

# Solar PV supply chains

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 **SOVERÄN**



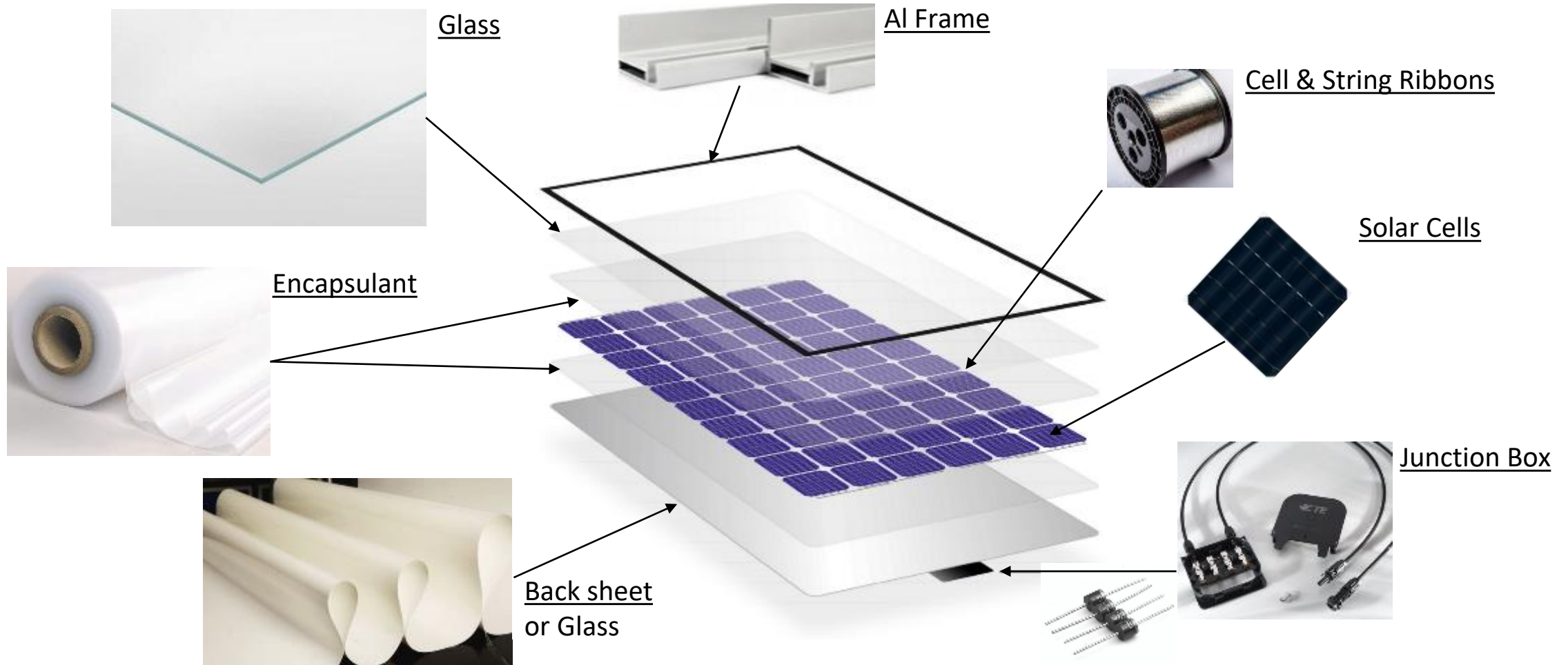
# List of Abbreviations

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- PV: Photovoltaics
- NZIA: Net Zero Industry Act
- poly-Si: Polysilicon
- Cz: Czochralski
- Mg-Si: Metallurgical grade silicon
- Al-BSF: Aluminum Back Surface Field
- PERC: Passivated Emitter and Rear Contact
- TOPCon: Tunnel oxide passivated contact
- SHJ: Silicon heterojunction
- CdTe: Cadmium telluride
- CIGS: Copper indium gallium selenide
- COGS: Cost of Goods Sold
- MSP: Minimum Sustainable Price

# PV system components

## PV module

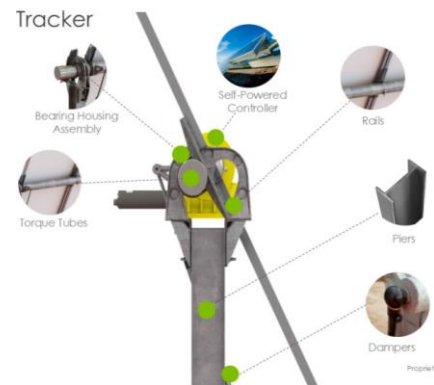


# PV system components

## Others

### Balance-of-system BOS

- Inverter
- Mounting structures and trackers
- Electrical storage device
- Cabling
- Energy management systems
- Grid connection



### PV manufacturing equipment & consumables

- Siemens reactors
- Cz ingot puller
- Quartz crucible
- Hotzone
- Diamond wire/saw
- Wet chemical tools
- Screen printers
- Etc.

**Cz puller**



**Crucible**



**Hotzone**



**Wafer slicer**



**Diamond wire**



# PV Si supply chain (main)

From quartz to module



Quartz



MG-Si



Poly-Si



Ingot



Wafer



PV Cell



PV Module

And many adjacent supply chains for input materials: Ag paste for metallization, Pb for soldering, Cu wiring, Indium Tin Oxide etc.

