CEA
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REPORT SAMPLE

PV Supply, Technology, and Policy Report

Q2 2024

PV Supply, Technology, and Policy Report

The PV Supply, Technology, and Policy Report (STPR) is published on a quarterly basis and covers global and regional supply chain analysis, technology trends, and regional policy analysis. Given the breadth of technological developments in the solar industry, there will be a new technology focus each quarter; this quarter, the regional analysis includes **CEA's policy and supply analysis in the United States, Europe, and China. The technology trends cover TOPCon degradation, module hail risks, and TOPCon IP concerns.**

The strategic value of the STPR lies in its ability to enhance project profitability by leveraging industry incentives. It establishes security of supply through a thorough understanding of trade policy and aids stakeholders in understanding the project performance implications of new technology adoption.

Deliverables of the STPR include a quarterly report and full analyst support for any questions pertaining to its coverage. With the STPR, stakeholders gain a detailed view of the supply landscape, technology trends, and policy impacts, empowering them to make informed decisions and optimize their strategies in the PV and energy storage sectors.

In this report you will find:

- Global and regional supply chain analysis
- Technology trends
- Regional policy analysis

Executive summary

2024 PV value chain supply ~2x demand, trade barriers could impact U.S. supply

- After a more than 60% increase in global PV installation in 2023, 2024's growth rate is expected to face a sharp decline and the forecasted demand is forecasted between 401 GW and 511 GW.
- The supply part is still adding a large number of new capacities from polysilicon to module as many previously announced projects are targeted to online in 2024. The polysilicon capacity is expected to add over 600 GW, cell and module sectors will bring more than 300 GW each.
- The removal of the bifacial exemption to the Section 201 tariffs, the uncertainty brought by the launch of a new AD/CVD investigation, and ongoing enforcement of the UFLPA are keeping U.S. prices high. This further bolsters the economic case for U.S. manufacturing.
- In the first five months of 2024, almost 75% of modules and 50% of cells were imported from the four AD/CVD affected countries: Cambodia, Malaysia, Thailand, and Vietnam. The risk-free supply is limited and fragmented and not enough to meet the U.S. cell demand.
- European PV supply is shrinking as many long-standing suppliers closed production or filed bankruptcy due to failure to compete with imports. In the first four months of 2024, Europe imported around 33 GW of modules from China, accounts for 43% of Chinese module exports.
- TOPCon will account for around 75% of technology distribution in 2024; the shipment guidance for TOPCon modules will be more than 400 GW.
- TOPCon cell degradation issues are too early to conclude, proper manufacturing process and encapsulation could improve reliability. Buyers should avoid products without quality assurance.
- Hail has become a major cause of claims for solar systems, the PV industry shifted to thinner glass increases hail risk. Pursue tracker systems with stow technology or customize glass for high-risk areas could be procurement solutions.

U.S. increased solar trade barriers in Q2 2024

New AD/CVD case + removal of the bifacial exemption to Section 201 most impactful

Policy	Type	Nations/regions/ products affected	Most recent development	Policy development	Supply impact of policy change
Anti-dumping **(AD)** and countervailing duties **(CVD)**	Import duties	Cambodia, Malaysia, Thailand, and Vietnam (cells & modules)	5/14/24	On May 14, 2024, the U.S. Department of Commerce initiated AD/CVD investigations against imports of solar cells, whether or not assembled into modules, from Cambodia, Malaysia, Thailand, and Vietnam.	The threat of duties from the new AD/CVD investigations creates uncertainty around imports from the named countries, which comprised around 85% of PV module imports in 2023. This has already raised prices, delayed contract negotiations, altered procurement patterns, and pushed project completions back, particularly for those projects planned for 2025.
Section 201	Import tariff	Global (except Mexico, Canada, and certain developing countries) (PV cells & modules)	5/16/24	On May 16, 2024, U.S. President Biden removed the Section 201 exemption for bifacial solar products. Biden also maintained the tariff rate quota (TRQ), under which modules can be imported duty-free, at 5 GW.	The removal of the bifacial exemption increases the cost of module imports from most countries. This drives up the market price for solar, particularly when combined with the pending AD/CVD investigation. Given increased capacity of U.S. module factories and a lag in cell capacity, CEA considers it likely that the 5 GW TRQ will be reached this year.
Uyghur Forced Labor Prevention Act **(UFLPA)**	Import ban / human rights law	Xinjiang, China (polysilicon, ingots, wafers, PV cells & modules)	April 2024	CEA has confirmed that Customs detained modules from two new Indian suppliers under the UFLPA in April 2024.	The detention of Indian suppliers indicates that Customs is targeting suppliers beyond Chinese-owned companies, and this raises the risk for all other crystalline silicon PV module imports from suppliers who have not yet been detained.
Section 301	Import tariff	China (solar manufacturing equipment, batteries, other battery inputs)	5/14/24	On May 14, 2024, U.S. President Biden ordered exemptions to Section 301 tariffs for solar PV manufacturing equipment from China. Biden also increased tariffs on battery imports from 7.5% to 25%.	The new exemptions for PV manufacturing equipment marginally improve the economics of U.S. PV cell and module production. However, the increased tariff rate for batteries will increase the cost of solar + storage systems.

