this way. In the early development of the PV Industry, Europe held a large share of the global market. A great deal of the early technology and industry development took place in Germany and was funded through extensive central support, laying the ground for the modern industry we see today. In the late 2000s, early 2010s, however, market shares were lost to Asia, thanks to their innovation in mass production and substantial incentives from the Chinese government. China was in a good



Credit: Oxford PV.

position to ramp up production and gain the benefits of large-scale manufacturing and standardisation. Many European manufacturers were forced into insolvency during this time.

The current situation for PV manufacturing in Europe

Europe is home to relatively low manufacturing capacities, especially compared to its glory days. With around 11% of the global PV silicon manufacturing, 1% of wafer production, 0.4% of cells and 3% of global module supply in 2020, Europe is seriously lagging behind Asia in terms of upstream industry output.

As can be traced from these figures, there are significant parts missing from the PV manufacturing value chain in Europe. In this context, China is the main competitor, with as much as 95% of the ingot and wafer production shares in 2020. The corresponding numbers for polysilicon, cells and modules are 79%, 76% and 68%, respectively.

A solar cell from Oxford PV, which is focused on developing and commercialising perovskite-based solar technology.

This has shown to be risky, as turmoil caused by COVID-19, Chinese domestic policies and increases in material prices have seriously affected the global supply chain in recent years, putting Europe in a weak position. Both manufacturers and developers have been forced into higher prices and delayed project times as a consequence of the beforementioned events.

Europe's PV assets

Just like in early Industry development, Europe has world-leading research and technology institutes. Fraunhofer ISE, Centro Nacional de Energías Renovables (CENER), Interuniversity Microelectronics Centre (Imec), Institut National de l'Énergie Solaire (Ines), L'Institut Photovoltaïque d'Île-de-France (IPVF), ISC Konstanz, Forschungszentrum Jülich and the Austrian Institute of Technology are examples of renowned research institutes from the ESMC member base.

European scientists are focusing on

both breakthrough novel technologies and applied industry and system integration research. The Horizon program, amongst others, brings strong support to R&D&I, which helps ensure a future of innovation in the field of photovoltaics.

Europe also has a strong and expanding home market, and the European Commission (EC) has recently recognised the importance that the PV Industry has for the strategic autonomy of the EU. However, they have not yet put necessary regulations in place to create a level playing field with global competitors for European manufacturers. The European Union (EU), being the second largest market globally, is nowhere close to self-sufficiency in photovoltaics.

To counteract its position of energy dependency, as part of the aforementioned REPowerEU plan, the EC adopted the EU Solar Energy Strategy in May 2022. It identifies remaining barriers and challenges in the solar energy sector and outlines initiatives to overcome them and accelerate the deployment of solar technologies. The EU Solar Strategy sets a target of 750GWdc (600GWac) by 2030, which is a significant increase in pace compared to the 160 GW accumulated capacity in Europe at the end of 2021.

This accelerated deployment of PV is going to be supported by three main initiatives. The first is the European Solar Rooftops Initiative, including a proposal to gradually introduce an obligation to install PV in different types of buildings. Secondly, the EU large-scale skills partnership aims to help develop a skilled labour force in this area, as it currently constitutes a bottleneck in many member states. Lastly, the EU Solar PV Industry Alliance aims to become a forum for stakeholders in the sector and

help diversify the supply chains, retain more value in Europe and deliver efficient and sustainable PV products to help avoid supply risks for the necessary massive deployment of PV in the EU.

ESMC appreciates the creation of the EU Solar PV Industry Alliance, which will be the major framework for the proposals and decisions to create a long-term competitive European PV manufacturing industry. The EU should act quickly to elaborate concrete and targeted support measures for the European PV manufacturing industry, efficient enough to ensure the scaling of PV manufacturing capacities and trigger innovative solutions.

What challenges must be overcome?

In this context, ESMC talks in terms of a level playing field between European and Chinese manufacturers. There are several reasons why it is difficult for European PV manufacturers to compete with their Chinese counterparts. Being an electricity-intensive industry, the electricity price is a deciding factor. Chinese manufacturing is incentivised with subsidies on both water and electricity, while European companies must in turn cover their consumption and emissions just as any non-strategic industrial sector. In addition, labour is cheaper in China than in Europe, which has extensive regulations around fair labour conditions. While ESMC recognises and welcomes these laws, it distorts competition.

