

## ■ Dominant PV Trade Flows ■ In Europe 2022



### A customs data analysis performed by the European Solar Manufacturing Council

The European Solar Manufacturing Council (ESMC) is the organisation representing the interests of the European PV manufacturing industry. ESMC aims at promoting and supporting the PV manufacturing industry and its value chains at the European level, by creating a supportive political environment.

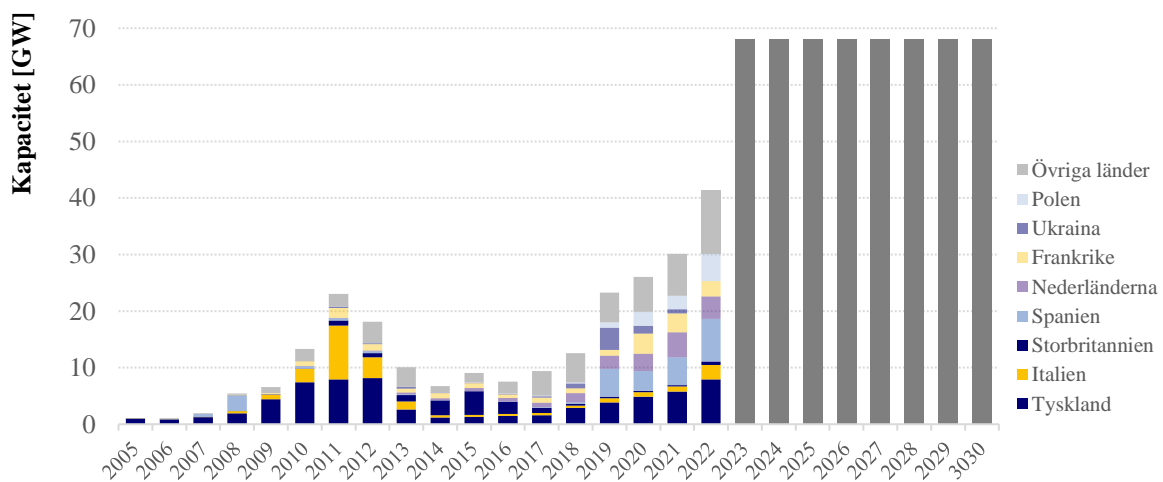
This study has been conducted by Amelia Oller Westerberg and Johan Lindahl. Any questions regarding the analysis or requests for additional information can be handled through [westerberg@esmc.solar](mailto:westerberg@esmc.solar).



## BACKGROUND AND AIM

During the early stages of the global photovoltaic (PV) development, Europe held a significant share of the market and the industry. However, over time, other regions, particularly China, began to gain larger market shares in terms of both installation and manufacturing volumes. By the end of 2022, the European Union (EU) had become the second-largest market in terms of cumulative and annual PV capacity, following China. Notably, four individual European markets, namely Spain, Germany, Poland, and the Netherlands ranked in the top 10 for annual installations, holding positions 5, 6, 8, and 10, respectively<sup>1</sup>. This indicates that the EU and Europe are well represented in terms of PV deployment, but the same cannot be said for the manufacturing of the necessary hardware.

Communicated in the REPowerEU<sup>2</sup> and the EU Solar Energy Strategy<sup>3</sup>, the European Union has ambitious energy transition plans and aims to deploy 750 GW<sub>DC</sub> (600 GW<sub>AC</sub>) by 2030, demonstrating a significant acceleration compared to the current pace, as shown in Figure 1. At the same time, the transition towards cleaner and more sustainable energy sources is at risk due to Europe's dependence on third-party countries for key components of renewable energy technologies, such as solar photovoltaic and solar thermal, onshore wind, offshore renewable energy, batteries and storage, electrolyzers and fuel cells. This risk has been emphasized in recent communications from the European Union, such as the Net-Zero Industry Act<sup>4</sup>. Adding to that, the ongoing invasion of Ukraine has further accentuated the geopolitical risks of heavy dependence on imports for our energy supply. The development of circular supply chains and the use of alternative materials could also help decrease dependence. ESMC's members are all active in the development of stronger European PV value chains, and swift action in support of Europe's domestic PV industry is required to mitigate these risks and ensure a sustainable energy future for Europe.



**Figure 1.** Annual installed capacity in Europe (blue) and the needed capacity additions to meet the EU Solar Strategy deployment target for 2030 (IEA PVPS<sup>1,5</sup>, European Commission<sup>3</sup>, ESMC).

<sup>1</sup> IEA PVPS Task 1: Snapshot of Global PV Markets (2023)

<sup>2</sup> EU REPowerEU Plan (2022)

<sup>3</sup> EU Solar Energy Strategy (2022)

<sup>4</sup> EU Net-Zero Industry Act (2023)

<sup>5</sup> IEA PVPS Task 1: Trends in PV Applications 2022



In line with the mission of ESMC, an annual study has been conducted in recent years to provide an overview of the central PV cell and module trade flows in and out of Europe. By analyzing customs data and mapping trade routes from specific countries or regions over a four-year period (2018 to 2021), ESMC has been able to evaluate and quantify the risky and unfortunate trade development. This analysis does not only benefit individual member companies but also serves as a basis for discussions within ESMC and the continuous communication with the European Commission and Member States' National Governments.

The past reports<sup>6</sup> traces the development over time, while this report focuses on the trade flows of 2022, distinguishing between PV cells and modules. Both of these two extra-European import flows exhibit dependency on third countries and highlights vulnerabilities at different stages of the value chain, since cells are imported by the European PV industry for module assembly and modules are imported for end-user applications.

## DATA AND METHODOLOGY

The analysis relies on data obtained from Trade Map<sup>7</sup>, a database managed by the International Trade Centre (ITC). Trade Map provides comprehensive monthly import and export data. The data availability in Trade Map is categorized into three types: No data, Reporting Data, and Mirror Data. Mirror Data is accessible for countries without official reporting, but that are engaged in trade with reporting countries. This is because the export of a product from country X to country Y is equivalent to the import of that product into country Y from country X. The data reported to ITC is provided by the trading entities of respective countries. It is important to note that the reporting system used opens up for misreporting and variations in data quality. However, it is considered the most reliable option currently available.