EU policy summary – Regulations impacting PV supply chains

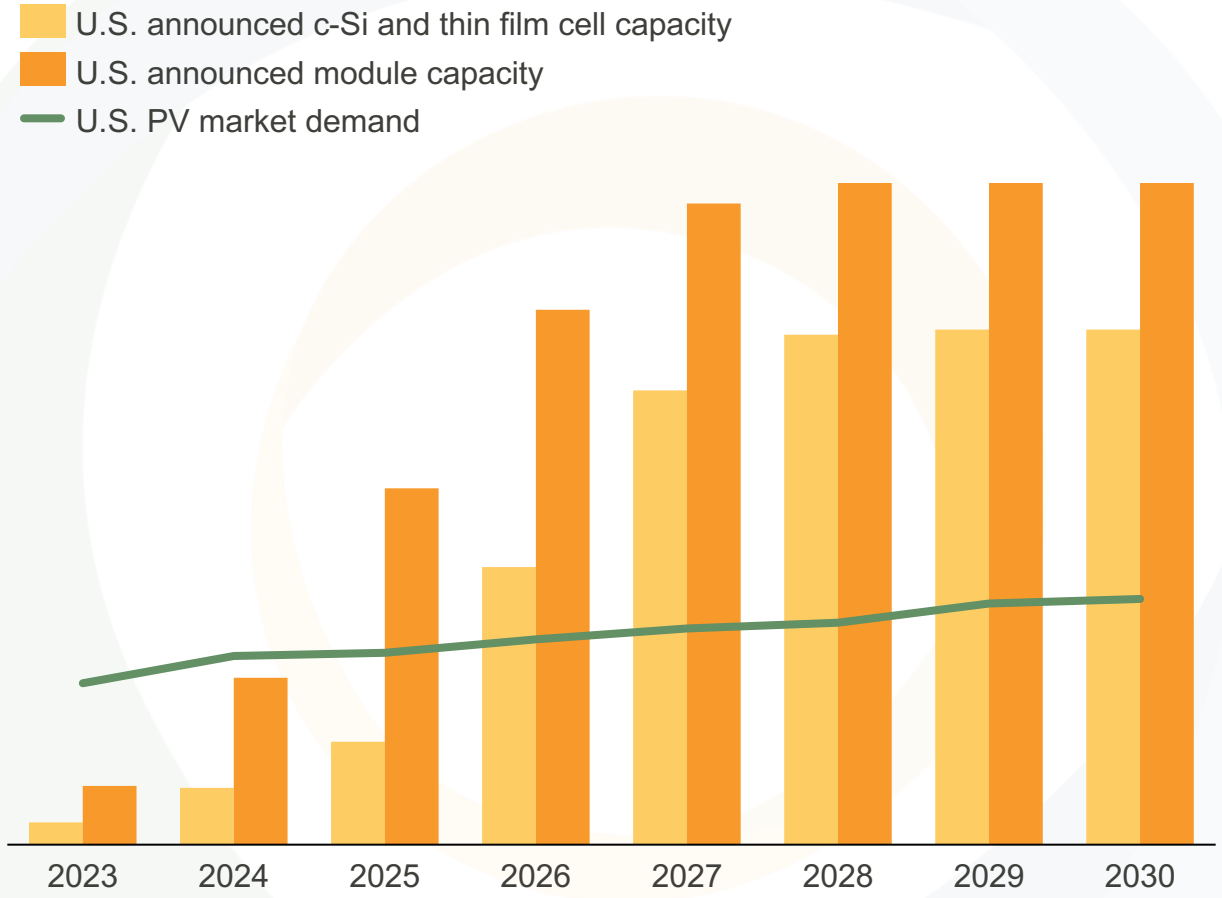
EU policy recap and progress in Q1 2024

	Recap	Q1 updates	Q1 progress	Supply impact
EU forced labor regulation	EU-wide ban on products made with forced labor	The final text mandates that the "burden of proof" will remain on the EU Commission, not importers Regulation is not applicable until 3 years after it enters into force (expected Q3-2027)	**Final text agreed**: Mar 5, 2024 **Final Parliament Vote**: April 24, 2024 **Approved by EU Council**: Expected: - **Enters into force**: 20 days following EU Council approval	No investigations or bans will take place until 2027, giving suppliers enough time to evaluate supply chains and ensure they are compliant with the regulation
Net Zero Industry Act	New EU-wide targets for manufacturing (40%) across all net zero technologies. It also includes reduced administrative burdens for manufacturing facilities, new non-pricing criteria in public auctions to create market demand for EU-made products	The final text includes no direct incentives for clean technology manufacturers In May 2024, new guidance was published to assist with the design and methodology of new non-price criteria in public auctions	**Final text adopted**: February 6, 2024 **Final Parliament Vote**: April 24, 2024 **Approved by EU Council**: May 27, 2024 **Enters into force**: 20 days following EU Council approval	This regulation will facilitate easier investment conditions for manufacturers however, without financial incentives for any technology, its overall impact reduced To compete with PV supply chains from China or Southeast Asia, the EU will need to introduce huge funding packages (similar to the U.S. Inflation Reduction Act), which, at this moment, is not hinted at or expected. It will be up to the Member States to allocate national funding for support of national PV supply chains
Critical Raw Materials Act	EU-wide, non-binding targets for extraction (10%) processing and refining (40%) and recycling (25%). Mitigation against supply shocks through new international partnerships monitoring, and stockpiling of key materials	The Commission is expected to release a call for proposals for companies to apply as a "strategic project", awarding them additional support in permitting and assistance in obtaining financial benefits from existing EU funding packages	**Final Parliament Vote**: Dec 12, 2023 **Approved by EU Council**: Mar 18, 2024 **Enters into force**: May 23, 2024	Targets for extraction, processing, refining, and recycling are non-binding, undermining the regulatory impact and likelihood of completion Risk assessments, stockpiling, and monitoring should help mitigate any market disruptions for domestic PV supply chains in the future