# SOUVERÄN Scope

## NZIA components and others

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### NZIA components

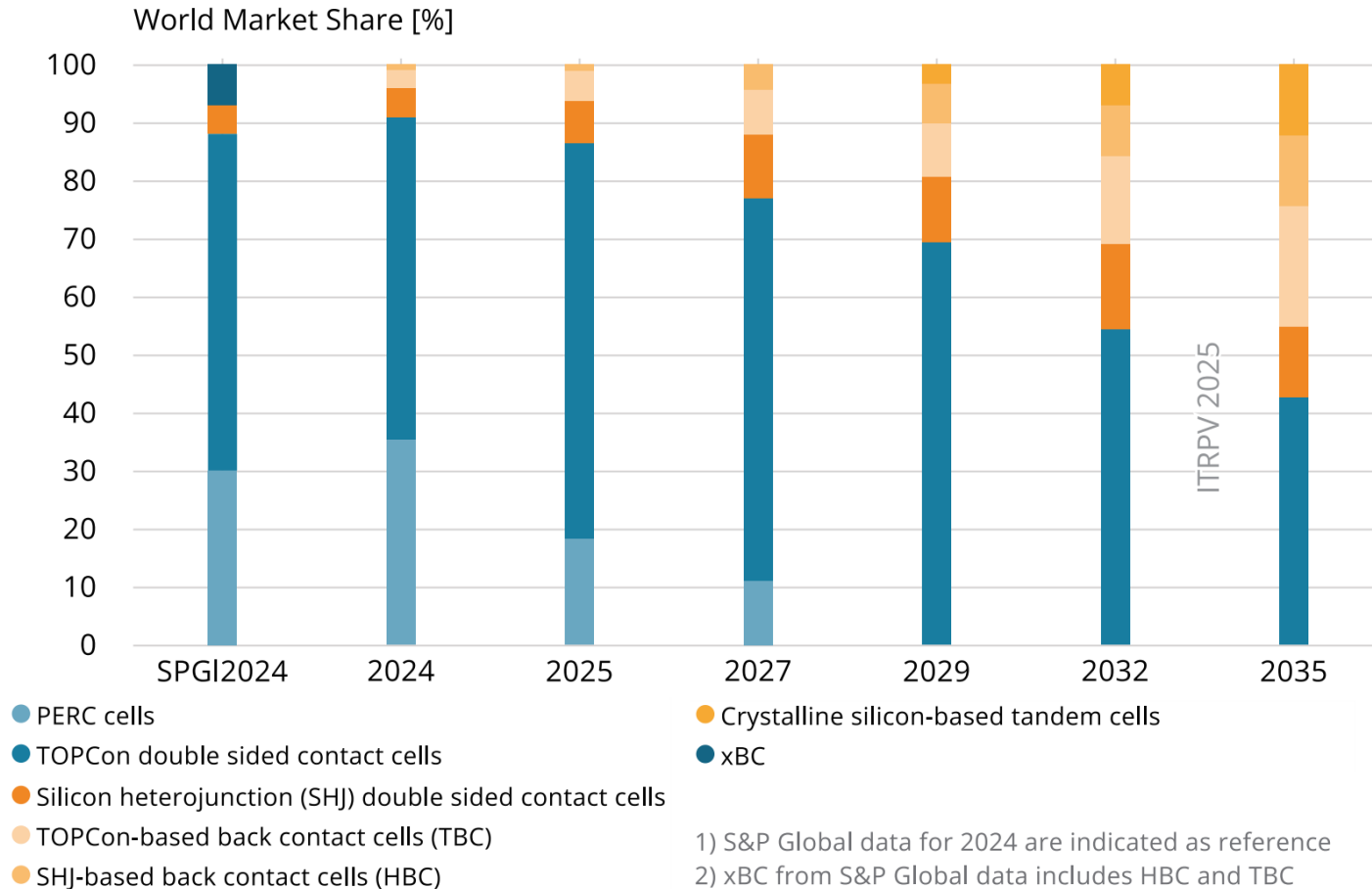
- PV grade polysilicon (poly-Si)
- PV grade silicon ingots or equivalent
- PV wafers or equivalent
- PV cells or equivalent
- Solar glass
- PV modules
- PV inverters
- PV trackers and their specific mounting structures

### Added components

- Quartz
- mg-Si
- Silver ore
- Refined silver
- Silver powder
- Silver paste
- PV manufacturing equipment\*

# PV Industry Landscape

## Cell technology



## Main PV Cell Technologies

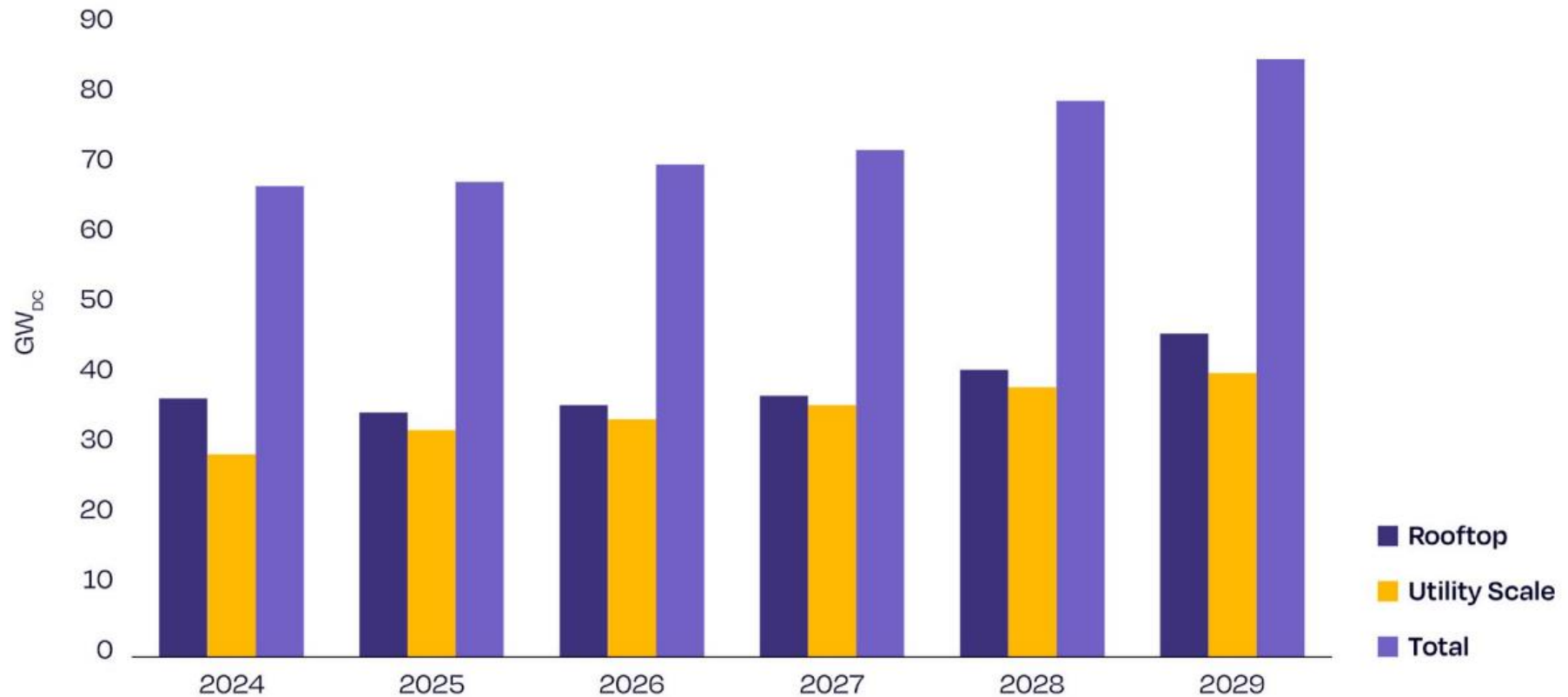
- **BSF** - *not relevant anymore*
- **PERC** - *being replaced by TOPCon*
- **TOPCon**
- **TOPCon-based back contact**
- **SHJ**
- **SHJ-based back contact**
- **Silicon based-tandem cells**
  - Perovskite-silicon tandem
  - III-V/Si
- **Thin films**
  - **CdTe**
  - **CIGS**

