



Task 1 Analysis & Outreach

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## FACT SHEET

# TRENDS IN PHOTOVOLTAIC APPLICATIONS

# 2025

Author:

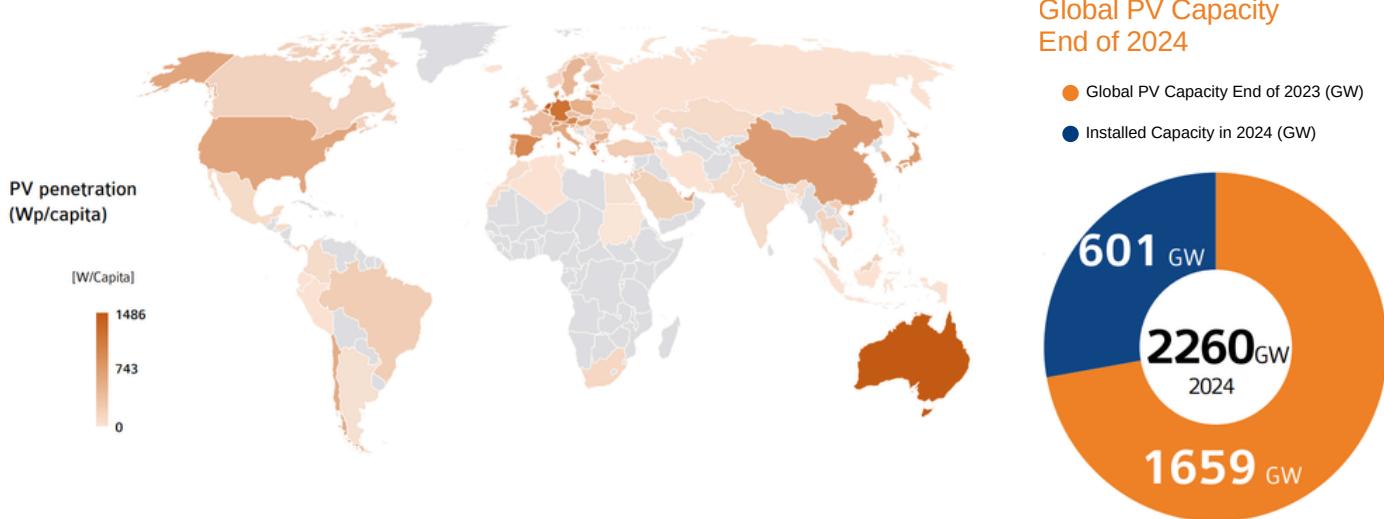
Mélodie de l'Épine, Becquerel Institute, France



## A Record Year for Solar PV

Global installed PV capacity reached 2.26 TW (+29% YoY) in 2024, with 601 GW of new capacity installed. China led the market with 357 GW followed by the EU (66 GW), USA (47 GW), and India (32 GW).

Photovoltaics now provide over 10% of global electricity, confirming its pivotal role in the clean energy transition. Diversification accelerated with agrivoltaics, floating PV, and storage-integrated systems gaining ground across regions. The PV industry continued its structural shift, balancing record installations with ongoing price pressures and overcapacity challenges.



PV now generates **10.8 %** of the world's electricity demand.

In **21 countries**, PV should cover **over 10 %** of national electricity demand in 2025.