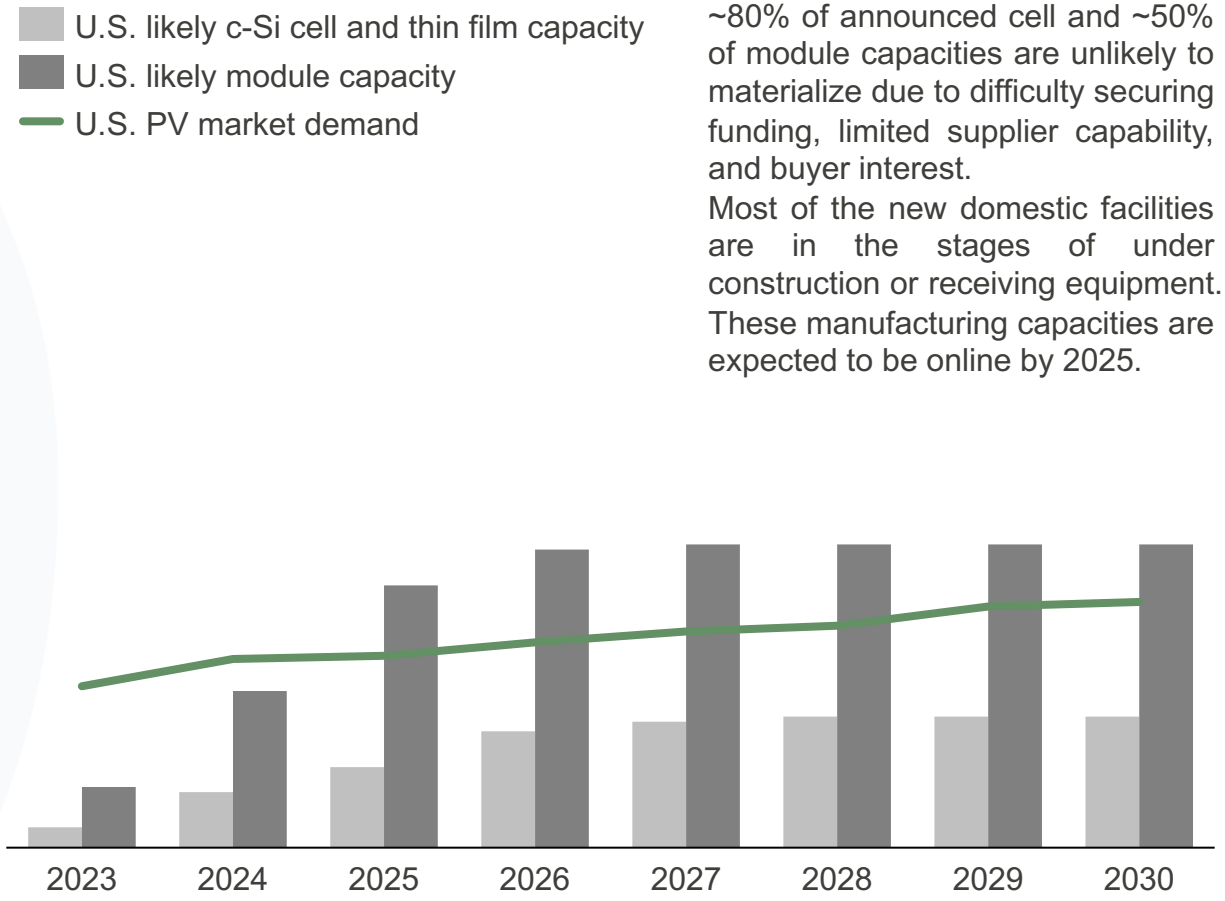
U.S. announced cell and module capacity is over 2x demand by 2030

Likely capacity is much lower, module will meet market demand while cell need import

Announced module and cell capacity vs. U.S. demand (GW)



Likely module and cell capacity vs. U.S. demand (GW)



~80% of announced cell and ~50% of module capacities are unlikely to materialize due to difficulty securing funding, limited supplier capability, and buyer interest.

Most of the new domestic facilities are in the stages of under construction or receiving equipment. These manufacturing capacities are expected to be online by 2025.