# PV Industry Landscape

## Market segmentation

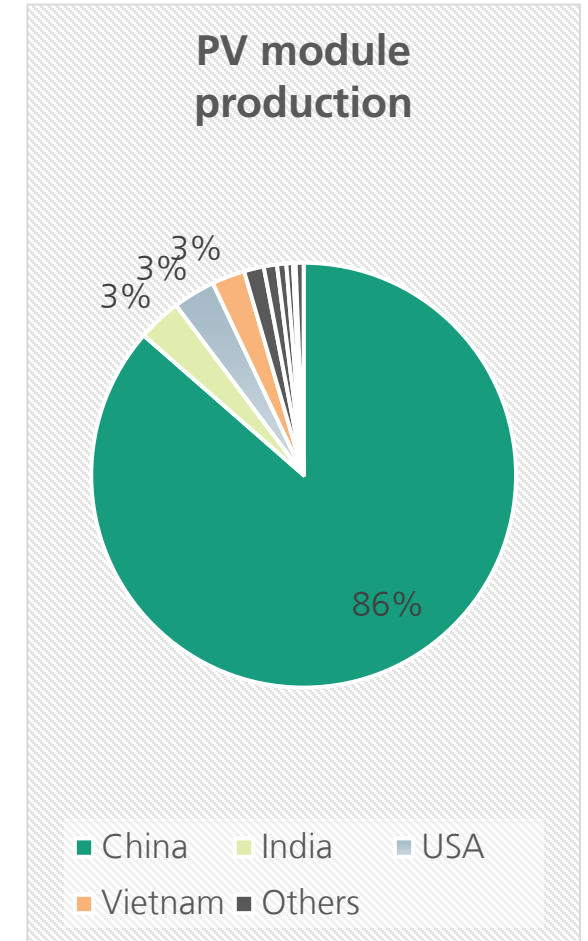
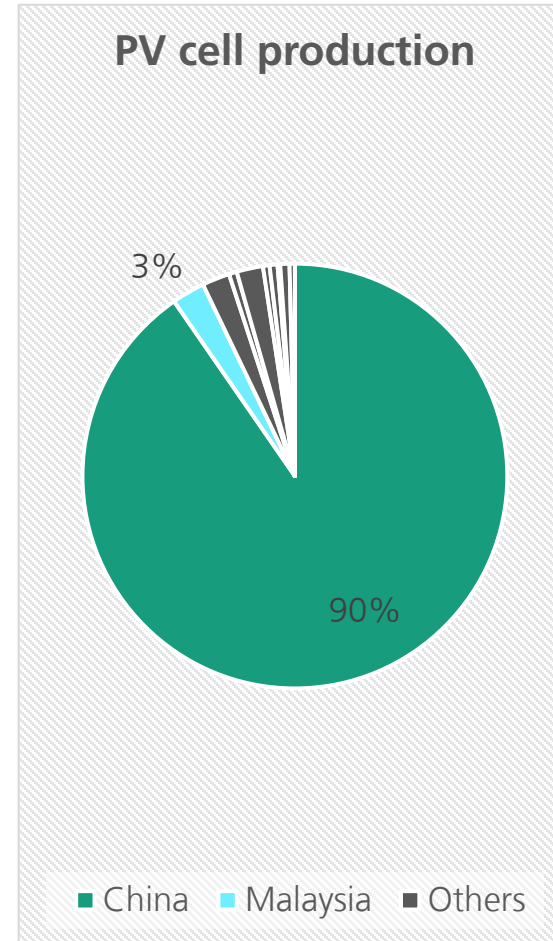
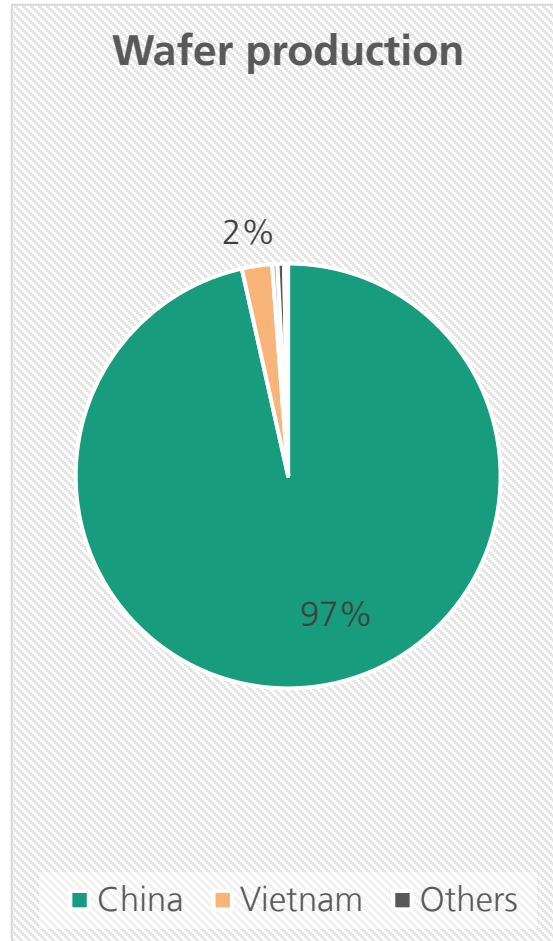
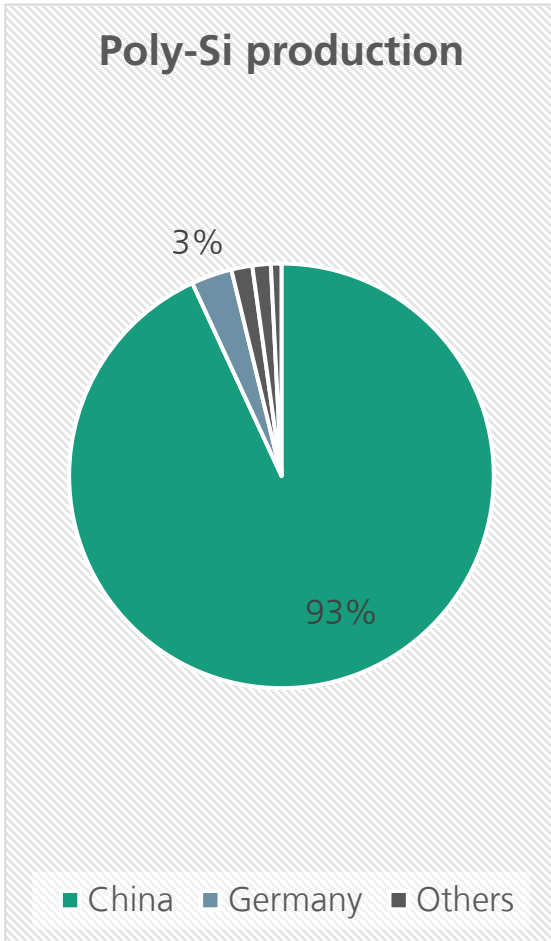
### EU rooftop and utility-scale solar PV market segments