Within the database, the data is organized in Harmonized System (HS) codes. For this particular analysis, the data has been collected at the 6-digit HS code level, specifically focusing on codes 854142: *Photovoltaic cells not assembled in modules or made up into panels*, and 854143: *Photovoltaic cells assembled in modules or made up into panels*. These two new HS codes were introduced on 1 January 2022, so it should be noted that there is a difference compared to previous years, where the code 854140: *Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; Light emitting diodes*, along with specific 10-digit National Tariff Line (NTL) codes tailored to specific markets, was used for the analysis. These variations in datasets between the new and old HS codes prevent a direct comparison between the previous reports and this one.

The analysis has been conducted at the country level, examining the trade of each individual country separately. The data from all countries has then been aggregated to provide an overview of Europe's trade. The national trade ministries have already performed currency conversion to US dollars (\$US) for the European trade data, as all information in the ITC database is reported in this currency. Since it is more logical to present the trade flows in Euros (€), the 2022 average conversion rate has been used to reconvert the aggregated European data.

It is important to note that there are general discrepancies between export statistics and the corresponding import statistics reported by partner countries. Such inconsistencies are a well-

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<sup>6</sup> [Dominant PV Trade Flows in Europe 2018-2021 \(2022\)](#)

<sup>7</sup> [About Trade Map \(2023\)](#)



known issue within the field of trade reporting and analysis, and there are various potential explanations for the differences in valuations. Therefore, while the presented numbers accurately reflect what has been reported to official authorities, they should not be regarded as absolute figures, but rather as indicative patterns. Moreover, it should be recognized that trade data is never entirely comprehensive. Challenges such as smuggling and non-reporting pose significant problems in certain countries. Additionally, trade statistics, like any other source of information, are susceptible to errors and omissions. Many countries include re-imports in their import statistics and re-exports in their export statistics, which can further contribute to discrepancies. In the context of this analysis, the mismatch between import and export data is the most relevant source of potential error.

Several factors can account for the disparities observed<sup>8</sup>, including the use of special national or regional trade systems that exclude trade conducted in free zones, time lags (where exports are registered in one year and corresponding imports in the following year), country and product confidentiality, methodological differences related to import-export calculations (the recommendation is for import statistics to be compiled by country of origin, export statistics compiled by last known destination, and exclusion of goods in transit from trade statistics), as well as variations in value reporting (such as CIF: Cost Insurance Freight or FOB: Free On Board).

Given these considerations, it is essential to interpret the presented data with caution and recognize the inherent limitations and uncertainties associated with trade statistics. They serve as a valuable reference, but a comprehensive understanding of the broader trade landscape requires considering multiple factors and potential sources of discrepancy.

## TRADE WAYS

The presented analysis focuses on Europe and includes the trade with following regions and countries: China, Japan, Taiwan, Malaysia, India, Vietnam, South Korea, Rest of Asia, Africa, Middle East, Oceania, USA, South America, and the rest of North America & Central America. A geographical categorization table is provided in the Appendix. The data availability for the analysis was generally satisfactory, although there were some countries that lacked data, namely Albania, Kosovo, and Moldova. Consequently, these countries have been excluded from the analysis. Additionally, Belarus, Macedonia, Montenegro, and Ukraine only had mirror data available, making them markets with higher uncertainties since trade with other countries without direct data cannot be traced. However, it is worth noting that the markets without reported data are relatively small compared to the major markets in Europe, with Ukraine being an exception.

Table 1 illustrates the total value of trade imports and exports to and from Europe. The analysis is based on the trade flows of individual European countries, excluding their trade with other European countries (both import and export).

Imported goods significantly outweigh exports in this product category, indicating a considerable dependency on hardware imports from other regions. The continuous growth of the European deployment markets, along with the observed price trends in recent years, highlights the substantial and increasing annual value lost to foreign exports. This could have instead harnessed within the European economic area, contributing to the creation of green jobs,

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<sup>8</sup> [FAQ Trade Map](#)



increased tax revenues, and the promotion of sustainable business practices in accordance with EU regulations.

Among European countries, the Netherlands, Germany, Spain, Poland, and Greece have the highest total imports of modules from outside of Europe. Germany, France, Slovenia, Luxembourg, and Croatia are the markets with the highest extra-European imports of cells.

**Table 1:** Summary of Extra-European Import and Export values of European Countries and the EU27 expressed in billions of Euros, €. The raw data is extracted from Trade Map (International Trade Centre) for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	Extra-European import		Extra-European Export		Trade Balance		
	Cells [€, billions]	Modules [€, billions]	Cells [€, billions]	Modules [€, billions]	Cells [€, billions]	Modules [€, billions]	Total [€, billions]
<b>Europe</b>	0.44	24.88	0.02	0.13	-0.42	-24.75	-25.17
<b>EU27</b>	0.42	23.93	0.02	0.13	-0.40	-26.81	-24.21

Table 2 shows the inter-European trade based on export data, where all countries' separate trade with other European countries has been summarised. Note that re-distribution of foreign modules and cells within the Single Market is to be expected and that the values shown in Table 2 likely partially include values already accounted for once in Table 1.

However, it clearly shows that the Internal European Market is strong and that a majority of the European countries' export is inter-European, which also captures the interregional manufacturing volumes. Even if the inter-European trade likely captures parts of the externally imported modules and cells, it is evident that the extra-European import amounts to much more than the internally traded value.

**Table 2:** Summary of Inter-European trade based on export flows between European Countries, expressed in billions of Euros, €. The raw data is extracted from Trademap (International Trade Centre) for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	Inter-European trade		
	Cells [€, billions]	Modules [€, billions]	Total [€, billions]
<b>Europe</b>	0.20	11.50	11.70

Table 3 presents a more comprehensive breakdown of the traded quantities of PV cells and modules with countries outside of Europe. The result clearly shows that China is the dominant source of supply for PV cells and modules in Europe. The concentration of supply from China is remarkable, with 89.9% of PV cells and 95.7% module imports originating from China. In total, 95.6% of the monetary value of total imports in these two categories is attributed to China.

While it is not impossible, it seems unlikely that the exported volumes of cells and modules to China and other Asian countries are primarily intended for large-scale installations or for module assembly with European hardware. One plausible explanation could be that these exports consist of returns.

In addition to exports to Asia, it is noteworthy that the United States of America stands out as the largest single Extra-European importer of European PV hardware.