European PV supply chain at risk of closure, capacities even limited

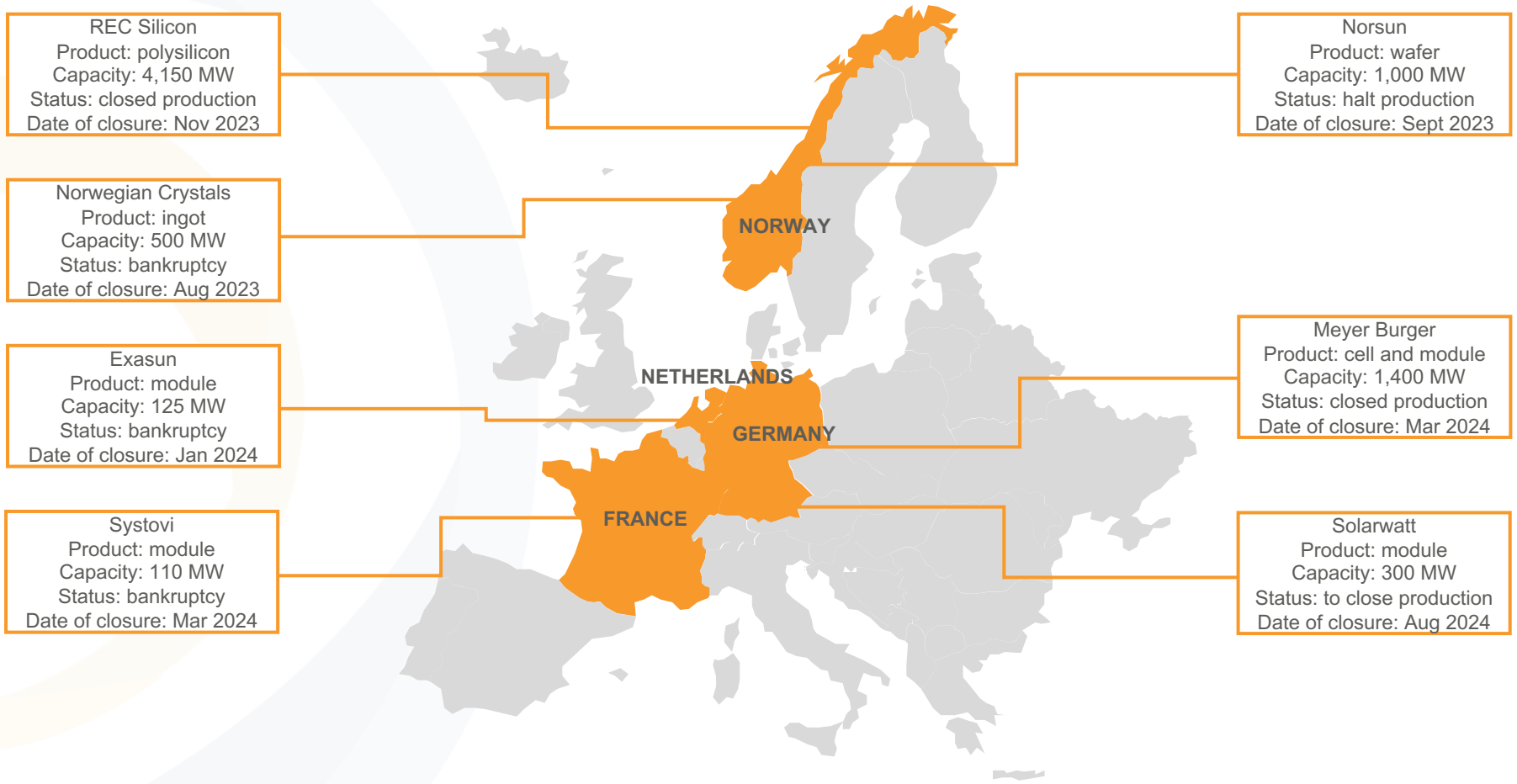
Long-standing suppliers halt production or bankrupt due to a lack of competitiveness

European PV supply capacities have decreased recently as many of the industry veterans shut down production lines in the region or filed bankruptcy.

Norway's three major upstream suppliers were no longer operating in 2023 due to high manufacturing costs and fierce market competition dominated by Chinese producers.

On the downstream side, European manufacturers face similar competition, and many of the domestic module producers have decided to close European factories or switch future capacity to other regions, leaving the European manufacturing capacities even more limited. For example, the long-standing Swiss PV manufacturer Meyer Burger announced closure of its Germany plant in March 2024. The company is seeking to redirect future production capabilities in the U.S. due to favorable policy and financial support.