Annual EU historical and forecast solar PV market segmentation 2024-2029



# PV supply concentration

## Share by production location in 2024

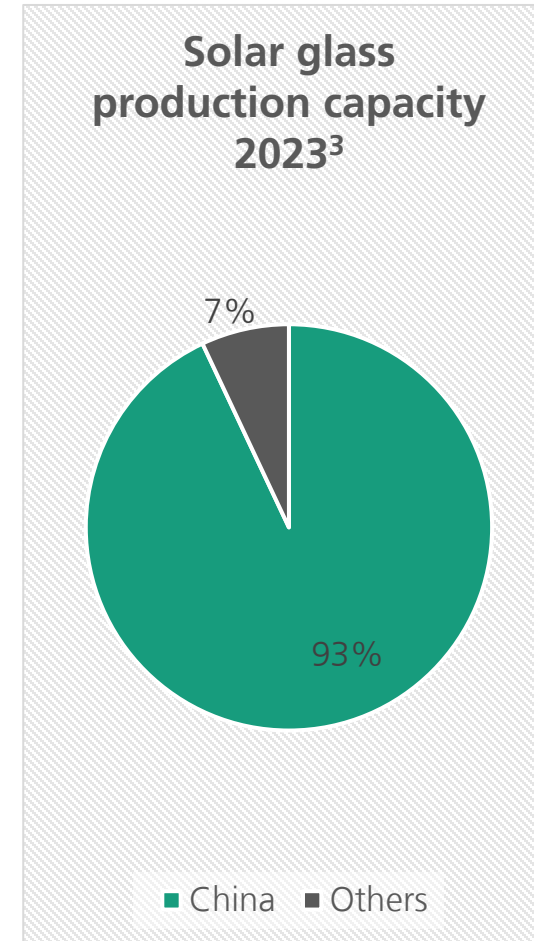
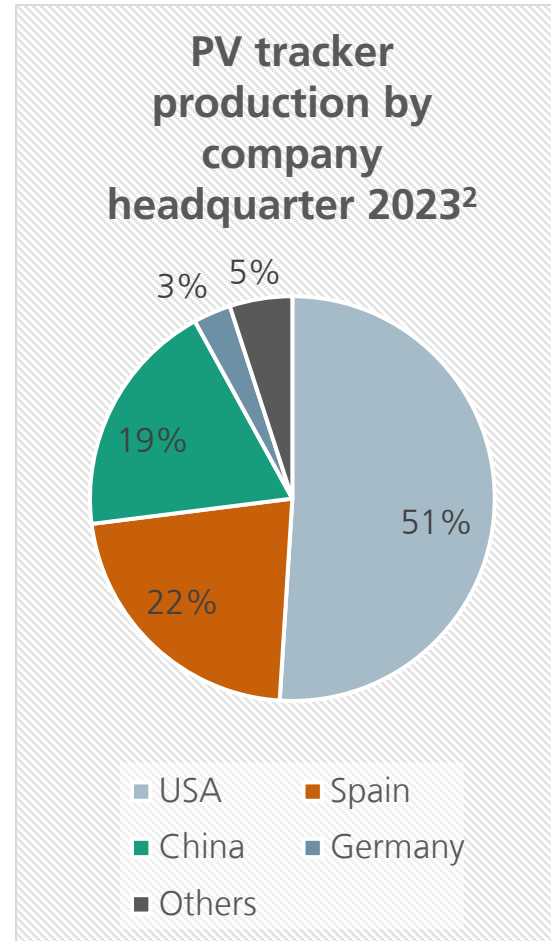
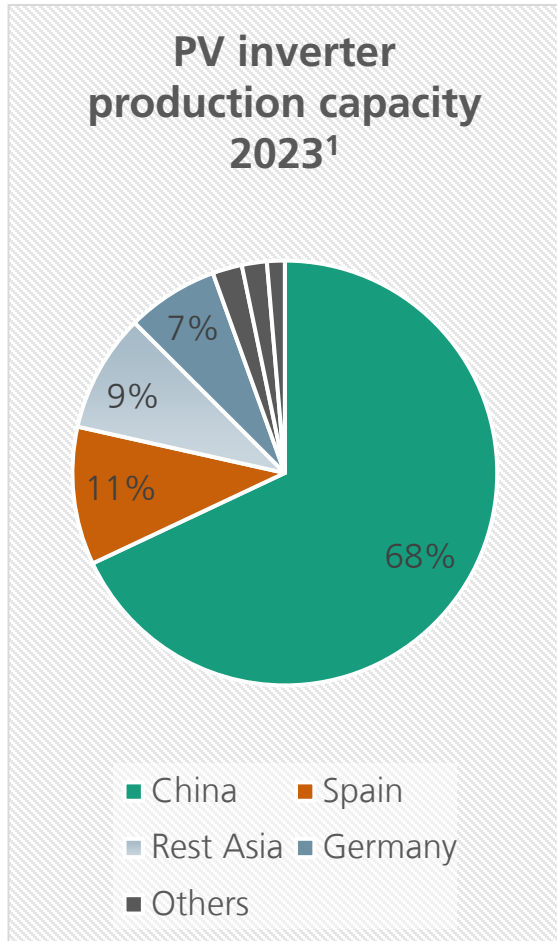


# PV supply concentration

## German solar glass maker GMB files for insolvency

German solar glass manufacturer Glasmanufaktur Brandenburg GmbH has filed for insolvency, affecting 247 employees at its Tschernitz facility, according to multiple media reports.

JULY 8, 2025 SANDRA ENKHARDT



1 SolarPower Europe, 2024: Inverter Explained 2.0 - [SPE Inverter Report 2024](#)

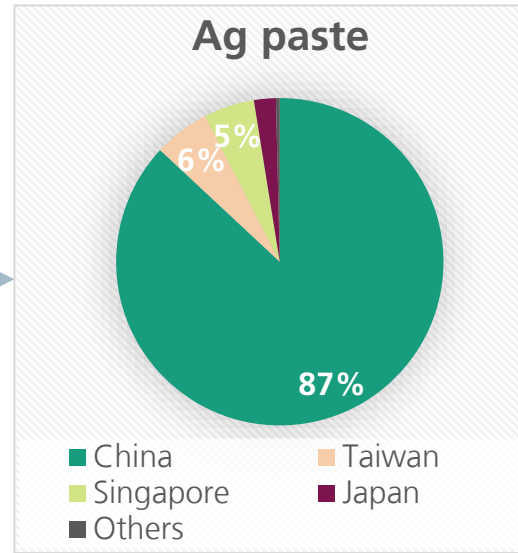
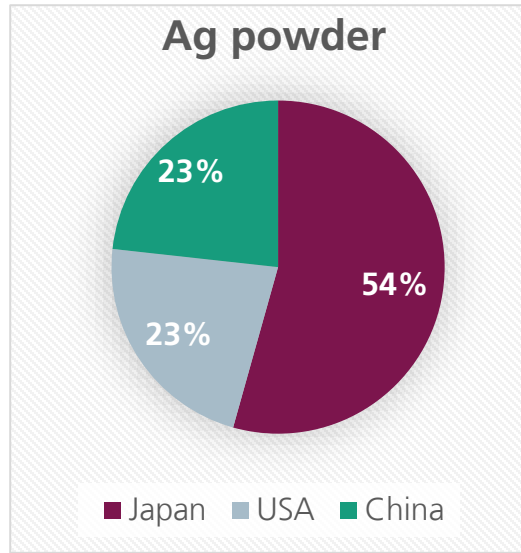
2 SolarPower Europe, 2025: Solar Mounting Systems Explained - [Solar Mounting Systems Explained - Supporting Europe's Flexible Solar Future - SolarPower Europe](#), companies' documents