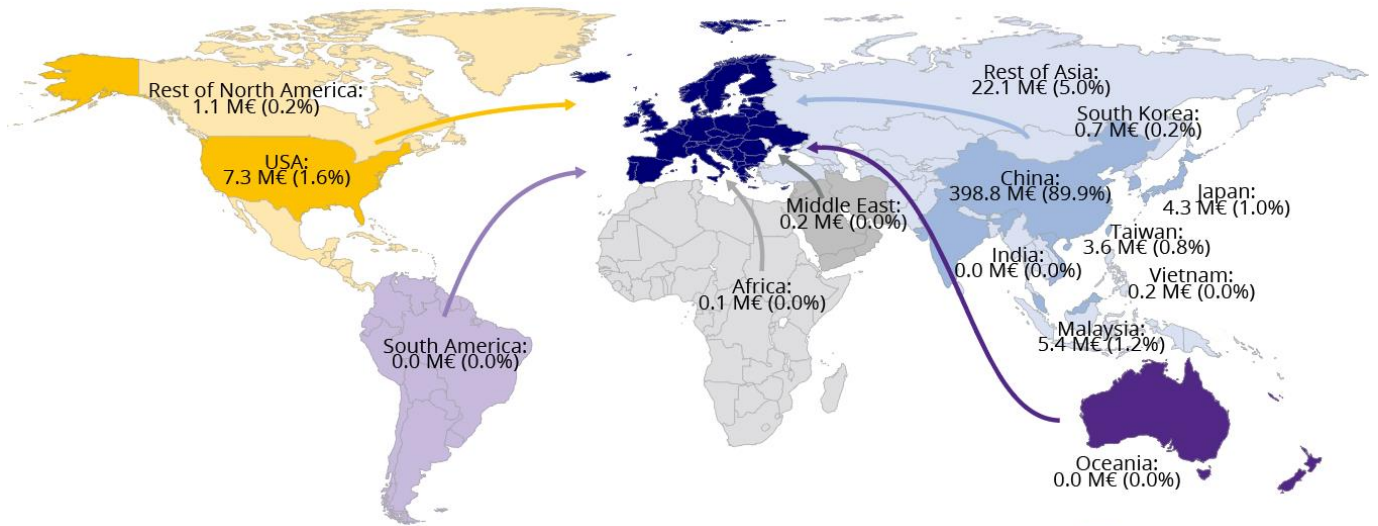
**Table 3.** The imported and exported value [€, millions] and the share [%] of PV modules and cells into Europe from third countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map (International Trade Centre) for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	398.8 (89.9)	23 807.2 (95.7)	24 206.0 (95.6)	4.8 (19.7)	5.4 (4.1)	10.2 (6.6)
<u>Japan</u>	4.3 (1.0)	11.2 (0.0)	15.5 (0.1)	2.1 (8.7)	2.6 (2.0)	4.7 (3.1)
<u>Taiwan</u>	3.6 (0.8)	221.2 (0.9)	224.8 (0.9)	0.3 (1.3)	1.4 (1.1)	1.7 (1.1)
<u>Malaysia</u>	5.4 (1.2)	241.8 (1.0)	247.2 (1.0)	0.8 (3.2)	0.4 (0.3)	1.2 (0.8)
<u>India</u>	0.0 (0.0)	2.1 (0.0)	2.1 (0.0)	0.1 (0.4)	0.9 (0.7)	1.0 (0.6)
<u>Vietnam</u>	0.2 (0.0)	194.4 (0.8)	194.6 (0.8)	0.0 (0.1)	0.1 (0.1)	0.1 (0.1)
<u>South Korea</u>	0.7 (0.2)	53.6 (0.2)	54.3 (0.2)	0.7 (2.7)	1.2 (0.9)	1.8 (1.2)
<u>Rest of Asia</u>	22.1 (5.0)	212.1 (0.9)	234.3 (0.9)	6.6 (27.1)	2.8 (2.2)	9.4 (6.1)
<u>Africa</u>	0.1 (0.0)	3.5 (0.0)	3.6 (0.0)	1.0 (4.2)	30.3 (23.2)	31.4 (20.2)
<u>Middle East</u>	0.2 (0.0)	4.8 (0.0)	5.0 (0.0)	1.2 (4.9)	11.0 (8.4)	12.2 (7.9)
<u>Oceania</u>	0.0 (0.0)	1.8 (0.0)	1.8 (0.0)	0.5 (2.1)	1.3 (1.0)	1.8 (1.2)
<u>USA</u>	7.3 (1.6)	101.7 (0.4)	109.0 (0.4)	5.1 (21.0)	54.3 (41.5)	59.4 (38.2)
<u>Rest of N &amp; C America</u>	1.1 (0.2)	29.2 (0.1)	30.3 (0.1)	0.9 (3.6)	14.0 (10.7)	14.9 (9.6)
<u>South America</u>	0.0 (0.0)	0.2 (0.0)	0.2 (0.0)	0.2 (0.8)	5.3 (4.0)	5.5 (3.5)
<b>Total</b>	<b>443.8</b>	<b>24 884.9</b>	<b>25 328.8</b>	<b>24.3</b>	<b>131.0</b>	<b>155.3</b>

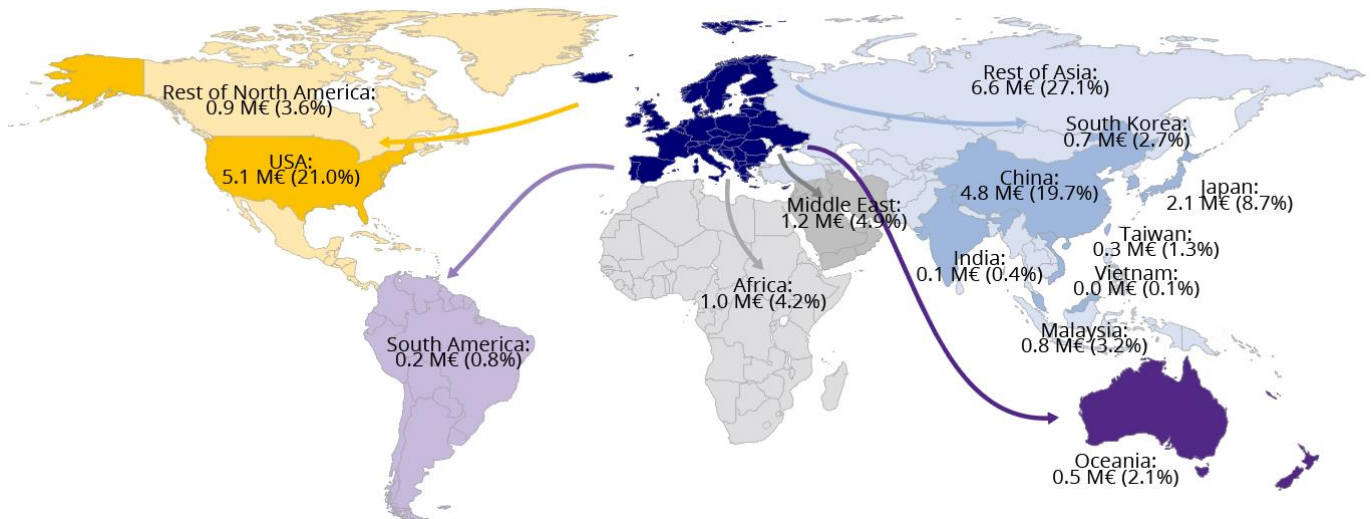


To visualize the trade flows, they are mapped out in Figures 2-5 respectively for the import and exports of cells and modules.