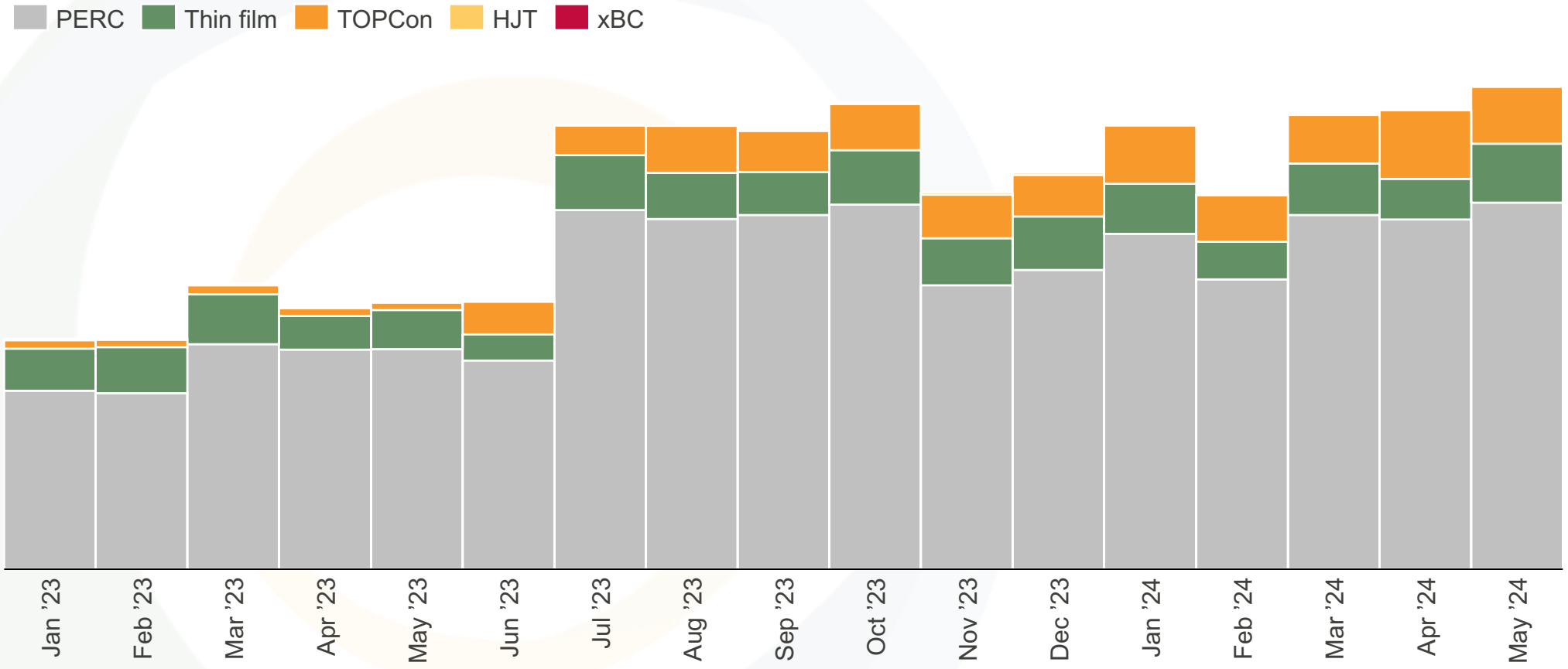
European map of PV suppliers closed production or bankruptcy



PERC still accounts for majority of product types; n-type increasing

Thin film represents another leading technology platform for U.S. imports

U.S. PV module import distribution, by technology (GW)



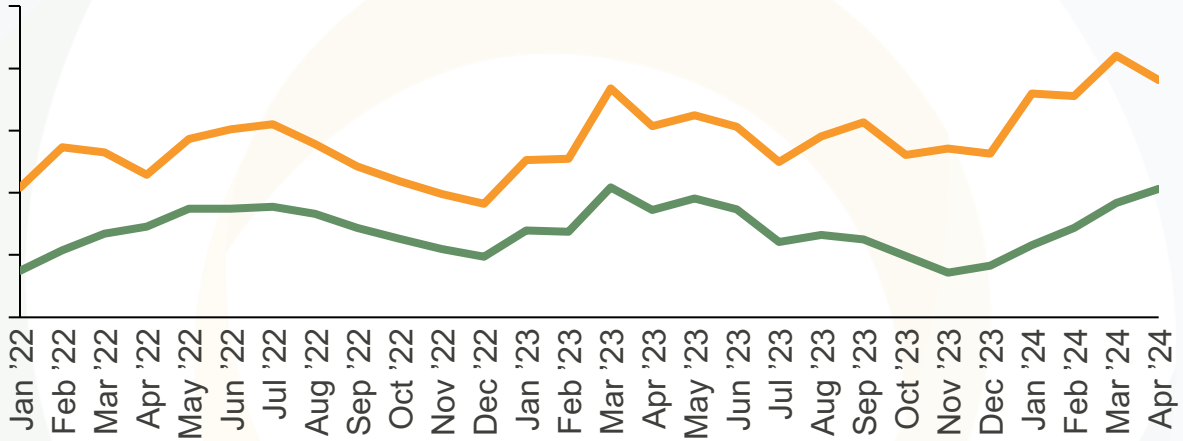
	GW	%
xBC	0.0	0%
HJT	XX.X	0.3%
TOPCon	XX.X	9%
Thin film	XX.X	12%
PERC	XX.X	78%

Europe counts half of China module exports, Netherlands re-exports

Limited and declining cell imports indicate shrinking module production in Europe

China to Europe module export (GW)

	Global	Europe
2022 FY	XX.X GW	XX.X GW XX%
2023 FY	XX.X GW	XX.X GW XX%
2024 Jan-April	XX.X GW	XX.X GW XX%



China to Europe cell export (GW)