3 Solarbe Global, 2024 - <https://www.solarbeglobal.com/chinas-dominance-in-solar-pv-glass-expected-to-decline/>  
pv magazine, 2025 - [German solar glass maker GMB files for insolvency - pv magazine International](#)

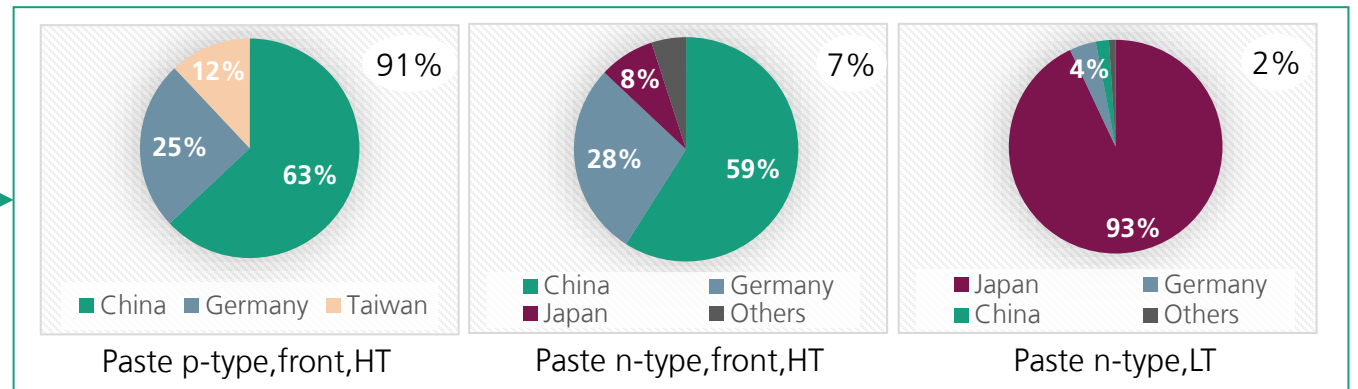
# PV supply concentration

## Silver production for PV in 2021

By production location

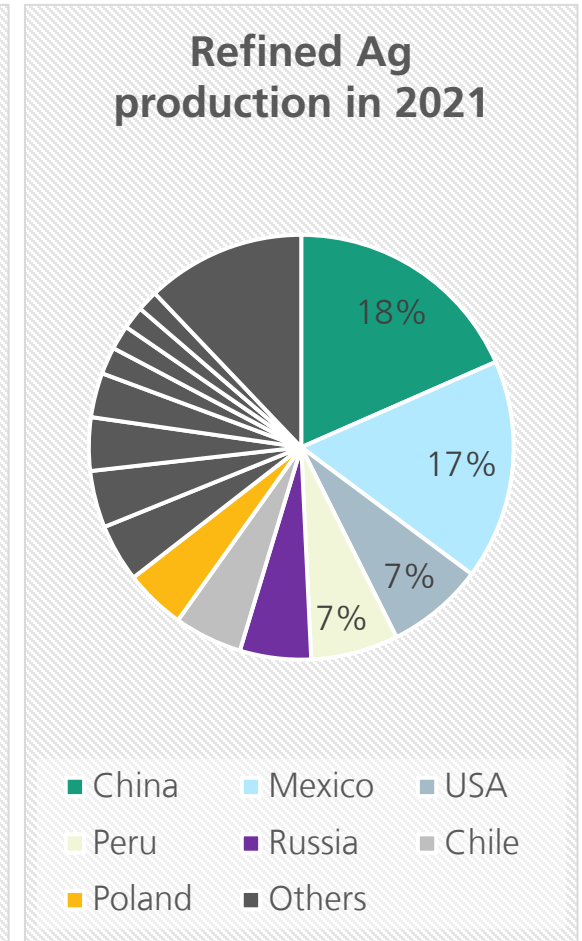
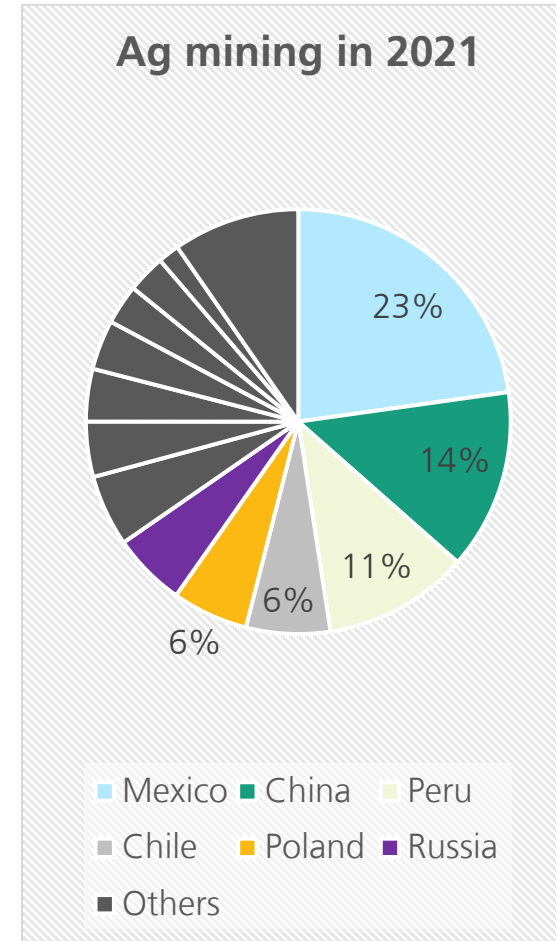
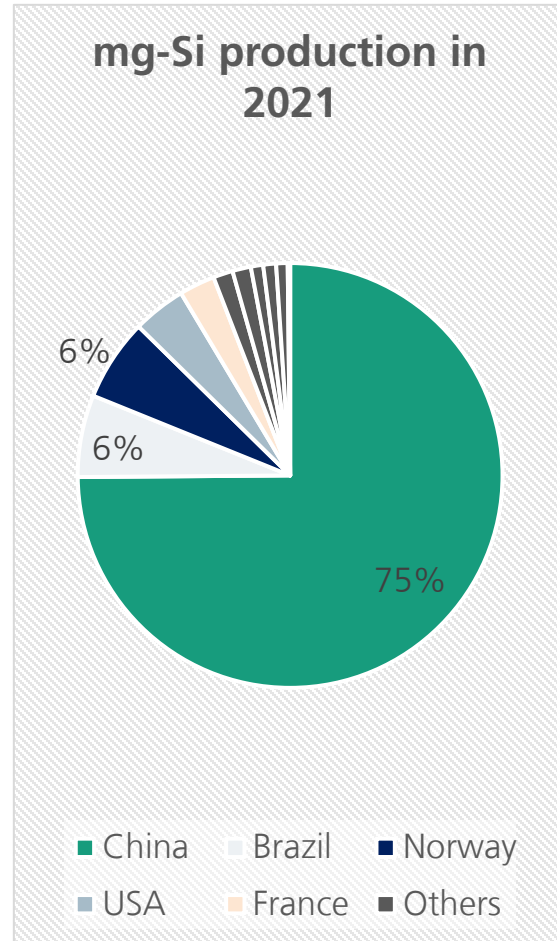
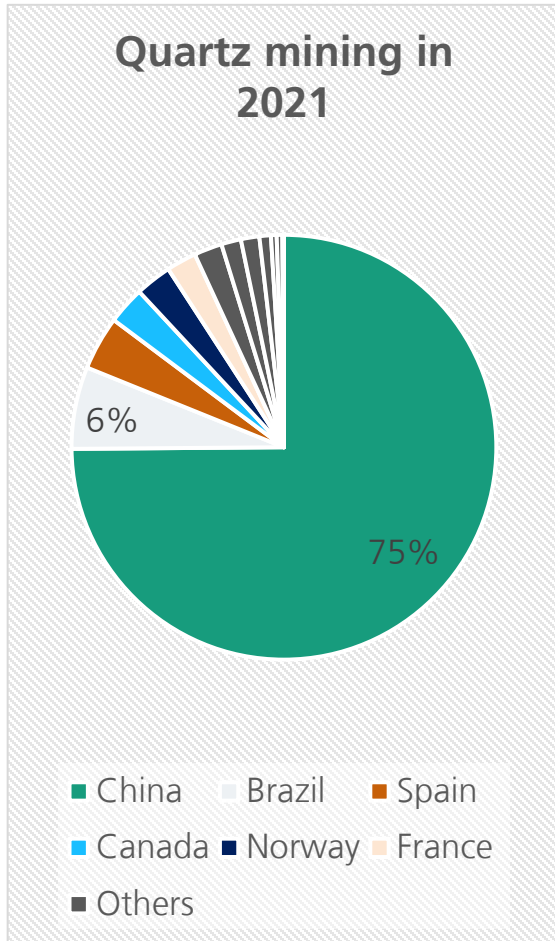