### Trade flows – PV Cells



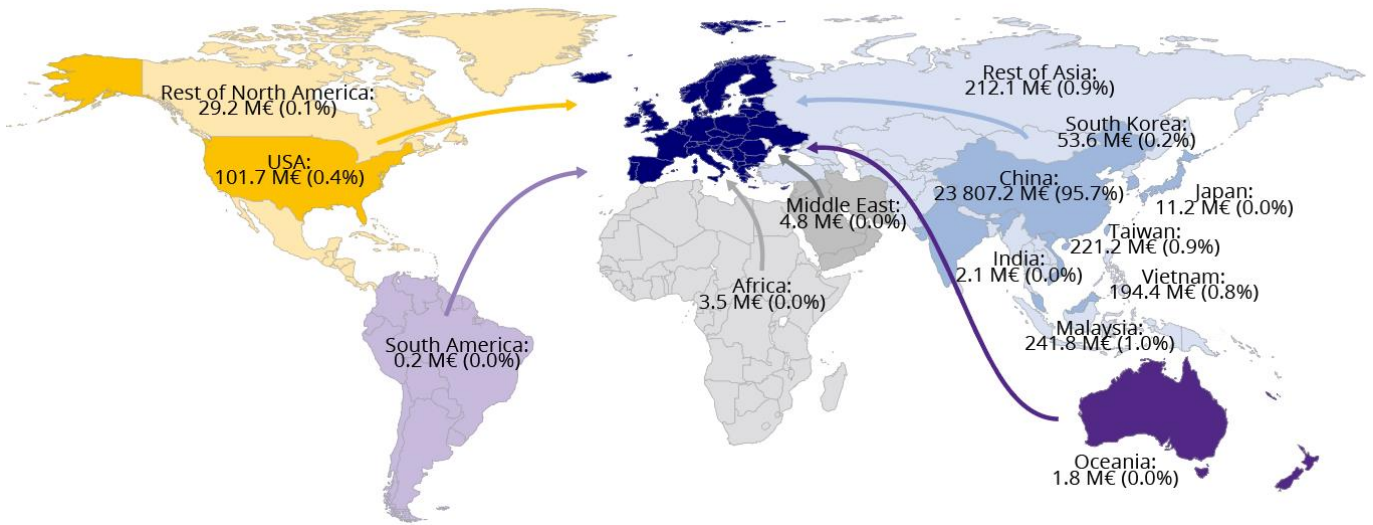
**Figure 2:** A visual representation of the import flows of PV cells into Europe expressed in millions of Euros [M€] and the share of the total extra-European import of cells [%]. The raw data is based on the HS code 854142 (Photovoltaic cells not assembled in modules or made up into panels) from Trade Map.



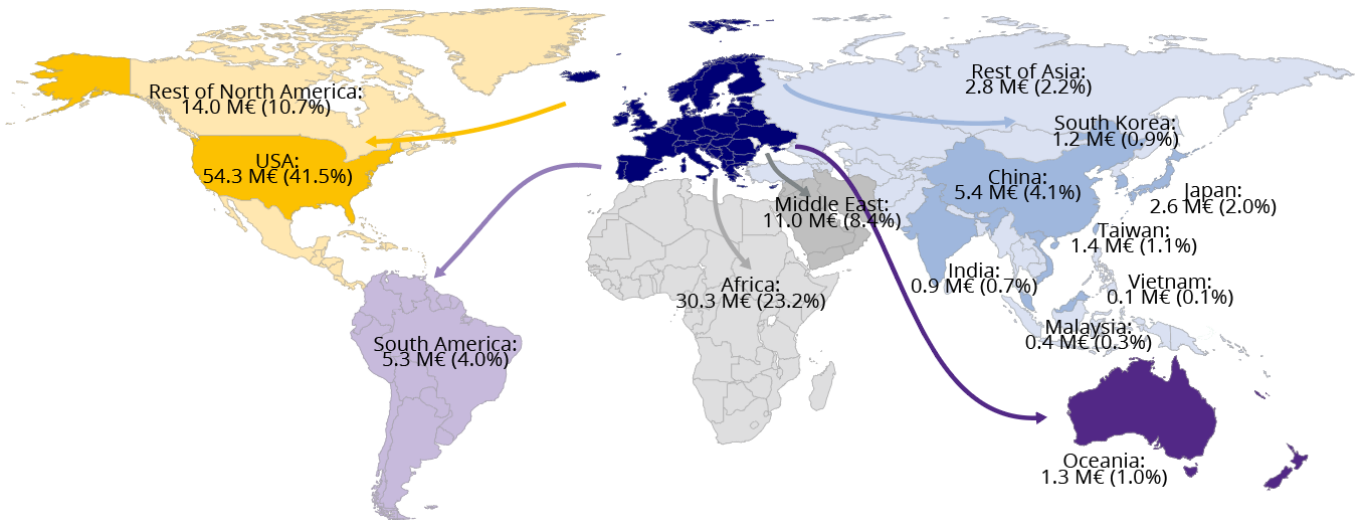
**Figure 3:** A visual representation of the export flows of PV cells out of Europe expressed in millions of Euros [M€] and the share of the total extra-European export of cells [%]. The raw data is based on the HS code 854142 (Photovoltaic cells not assembled in modules or made up into panels) from Trade Map.



## Trade flows – PV Modules



**Figure 4:** A visual representation of the import flows of PV modules into Europe expressed in millions of Euros [M€] and the share of the total extra-European import of modules [%]. The raw data is based on the HS code 854143 (Photovoltaic cells assembled in modules or made up into panels) from Trade Map.