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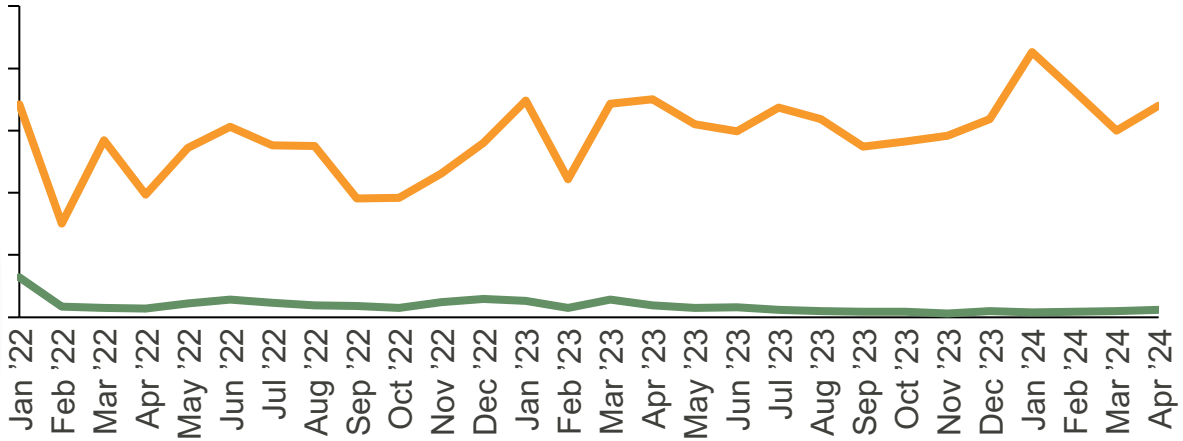
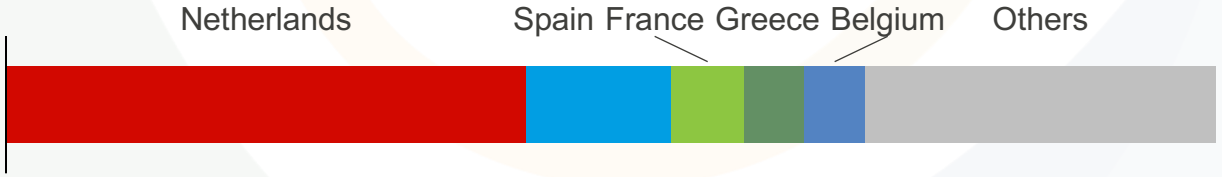
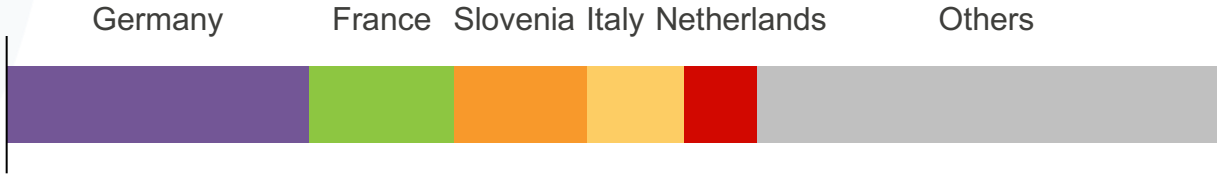


China to Europe module export distribution (%)



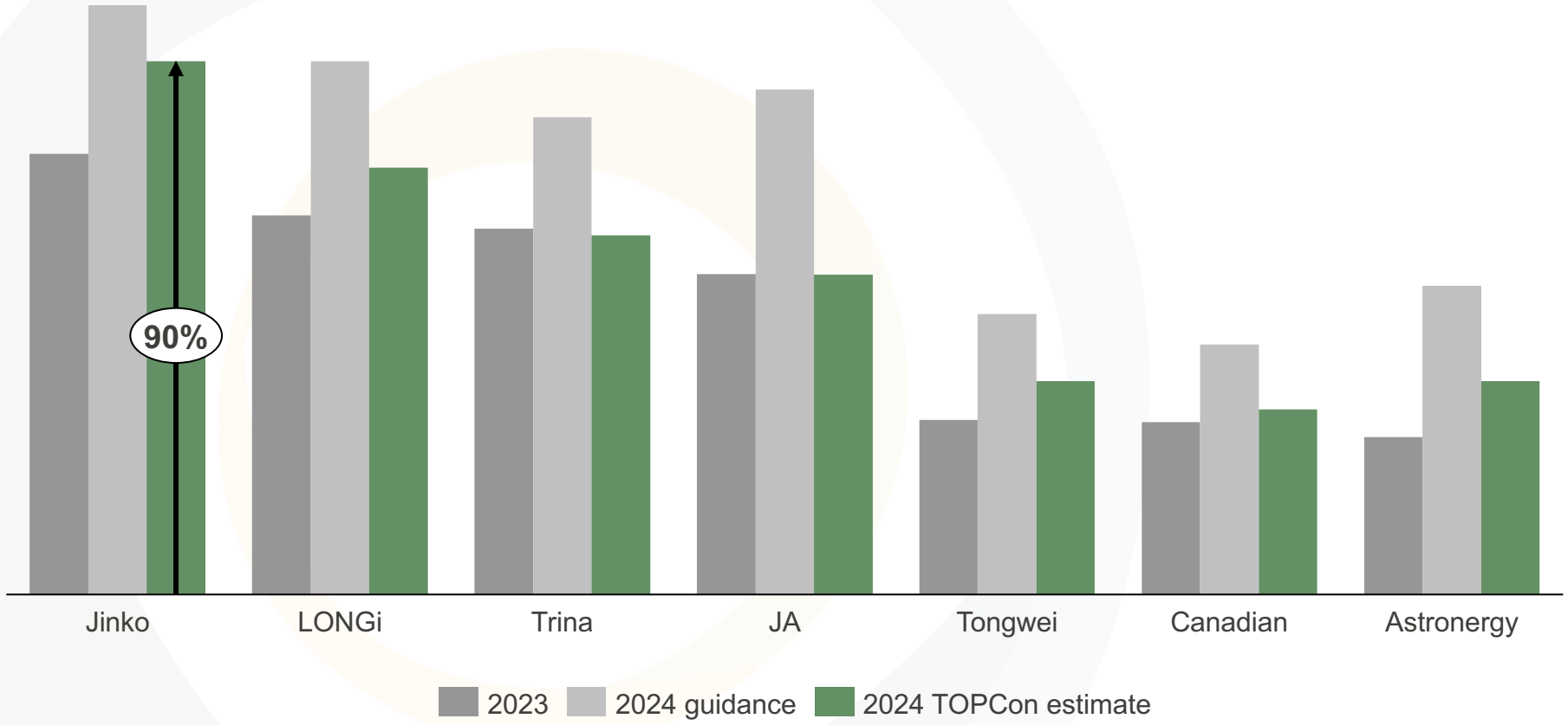
China to Europe cell export distribution (%)