By company headquarter



# PV supply concentration

World material production (not PV specific)



# PV supply concentration

## Manufacturing equipment

There is currently no production capacity in the EU for the following components and consumables needed for ingot/wafer manufacturing:

- Cz pullers
- Diamond wire saws
- Crucibles
- Diamond wire

- This equipment and technology is available in Europe, although expansion and new investments in production capacity may remain necessary, depend on yearly installation / production necessary.
- Basic knowledge of the technology and innovation processes is still available in Europe
- There is a need to expand the production.

### Availability of equipment in the EU for PV manufacturing.

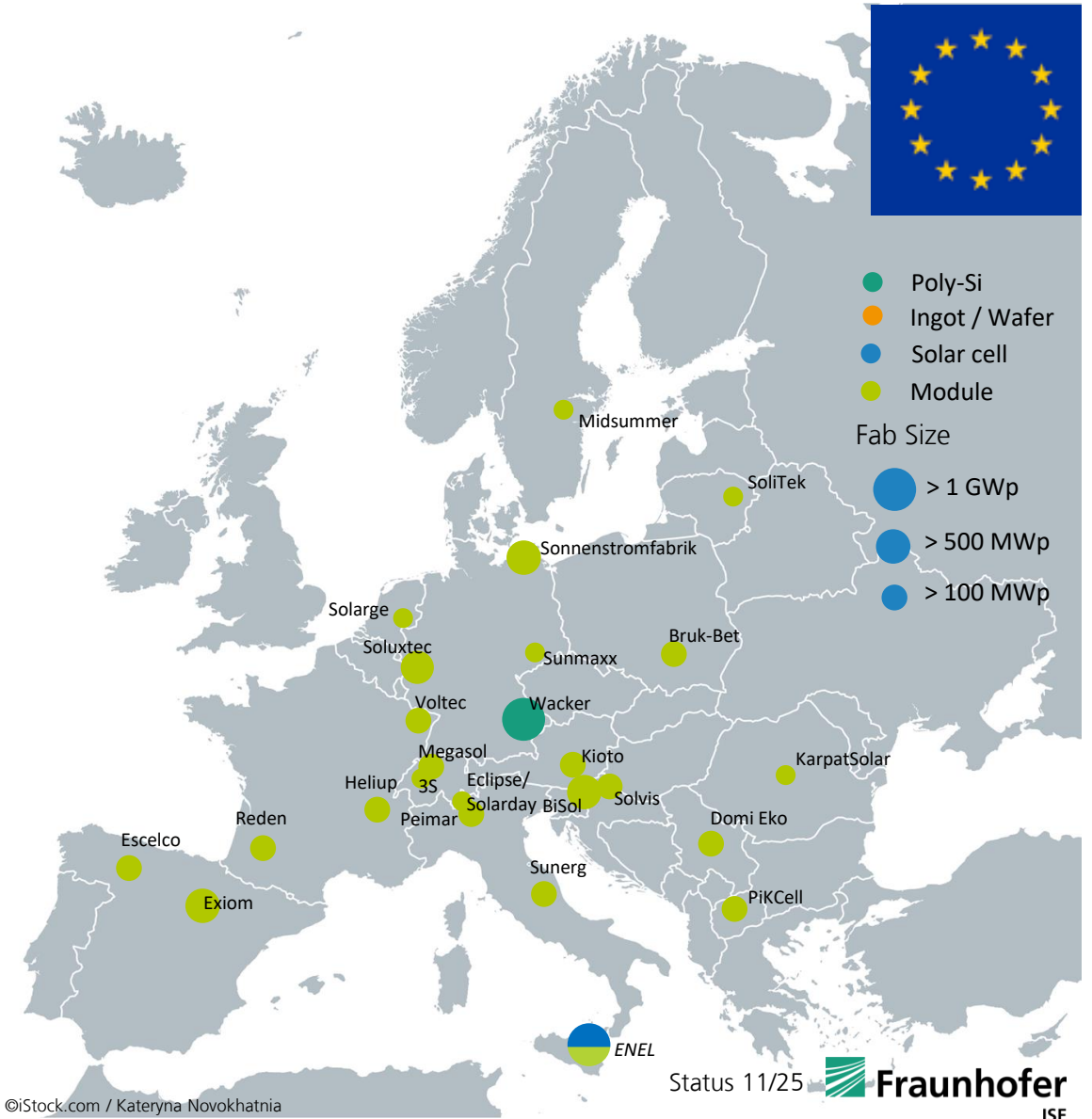
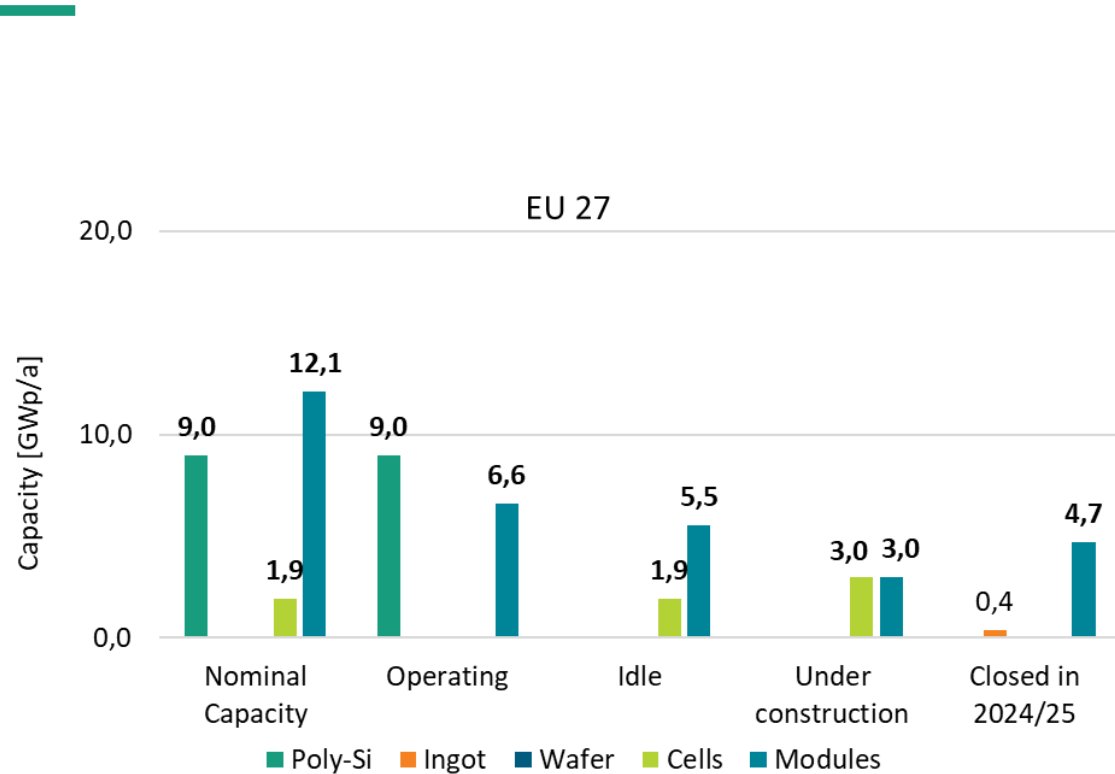
Key equipment wafering	Availability in EU	Scale up capacity in EU
Ingot Cz puller	✓	Lack of available expertise and capacity to rapidly expand manufacturing for these investments without significant investments.
Cropping – Squaring – Polishing	✓✓	
Diamond Wire Saws	✓	
Separation and cleaning	✓✓	
Testing and sorting	✓✓✓	
Fab automation	✓✓	