## Global Installations

**China** is the world's No. 1 PV market.

**34 countries** installed at least **1 GWp DC** of PV in 2024.

**40 countries** have reached at least **4 GWp DC** of cumulative capacity in 2024.

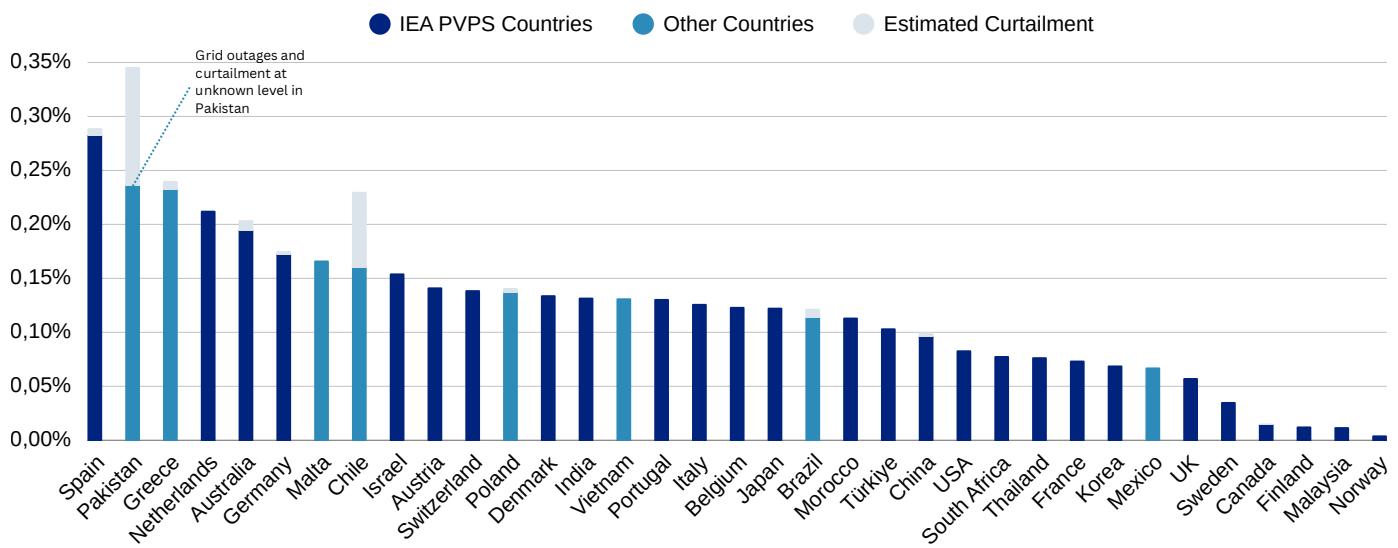
**1 045 million** tons of CO<sub>2</sub> were saved in 2024.

Metric	Value
New PV Installed (2024)	601 GW DC **
Cumulative Capacity	2 261 GW DC
Global Capacity Growth Year-on-Year	+29%

\*\* Uncertainty in AC/DC ratios in some countries including China indicates that a minimal value of 553.3 GW DC plus a possible further 47.8 GW equals the maximal annual volume of 601 GW DC reported here.



## PV Contribution to Electricity Demand in 2024



## Economic Impact



### Global Business Value

- Installation Market \$410 Billion
- O&M services: ~\$20 Billion
- Equals 0.38% of global GDP



### Employment Growth

- 9.1 million jobs globally (+26% from 2023)
- China: 6.5 million jobs
- India, Brazil, USA: 225 000–375 000 jobs each
- Installation and O&M sectors expanding fast

## Top 10 Countries in 2024

### For Annual Installed Capacity

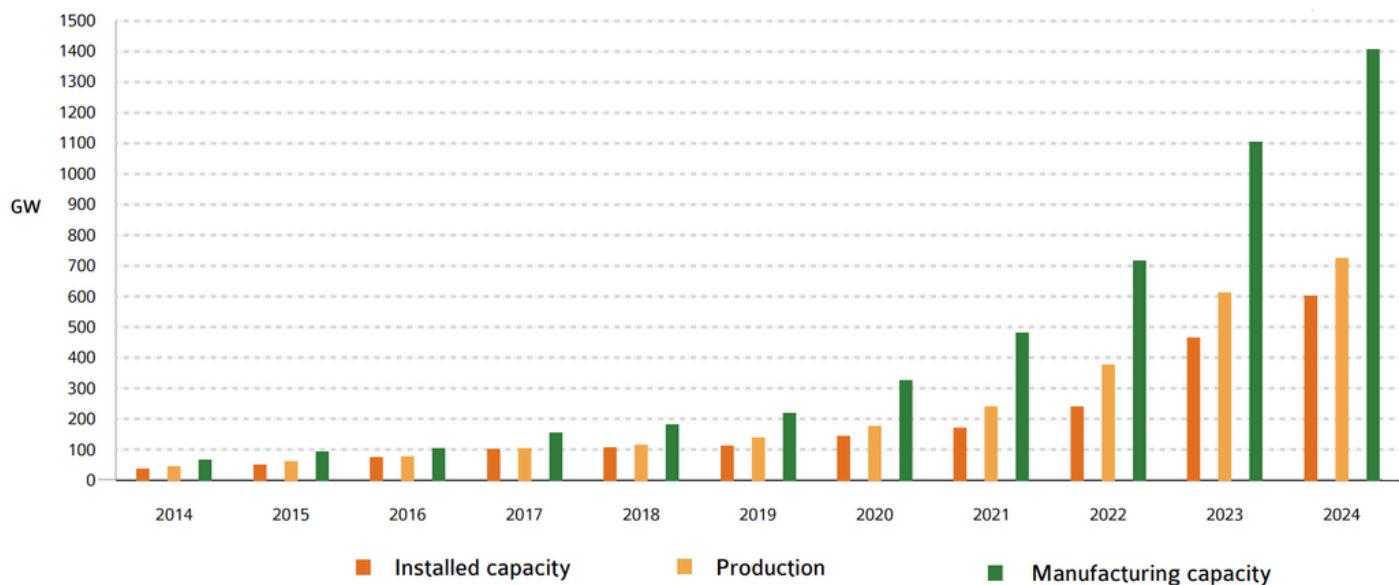
	China	357.3 GW **
	USA	47.1 GW
	India	32.0 GW
	Pakistan	18.0 GW
	Germany	17.3 GW
	Brazil	14.4 GW
	Spain	8.7 GW
	Italy	6.7 GW
	France	6.1 GW
	Japan	5.7 GW