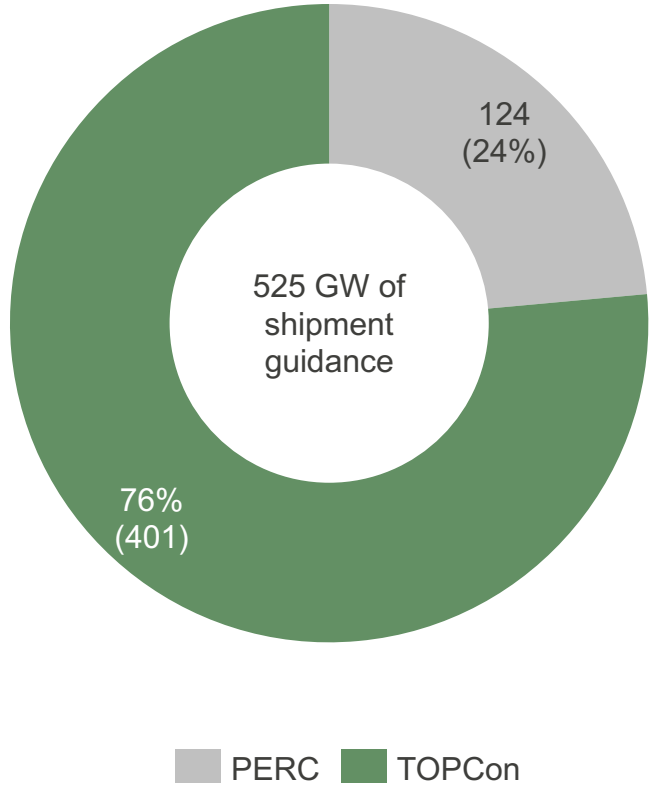
Top 7 suppliers shipment guidance more than 500 GW combined

TOPCon will become the major technology distribution, some suppliers target 90%

Module shipments (2023) and shipment guidance (2024), top 7 suppliers in 2023 (GW)



Technology distribution (GW, %)



Hail is the most common cause of claims for solar systems

Insurers set claim restrictions; module buyers are concerned about procurement risk