Key equipment Cell manufacturing	Availability in EU	Scale up capacity in EU
Wet Chemical tools (texture, etching, etc.)	✓✓✓	Manufacturing capacity for this equipment could be significantly expanded, though requiring investments and market visibility.
Thermal tools (diffusion, CVD, firing, etc.)	✓✓✓	
Laser tools	✓✓✓	
Printing	✓✓✓	
IV Sorting, Insitu Quality Control	✓✓✓	
Equipment + Fab Automation	✓✓✓	
PERC, TOPCon, HJT, New technologies	✓✓✓	

Key Equipment	Availability in EU	Scale up capacity in EU
Laser cutter	✓✓✓	Manufacturing capacity for this equipment could be significantly expanded, though requiring investments and market visibility.
Stringer	✓✓✓	
Laminator	✓✓✓	
IV Measuring – Inline Quality Controll	✓✓✓	
Automation	✓✓✓	

# EU PV Manufacturing Landscape – Status Quo

EU 27



Source: ©iStock.com / Kateryna Novokhatnia

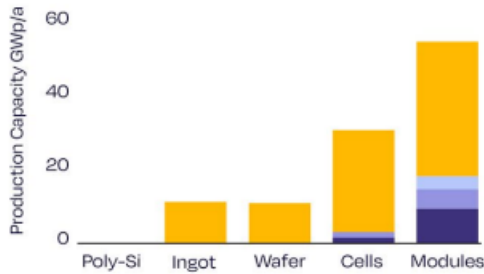
Status 11/25