**Figure 5:** A visual representation of the export flows of PV modules out of Europe expressed in millions of Euros [M€] and the share of the total extra-European export of modules [%]. The raw data is based on the HS code 854143 (Photovoltaic cells assembled in modules or made up into panels) from Trade Map.





## NATIONAL TRADE FLOWS

This section focuses on the dominant trade flows of selected EU Member States, chosen based on their domestic market size and representation in the European Solar Manufacturing Council (ESMC). The countries included are Germany, France, Spain, the Netherlands, Italy, Poland, Portugal, Sweden, Greece, and Denmark.

Across these specific countries, a similar trend to that of the entire European market can be observed, with China remaining the most significant trade partner. China is the largest source of PV cells and modules for all the presented Member States, with the exception of cases where internally traded European value outweighs Chinese imports. It is important to note, however, that these internally traded values could still involve Chinese or Asian modules and cells circulating between EU Member States, as already mentioned.



## Germany

**Table 4** The traded value [€, millions] and the share [%] of the total import and export for Germany in 2022 for a selection of regions and countries. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	201.0 (83.1)	3 074.0 (86.9)	3 275.0 (86.7)	3.2 (8.5)	4.0 (0.3)	7.2 (0.5)
<u>Japan</u>	0.7 (0.3)	0.2 (0.0)	0.8 (0.0)	0.1 (0.3)	2.2 (0.2)	2.4 (0.2)
<u>Taiwan</u>	2.0 (0.8)	92.9 (2.6)	95.0 (2.5)	0.3 (0.8)	0.1 (0.0)	0.4 (0.0)
<u>Malaysia</u>	3.0 (1.2)	62.8 (1.8)	65.8 (1.7)	0.1 (0.2)	0.3 (0.0)	0.4 (0.0)
<u>India</u>		0.1 (0.0)	0.1 (0.0)	0.1 (0.2)	0.8 (0.1)	0.9 (0.1)
<u>Vietnam</u>	0.0 (0.0)	54.9 (1.6)	54.9 (1.5)	0.0 (0.0)	0.1 (0.0)	0.1 (0.0)
<u>South Korea</u>	3.0 (1.2)	16.7 (0.5)	19.7 (0.5)	0.6 (1.5)	0.5 (0.0)	1.0 (0.1)
<u>Rest of Asia</u>	6.1 (2.5)	30.8 (0.9)	36.9 (1.0)	2.0 (8.1)	1.3 (0.1)	4.3 (0.3)
<u>Africa</u>	0.0 (0.0)	0.1 (0.0)	0.1 (0.0)	0.3 (0.9)	6.3 (0.4)	6.6 (0.5)
<u>Middle East</u>	0.1 (0.0)	0.0 (0.0)	0.1 (0.0)	0.7 (1.9)	2.2 (0.2)	2.9 (0.2)
<u>Oceania</u>		0.3 (0.0)	0.3 (0.0)	0.4 (1.1)	0.4 (0.0)	0.8 (0.1)
<u>USA</u>	5.4 (2.2)	2.6 (0.1)	8.1 (0.2)	3.4 (8.9)	42.4 (3.0)	45.7 (3.2)
<u>Rest of N &amp; C America</u>	0.4 (0.2)	5.0 (0.1)	5.4 (0.1)	0.3 (0.8)	0.5 (0.0)	0.8 (0.1)
<u>South America</u>		0.0 (0.0)	0.0 (0.0)	0.1 (0.3)	0.2 (0.0)	0.3 (0.0)
<u>Europe</u>	20.1 (8.3)	196.5 (5.6)	216.6 (5.7)	25.1 (66.6)	1 337.4 (95.6)	1 362.5 (94.9)
<b>Total</b>	<b>241.9</b>	<b>3 547.0</b>	<b>3778.9</b>	<b>37.6</b>	<b>1 398.6</b>	<b>1436.2</b>



## France

**Table 5.** The traded value [€, millions] and the share [%] of the total import and export for France in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	49.5 (55.1)	839.7 (69.6)	889.3 (68.6)	0.0 (0.2)	0.0 (0.0)	0.1 (0.0)
<u>Japan</u>	0.1 (0.1)	3.1 (0.3)	3.2 (0.2)	0.1 (0.3)	0.0 (0.0)	0.1 (0.0)
<u>Taiwan</u>	0.0 (0.0)	0.3 (0.0)	0.4 (0.0)		0.0 (0.0)	0.0 (0.0)
<u>Malaysia</u>	1.6 (1.8)	35.0 (2.9)	36.7 (2.8)	0.0 (0.2)		0.0 (0.0)
<u>India</u>	0.0 (0.0)	0.7 (0.1)	0.7 (0.1)		0.0 (0.0)	0.0 (0.0)
<u>Vietnam</u>		13.1 (1.1)	13.1 (1.0)	0.0 (0.1)		0.0 (0.0)
<u>South Korea</u>	1.6 (1.8)	1.0 (0.1)	2.6 (0.2)	0.0 (0.0)		0.0 (0.0)
<u>Rest of Asia</u>	9.7 (10.8)	50.0 (4.1)	59.8 (4.6)	0.0 (0.1)	0.1 (0.1)	0.1 (0.0)
<u>Africa</u>	0.1 (0.1)	0.1 (0.0)	0.2 (0.0)		7.4 (3.8)	7.4 (3.4)
<u>Middle East</u>		0.3 (0.0)	0.3 (0.0)		1.2 (0.6)	1.2 (0.5)
<u>Oceania</u>		0.0 (0.0)	0.0 (0.0)		0.6 (0.3)	0.6 (0.3)
<u>USA</u>	0.4 (0.5)	55.7 (4.6)	56.2 (4.3)	1.1 (4.8)	1.2 (0.6)	2.3 (1.1)
<u>Rest of N &amp; C America</u>	0.0 (0.0)	4.5 (0.4)	4.6 (0.4)	0.1 (0.4)	0.3 (0.2)	0.4 (0.2)
<u>South America</u>		0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.2 (0.1)	0.2 (0.1)
<u>Europe</u>	26.8 (29.7)	202.4 (16.8)	229.1 (17.7)	21.5 (93.8)	183.3 (94.3)	294.9 (94.2)
<b>Total</b>	<b>90.0</b>	<b>1 206.1</b>	<b>1296.1</b>	<b>23.0</b>	<b>194.4</b>	<b>217.4</b>