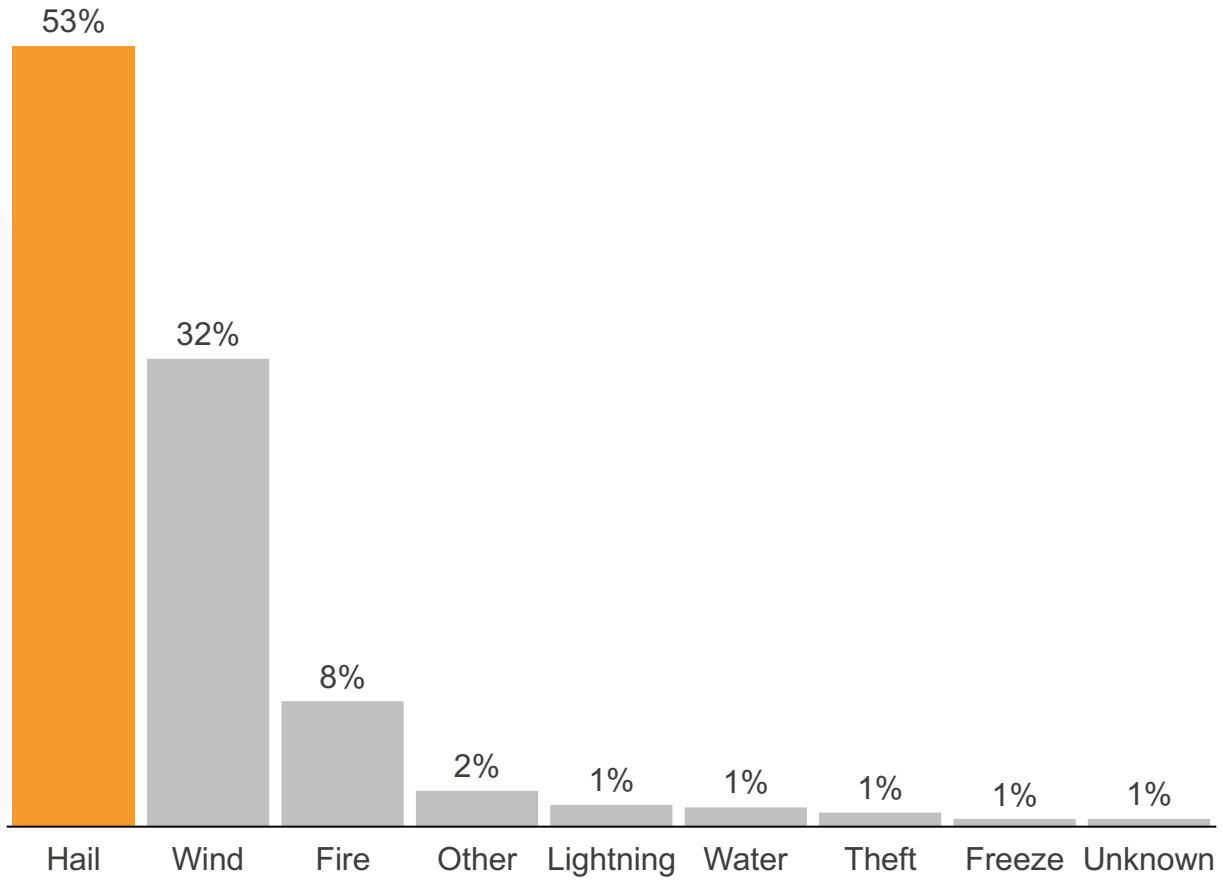
- Hail insurance still exists in the same category as severe storms
- Insurers now have increased concerns about hail coverage, especially in areas prone to severe hail due to recent hail events.

- Insurance is used to cover the module replacement cost in a hail event.
- New policies have set high deductibles and coverage limits in hail-prone areas.
- Rates may change as risk is continually re-assessed.

- Buyers are worried that they cannot find proper modules to meet hail resistance demand.
- Even if modules pass standard hail-resistant tests, some buyers are not confident in a specific product's reliability.

- Some suppliers have upgraded hail resistance and tested it to a more severe level; however, such module is usually based on special designs and/or materials that are not mainstream due to cost or limited demand.

Causes of claims for U.S. PV systems (% of total claims)

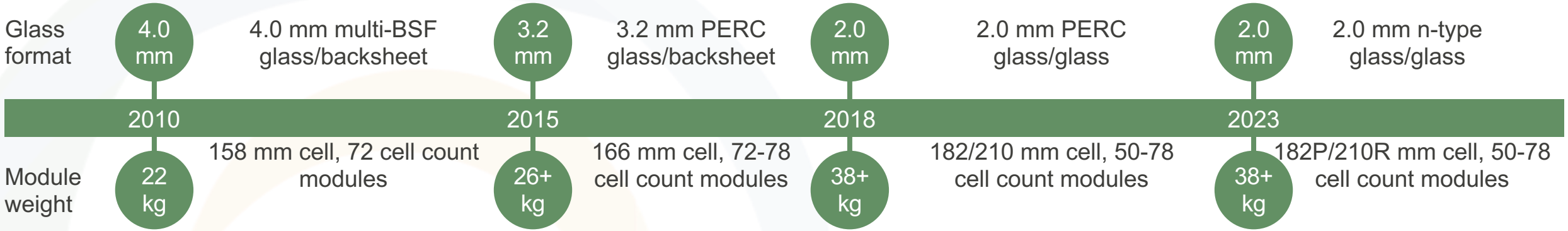


Notes | Data source from NREL Insurance in the Operation of Photovoltaic Plants.

The PV industry shifted to thinner glass as module weights increased

Thinner glass increases hail risk; thicker glass + backsheets less desirable for n-type

Mainstream crystalline silicon module format timeline



Module characteristics matrix with different glass formats

	PERC 2.0 mm glass/glass	PERC 3.2 mm glass/backsheet	n-type 2.0 glass/glass	n-type 3.2 glass/backsheet	2.8 mm thin film glass/glass
Hail damage risk	Baseline				
Reliability risk	Baseline				
Supply and delivery risk	Baseline				
Relative power class	Baseline				

Notes | indicates better than baseline risk assessment or performance; indicates worse than baseline risk assessment or performance.

Report Contents: 51 Pages of In-Depth Reporting

CEA's **Supply, Technology, and Policy Report** applies a systems level thinking approach to provide comprehensive industry analysis. We report on current trends and have a pulse on the latest solar, energy storage and green hydrogen technologies set to disrupt the clean energy landscape.

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