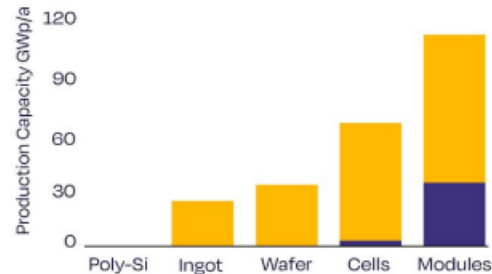
# PV supply diversification efforts

## Global operating and announced manufacturing capacity outside China

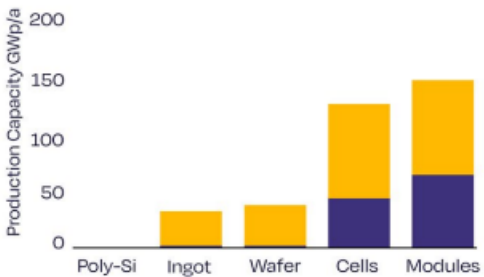
1 EU27



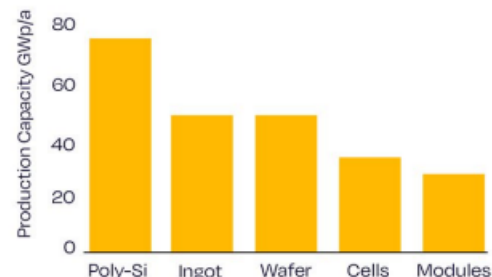
2 United States



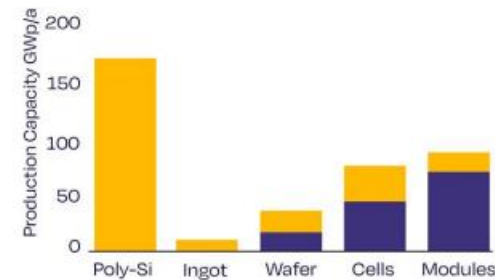
3 India



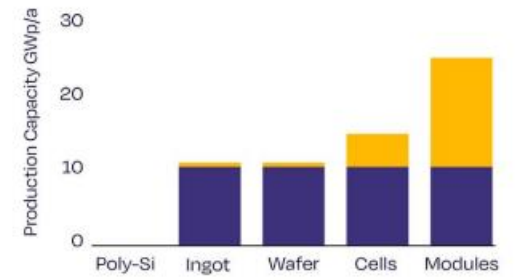
4 Middle East



5 Southeast Asia



6 Turkiye

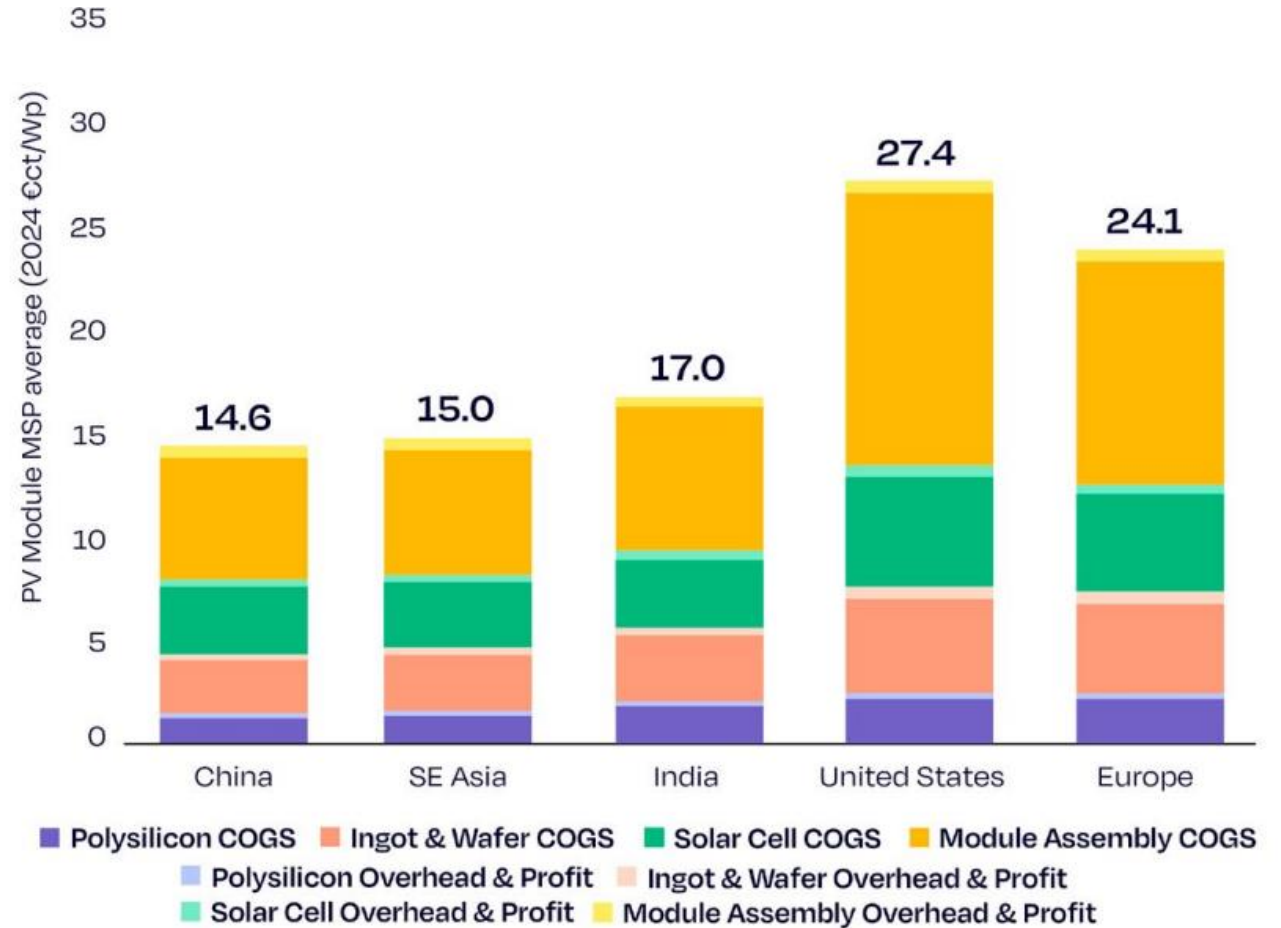
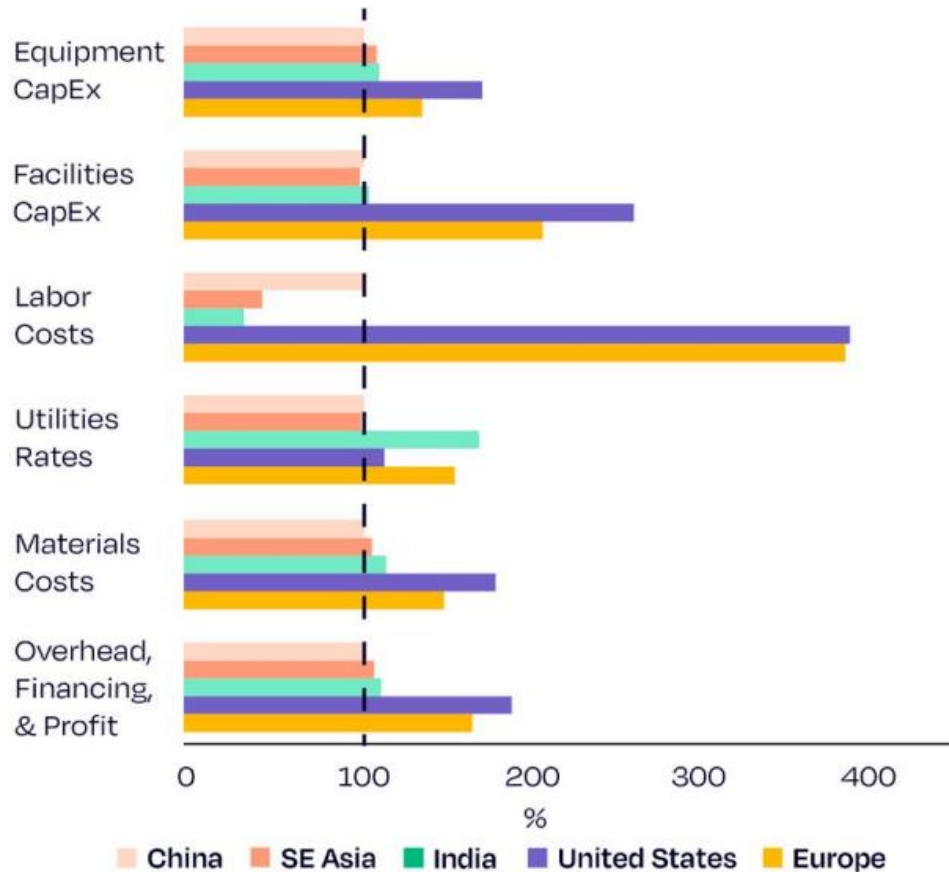


■ Operating ■ Planned ■ Idle ■ Closed in 2024

# Comparative cost gap analysis

## PV module production costs

COGS = Cost of Goods Sold  
MSP = Minimum Sustainable Price



# Comparative cost gap analysis

## PV module production costs - including Module shipping costs and EU scaling of production facility

Delivered Minimum Sustainable Price (MSP) for solar PV Module



## Contact

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