## Spain

**Table 6.** The traded value [€, millions] and the share [%] of the total import and export for Spain in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	11.4 (23.4)	2798.9 (83.7)	2 810.3 (82.8)		0.2 (0.1)	0.2 (0.1)
<u>Japan</u>		0.2 (0.0)	0.2 (0.0)	0.0 (0.5)		0.0 (0.0)
<u>Taiwan</u>	0.0 (0.1)	3.6 (0.1)	3.6 (0.1)			
<u>Malaysia</u>		6.7 (0.2)	6.7 (0.2)			
<u>India</u>	0.1 (0.0)	0.2 (0.0)	0.3 (0.0)			
<u>Vietnam</u>	0.0 (0.1)	1.1 (0.0)	1.1 (0.0)			
<u>South Korea</u>				0.0 (0.3)	0.2 (0.1)	0.2 (0.1)
<u>Rest of Asia</u>	0.0 (0.0)	2.6 (0.1)	2.7 (0.1)		0.0 (0.0)	0.0 (0.0)
<u>Africa</u>		0.2 (0.0)	0.2 (0.0)	0.1 (9.5)	3.9 (2.5)	4.0 (2.5)
<u>Middle East</u>	0.1 (0.2)		0.1 (0.0)	0.2 (20.1)	1.4 (0.9)	1.6 (1.0)
<u>Oceania</u>				0.0 (0.4)	0.1 (0.1)	0.1 (0.1)
<u>USA</u>	0.0 (0.0)	6.4 (0.2)	6.4 (0.2)	0.0 (1.8)	2.3 (1.5)	2.4 (1.5)
<u>Rest of N &amp; C America</u>		0.1 (0.0)	0.1 (0.0)	0.0 (0.4)	3.4 (2.2)	3.4 (2.2)
<u>South America</u>		0.0 (0.0)	0.0 (0.0)	0.0 (2.6)	3.5 (2.2)	3.6 (2.2)
<u>Europe</u>	37.2 (76.2)	525.0 (15.7)	562.2 (16.6)	0.7 (64.4)	143.0 (90.5)	143.7 (90.3)
<b>Total</b>	<b>48.9</b>	<b>3 344.9</b>	<b>3 393.7</b>	<b>1.1</b>	<b>158.0</b>	<b>159.1</b>



## The Netherlands

**Table 7.** The traded value [€, millions] and the share [%] of the total import and export for the Netherlands in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	10.5 (26.3)	10 429.6 (89.0)	10 440.0 (88.8)	0.4 (0.3)	0.1 (0.0)	0.5 (0.0)
<u>Japan</u>	0.5 (1.3)	2.2 (0.0)	2.7 (0.0)	0.1 (0.0)	0.0 (0.0)	0.1 (0.0)
<u>Taiwan</u>	0.1 (0.3)	122.2 (1.0)	122.3 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>Malaysia</u>	0.1 (0.2)	68.0 (0.6)	68.1 (0.6)	0.0 (0.0)		0.0 (0.0)
<u>India</u>		0.8 (0.0)	0.8 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>Vietnam</u>		103.5 (0.9)	103.5 (0.9)	0.0 (0.0)		0.0 (0.0)
<u>South Korea</u>	0.1 (0.2)	22.2 (0.2)	22.2 (0.2)	0.1 (0.1)	0.5 (0.0)	0.6 (0.0)
<u>Rest of Asia</u>	0.7 (1.9)	117.9 (1.0)	118.7 (1.0)	0.3 (0.3)	0.2 (0.0)	0.5 (0.0)
<u>Africa</u>	0.0 (0.0)	1.4 (0.0)	1.4 (0.0)	0.1 (0.1)	1.7 (0.0)	1.8 (0.0)
<u>Middle East</u>		4.3 (0.0)	4.3 (0.0)	0.2 (0.1)	1.9 (0.0)	2.0 (0.0)
<u>Oceania</u>		0.5 (0.0)	0.5 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>USA</u>	0.0 (0.0)	8.4 (0.1)	8.4 (0.1)	0.2 (0.1)	3.9 (0.1)	4.1 (0.1)
<u>Rest of N &amp; C America</u>		17.6 (0.2)	17.6 (0.1)	0.4 (0.3)	0.5 (0.0)	0.8 (0.0)
<u>South America</u>				0.1 (0.1)	0.5 (0.0)	0.6 (0.0)
<u>Europe</u>	27.8 (69.8)	819.7 (7.0)	847.5 (7.2)	105.8 (98.5)	7 381.3 (99.9)	7487.1 (99.9)
<b>Total</b>	<b>39.8</b>	<b>11 718.1</b>	<b>11 757.9</b>	<b>107.4</b>	<b>7 390.8</b>	<b>7 498.2</b>



## Italy

**Table 8.** The traded value [€, millions] and the share [%] of the total import and export for Italy in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	9.1 (41.3)	407.9 (29.1)	417.1 (29.2)			
<u>Japan</u>		0.1 (0.0)	0.1 (0.0)	0.0 (0.4)	0.1 (0.2)	0.2 (0.2)
<u>Taiwan</u>	0.0 (0.1)	1.0 (0.1)	1.0 (0.1)	0.0 (0.2)		0.0 (0.0)
<u>Malaysia</u>		0.1 (0.0)	0.1 (0.0)			
<u>India</u>		0.0 (0.0)	0.0 (0.0)			
<u>Vietnam</u>						
<u>South Korea</u>		0.9 (0.1)	0.9 (0.1)			
<u>Rest of Asia</u>	0.1 (0.5)	0.6 (0.0)	0.7 (0.1)	0.1 (1.4)	0.3 (0.3)	0.3 (0.4)
<u>Africa</u>	0.0 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5.0 (6.1)	5.0 (5.8)
<u>Middle East</u>	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.5 (1.9)	1.5 (1.8)
<u>Oceania</u>				0.1 (2.0)	0.0 (0.0)	0.1 (0.2)
<u>USA</u>	0.2 (0.7)	0.1 (0.0)	0.2 (0.0)	0.0 (0.6)	2.3 (2.8)	2.3 (2.7)
<u>Rest of N &amp; C America</u>	0.1 (0.5)	1.2 (0.1)	1.4 (0.1)	0.0 (0.1)	0.2 (0.3)	0.2 (0.3)
<u>South America</u>		0.1 (0.0)	0.1 (0.0)	0.0 (0.2)	0.5 (0.6)	0.5 (0.6)
<u>Europe</u>	12.6 (56.7)	991.8 (70.6)	1 004.4 (70.4)	4.5 (95.0)	71.1 (87.7)	75.6 (88.1)
<b>Total</b>	<b>22.1</b>	<b>1 403.9</b>	<b>1 426.0</b>	<b>4.8</b>	<b>81.0</b>	<b>85.8</b>