Lastly, full value chain control gives access to cheaper and more accessible materials for Asian products and processes. As a complete industrial PV value chain currently does not exist in Europe, European manufacturers find themselves at a competitive disadvantage. These factors

are something that the EU must work to meet, by highlighting other advantages to European manufacturing and through capex and opex support in the build-up phase.

What policies would best support European PV manufacturing?

To create a level playing field, the operational cost structure of the entire European PV value chain must reach a level equivalent to, or as close as possible, to non-EU manufacturers. In parallel, other support measures should be implemented to scale the European PV manufacturing capacities to improve its competitiveness further.

In fact, cost and policy benchmarking show that European solar manufacturing is at an average of US\$0.028-0.073/Wp disadvantage compared to China. National tax and policy incentives amount to a US\$0.036 reduction of the delivered cost in China, US\$0.021-0.023/Wp in India and 0.127-0.197Wp in the US. The corresponding figure is US\$0.001\$/Wp in Europe, effectively demonstrating the need for support measures for European manufacturers to experience fair competition.

Scaling the capacities by unlocked capital investments and lowered operational costs

There are several ways the EC and EU member states could support European PV manufacturers. For comparison, the US government recently launched the Inflation Reduction Act (IRA), including substantial support for its domestic PV manufacturing sector. This clearly classifies the industry as strategically important and supports it accordingly. With several US dollar cents in manufacturing credits per Wp of manufactured p-Si, wafers, cells and modules, this packaged large support is expected to effectively stimulate the American upstream PV industry.

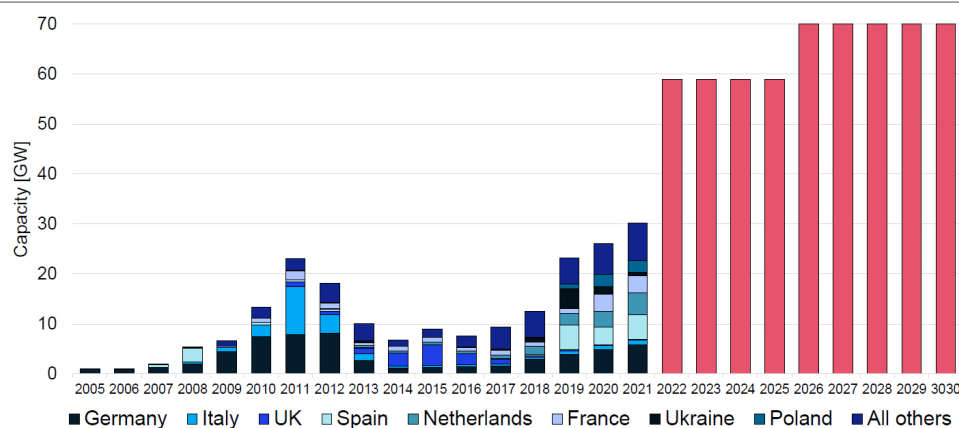
Similarly, manufacturing in China and India is well supported. Introducing a similar scheme in Europe would create incentives for European manufacturers and simultaneously prevent the possible side effect of the IRA for Europe: that investments in new manufacturing turn to the US instead of Europe. The ESMC, however, recognises that there are differences in the constitutional frame of the two markets and that measures would need to be adapted to the opportunities and limitations that the EU holds.

ESMC acknowledges that there is no silver bullet, the industry needs a holistic

Annual installed PV capacity in Europe

Annual installed PV capacity in Europe

The EU Solar Strategy sets a target of 750 GWdc (600 GWac) by 2030, a significant increase in pace



industrial policy approach of support in the EU policy framework. By introducing a strategic financial vehicle of at least €5 billion in form of state credit guarantees, ESMC envisions the anticipated scale-up of the EU PV manufacturing industry, while extensively reducing the capital and operational costs for the establishment of new PV manufacturing capacities in the EU.

Realistically, the European PV deployment market should be differentiated – one market for extra-European budget modules and another for locally produced modules, with its inherent benefits of lower carbon footprint and ensured socially sustainable labour conditions. Reasonable off-take agreements combined with tax exemptions and incentives would be the most sustainable way to boost European production in that direction. Additionally, by making imported goods and materials subject to the same standards on labour laws, hidden subsidisation and CO₂ footprint, large parts of the unfair competition that European manufacturers experience would be excluded.