## Poland

**Table 9.** The traded value [€, millions] and the share [%] of the total import and export for Poland in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	3.4 (28.5)	1 093.3 (63.9)	1 096.7 (63.7)			
<u>Japan</u>		0.1 (0.0)	0.1 (0.0)			
<u>Taiwan</u>		0.0 (0.0)	0.0 (0.0)			
<u>Malaysia</u>		13.4 (0.8)	13.4 (0.8)			
<u>India</u>						
<u>Vietnam</u>		0.3 (0.0)	0.3 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>South Korea</u>				0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>Rest of Asia</u>	0.0 (0.3)		0.0 (0.0)	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)
<u>Africa</u>				0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>Middle East</u>	0.0 (0.1)		0.0 (0.0)	0.2 (0.1)	0.2 (0.1)	0.2 (0.1)
<u>Oceania</u>						
<u>USA</u>	0.0 (0.0)	0.6 (0.0)	0.6 (0.0)	0.7 (0.3)	0.7 (0.3)	0.7 (0.3)
<u>Rest of N &amp; C America</u>						
<u>South America</u>						
<u>Europe</u>	8.5 (71.1)	603.3 (35.3)	611.8 (35.5)	1.3 (100.0)	244.5 (99.6)	245.7 (99.6)
<b>Total</b>	<b>11.9</b>	<b>1 711.0</b>	<b>1 722.9</b>	<b>1.3</b>	<b>245.5</b>	<b>246.7</b>



## Portugal

**Table 10.** The traded value [€, millions] and the share [%] of the total import and export for Portugal in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	0.0 (0.1)	953.2 (82.2)	953.2 (81.5)			
<u>Japan</u>						
<u>Taiwan</u>						
<u>Malaysia</u>		0.1 (0.0)	0.1 (0.0)			
<u>India</u>						
<u>Vietnam</u>		14.4 (1.2)	14.4 (1.2)			
<u>South Korea</u>						
<u>Rest of Asia</u>						
<u>Africa</u>				0.0 (0.3)	1.9 (0.4)	2.0 (0.4)
<u>Middle East</u>						
<u>Oceania</u>						
<u>USA</u>	0.0 (0.0)	3.8 (0.3)	3.8 (0.3)		0.1 (0.0)	0.1 (0.0)
<u>Rest of N &amp; C America</u>						
<u>South America</u>					0.1 (0.0)	0.1 (0.0)
<u>Europe</u>	10.9 (99.9)	187.5 (16.2)	198.4 (17.0)	3.4 (99.7)	488.6 (99.6)	492.0 (99.6)
<b>Total</b>	<b>10.9</b>	<b>1 159.0</b>	<b>1 169.9</b>	<b>3.4</b>	<b>490.8</b>	<b>494.2</b>





## Sweden

**Table 11.** The traded value [€, millions] and the share [%] of the total import and export for Sweden in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	0.1 (1.1)	96.0 (38.6)	96.0 (37.8)	0.4 (26.6)	0.5 (6.6)	0.9 (10.1)
<u>Japan</u>	0.0 (0.1)	0.6 (0.3)	0.6 (0.3)			
<u>Taiwan</u>		0.3 (0.1)	0.3 (0.1)			
<u>Malaysia</u>		0.0 (0.0)	0.0 (0.0)			
<u>India</u>		0.0 (0.0)	0.0 (0.0)			
<u>Vietnam</u>		0.1 (0.0)	0.1 (0.0)			
<u>South Korea</u>						
<u>Rest of Asia</u>		0.0 (0.0)	0.0 (0.0)		0.0 (0.1)	0.0 (0.1)
<u>Africa</u>		1.0 (0.4)	1.0 (0.4)		0.0 (0.1)	0.0 (0.1)
<u>Middle East</u>						
<u>Oceania</u>						
<u>USA</u>	0.0 (0.2)	0.0 (0.0)	0.0 (0.0)		0.0 (0.0)	0.0 (0.0)
<u>Rest of N &amp; C America</u>	0.4 (6.5)	0.0 (0.0)	0.4 (0.2)			
<u>South America</u>					6.9 (93.2)	6.9 (76.9)
<u>Europe</u>	5.3 (92.1)	150.5 (60.6)	155.9 (61.3)	1.1 (73.4)		1.1 (12.8)
<b>Total</b>	<b>5.8</b>	<b>248.5</b>	<b>254.3</b>	<b>1.6</b>	<b>7.4</b>	<b>9.0</b>



## Denmark

**Table 12.** The traded value [€, millions] and the share [%] of the total import and export for Denmark in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	0.1 (3.8)	229.5 (71.1)	229.7 (70.5)	0.0 (1.1)		0.0 (0.0)
<u>Japan</u>	0.0 (0.0)	0.3 (0.1)	0.3 (0.1)	0.0 (0.2)		0.0 (0.0)
<u>Taiwan</u>	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)			
<u>Malaysia</u>						
<u>India</u>				0.0 (0.2)		0.0 (0.0)
<u>Vietnam</u>						
<u>South Korea</u>				0.0 (0.9)		0.0 (0.0)
<u>Rest of Asia</u>	0.0 (0.8)		0.0 (0.0)	0.1 (21.1)	0.3 (2.0)	0.4 (2.6)
<u>Africa</u>					1.2 (8.3)	1.2 (8.1)
<u>Middle East</u>				0.0 (5.0)	0.0 (0.0)	0.0 (0.1)
<u>Oceania</u>				0.0 (0.2)	0.2 (1.1)	0.2 (1.1)
<u>USA</u>		0.0 (0.0)	0.0 (0.0)	0.1 (25.2)		0.1 (0.9)
<u>Rest of N &amp; C America</u>		0.0 (0.0)	0.0 (0.0)		0.5 (3.6)	0.5 (3.5)
<u>South America</u>					12.6 (84.7)	12.6 (82.4)
<u>Europe</u>	3.0 (95.3)	92.7 (28.7)	95.8 (29.4)	0.2 (46.0)		0.2 (1.3)
<b>Total</b>	<b>3.2</b>	<b>322.7</b>	<b>325.9</b>	<b>0.4</b>	<b>14.8</b>	<b>15.2</b>



## Greece

**Table 13.** The traded value [€, millions] and the share [%] of the total import and export for France in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	0.1 (2.6)	1 065.2 (97.2)	1 065.3 (96.7)			
<u>Japan</u>						
<u>Taiwan</u>						
<u>Malaysia</u>		2.9 (0.3)	2.9 (0.3)			
<u>India</u>						
<u>Vietnam</u>		0.3 (0.0)	0.3 (0.0)			
<u>South Korea</u>						
<u>Rest of Asia</u>		0.0 (0.0)	0.0 (0.0)			
<u>Africa</u>				0.0 (0.0)		0.0 (0.0)
<u>Middle East</u>				0.6 (0.2)		0.6 (0.2)
<u>Oceania</u>						
<u>USA</u>		1.1 (0.1)	1.1 (0.1)			
<u>Rest of N &amp; C America</u>		0.0 (0.0)	0.0 (0.0)			
<u>South America</u>					342.9 (99.8)	342.9 (99.0)
<u>Europe</u>	5.3 (97.4)	26.9 (2.5)	32.2 (2.9)	3.0 (100.0)		3.0 (0.9)
<b>Total</b>	<b>5.4</b>	<b>1 096.3</b>	<b>1 101.7</b>	<b>3.0</b>	<b>343.6</b>	<b>346.5</b>



## Belgium

**Table 14.** The traded value [€, millions] and the share [%] of the total import and export for France in 2022 for a selection of regions and countries. N & C America is short for North America and Central America. The raw data is extracted from Trade Map for HS-codes 854142 (Photovoltaic cells not assembled in modules or made up into panels) and 854143 (Photovoltaic cells assembled in modules or made up into panels).

	IMPORTS			EXPORTS		
	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]	Cells [€, millions, (%)]	Modules [€, millions, (%)]	Total [€, millions, (%)]
<u>China</u>	9.7 (65.3)	512.0 (60.7)	521.7 (60.8)			
<u>Japan</u>	0.0 (0.0)		0.0 (0.0)			
<u>Taiwan</u>	0.5 (3.5)	0.0 (0.0)	0.5 (0.1)			
<u>Malaysia</u>		0.0 (0.0)	0.0 (0.0)			
<u>India</u>		1.4 (0.2)	1.4 (0.2)	0.0 (0.0)		0.0 (0.0)
<u>Vietnam</u>						
<u>South Korea</u>						
<u>Rest of Asia</u>	0.0 (0.1)	0.0 (0.0)	0.0 (0.0)	0.2 (2.5)		0.2 (0.0)
<u>Africa</u>	0.0 (0.0)		0.0 (0.0)	0.2 (2.0)	1.3 (0.3)	1.5 (0.4)
<u>Middle East</u>				0.0 (0.0)	0.7 (0.2)	0.7 (0.2)
<u>Oceania</u>					0.0 (0.0)	0.0 (0.0)
<u>USA</u>	0.0 (0.0)		0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>Rest of N &amp; C America</u>	0.0 (0.0)		0.0 (0.0)		0.0 (0.0)	0.0 (0.0)
<u>South America</u>				0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
<u>Europe</u>	4.6 (31.1)	330.4 (39.2)	335.0 (39.0)	7.4 (95.4)	405.4 (99.5)	412.8 (99.4)
<b>Total</b>	<b>14.9</b>	<b>843.7</b>	<b>858.7</b>	<b>7.7</b>	<b>407.4</b>	<b>415.2</b>



## SUMMARY

It is a clear picture of Europe's import dependence that is depicted by the international customs data and the analysis of the European flows of PV cells and modules. The new HS codes, which isolate the flow of PV technology and separate the flows of cells and modules, enable a more detailed analysis of the flows compared to earlier years.

The total trade imbalance between the import and export of PV cells and modules in 2022 is € billion 25.17 and 24.21, respectively for Europe<sup>9</sup> and EU27. Among the European countries, the Netherlands, Germany, Spain, Poland, and Greece have the highest total imports of modules from outside of Europe and Germany, France, Slovenia, Luxembourg, and Croatia are the markets with the highest extra-European imports of cells.

China is by far the largest trading partner with Europe, and its dominance accounts for as much as 96.7 percent of the total European imports from third countries. Analyzing intra-European trade is more challenging based on the available trade data because of the probable redistribution of materials, where several trade steps of non-European modules occur within Europe. Therefore, intra-European trade flows likely include both European modules and foreign ones. However, it is evident that European countries have extensive trade with other European countries, generally exporting PV to other European countries to a greater extent than with non-European countries, as presented in Tables 10–14.

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<sup>9</sup> See the chosen definition of Europe in Table A.1 in Appendix.



## APPENDIX- ADDITIONAL TABLES

Presented below are the countries included in the analysis and their categorisation into regions. All trade flows into or out of Europe from or to all countries mentioned in Table A.1 have been analysed individually. The countries that are part of a region have then been summarised for presentation purposes. Note that both Russia and Turkey have been categorised as Asian countries and are therefore not included in the presented tables of European trade.

**Table A.1.** The categorisation of countries inside and outside of Europe used in this analysis. All countries that are not mentioned in this table are categorized under *Rest of World*.

COUNTRY OR REGION	SPECIFIED: THE CLASSIFICATION OF THE DIFFERENT REGIONS
<u>China</u>	China, Hong Kong
<u>Malaysia</u>	
<u>South Korea</u>	
<u>Japan</u>	
<u>Taiwan</u>	
<u>Rest of Asia</u>	Afghanistan, Armenia, Azerbaijan, Bangladesh, Bhutan, Brunei, Cambodia, East Timor, Georgia, India, Indonesia, Kazakhstan, Kyrgyzstan, Laos, Maldives, Mongolia, Myanmar, Nepal, North Korea, Pakistan, Philippines, Russia, Singapore, Sri Lanka, Tajikistan, Thailand, Turkey, Turkmenistan, Uzbekistan & Vietnam
<u>Africa</u>	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Democratic Republic, Côte d'Ivoire, Djibouti, Dominican Republic, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia & Zimbabwe
<u>The Middle East</u>	Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine (West Bank and Gaza Strip), Qatar, Saudi Arabia, Syria, United Arab Emirates & Yemen
<u>Oceania</u>	Australia, Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu & Vanuatu
<u>South America</u>	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay & Venezuela
<u>USA</u>	
<u>Rest of North America &amp; Central America &amp; the Caribbean</u>	Mexico, Canada, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua & Panama
<u>Rest of Europe</u>	Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Holy See, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine & United Kingdom
<u>Rest of World</u>	All countries not specifically mentioned