Lastly, the EU Innovation Fund is one of the world's largest funding programmes for demonstration of innovative low-carbon technologies. This fund is one option for support of large-scale manufacturing capacities. So far, there are examples of PV manufacturing among the projects that have been awarded funding but putting emphasis on breaking dependence for the roll-out of the fastest-growing power source in the world would help make more funding available for such projects.

Ecodesign and energy labelling

Another way to support the European PV Industry is to introduce policies that help emphasise the sales arguments of European-produced equipment and technology. A package such as that is the EU energy labelling and Ecodesign legislation, which aims to improve the energy efficiency of products on the EU market.

Ecodesign sets common EU-wide minimum standards to eliminate the least-performing products from the market. In turn, the energy labels provide a clear and simple indication of the energy efficiency and other key features of products at the point of purchase. By making PV modules and systems subject to this scheme, it would be easier for uptakers to make conscious choices. With the European countries' grid electricity mixes often being less carbon intense than other countries,

"Supporting innovative and breakthrough PV manufacturing technologies is critical to maintaining the long-term and sustainably competitive advantage of European PV manufacturing"

it would help European manufacturers highlight the environmental advantages of their products.

However, the regulatory design will be critical for the outcome for local manufacturers. While several benefits exist, a robust verification system is crucial for the policy to be impactful. Secondly, as the European Industry has many SMEs, extensive reporting can be particularly troublesome and costly for European organisations and companies.

These two policies are currently under development, as the EC is assessing the need for regulation to manage the environmental impacts of photovoltaic products. In case the policy development unfolds appropriately, this measure could be effective in combination with off-take agreements – a measure that will hopefully be coordinated under the EU Solar PV Industry Alliance.

IPCEI for innovative PV technologies

Supporting innovative and breakthrough PV manufacturing technologies is critical to maintaining the long-term and sustainably competitive advantage of European PV manufacturing. Especially with Europe's strong research institutes, innovative technology could play a significant part in re-establishing the value chain for photovoltaics. There is an ongoing industry collaboration effort, the PV-IPCEI framework, to make this reality. So far, 60 Industry partners are collaborating in the consortium.

IPCEIs make it possible to bring together knowledge, expertise, financial resources and economic actors throughout the EU and to jointly support these transnational cooperation projects with major synergies with state aid. So far, The Spanish government has taken the role of leader of the PV-IPCEI from the member states' point of view, with Austria, Belgium, Lithuania, Luxembourg, Poland and Norway also committed to supporting the ongoing process.

In fact, there might be a window of opportunity for European manufacturers to re-establish the industry in the coming years. With technologies such as tandem perovskite, heterojunction, TOPCon (tunnel oxide passivated contact) and IBC (interdigitated back contact) cells coming to, or close to, market, a long-awaited technology shift is approaching. By becoming early adopters of these innovative high-efficiency technologies and taking them to gigawatt scale, Europe could find an advantageous position. Additionally, as the European market has high shares of distributed PV systems, it makes sense to partly focus on high-efficiency applications for the residential market.

All in all, the European PV manufacturing industry finds itself in a very timely position to ramp up, given that the EC takes a holistic approach to the strategic importance of the industry. With an accelerating home market, an energy crisis, and global supply chain constraints, the arguments for locally produced photovoltaics are well demonstrated. European manufacturers offer low-carbon, high-efficient products, manufactured under robust labour regulations and without the cost or emissions of overseas shipping.

ESMC sees good opportunities for European PV manufacturing to become sustainably competitive during the next couple of years, if only a level playing field is provided by European policymakers. The EU Solar PV Industry Alliance is the appropriate framework for concretising and activating targeted support measures without delay – during the coming months – to create sustainable and fair conditions for the European PV manufacturing industry. ■

Author

Since being appointed secretary general of the European Solar Manufacturing Council in 2021, Johan Lindahl works for the creation of a political environment to support industrial PV manufacturing and research. Following his doctorate in engineering physics solid-state electronics, he has worked in research, policy and market-related roles. Amongst others, he has been the Swedish representative in IEA PVPS Task 1 for 11 years.



References

1. IPCEI - Important Projects of Common European Interest