### For Cumulative Capacity

	China	1 048.6 GW **
	USA	225.1 GW
	India	124.6 GW
	Germany	100.5 GW
	Japan	97.1 GW
	Brazil	52.2 GW
	Spain	47.7 GW
	Australia	39.9 GW
	Italy	37.1 GW
	South Korea	30.7 GW



## Yearly PV Installation, Module Production, and Module Production Capacity



## PV Market Segmentation

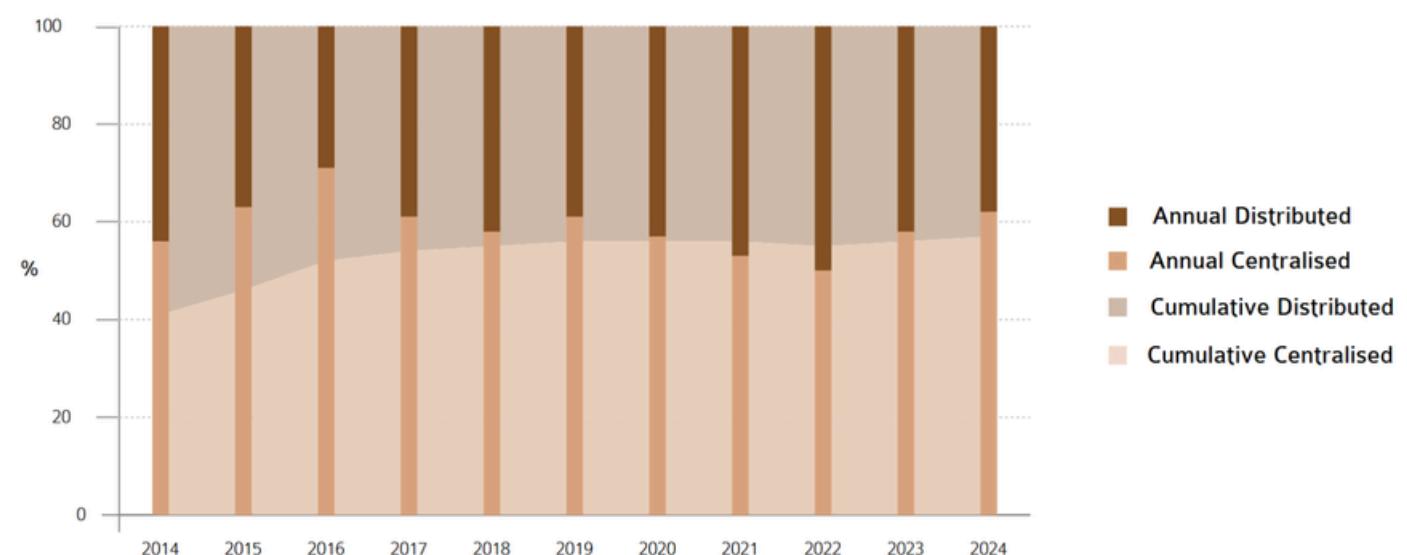
### Centralised PV

- » 373 GW (62% of new capacity)
- » Utility-scale systems dominated in USA, India, Saudi Arabia
- » Lowest tender prices: \$12.9/MWh (Saudi Arabia)

### Distributed PV

- » 228 GW (38% of new capacity)
- » Strong growth in Germany, Brazil, Pakistan
- » Prosumer models expanding globally

### Annual Share of Grid-Connected Installations 2014-2024





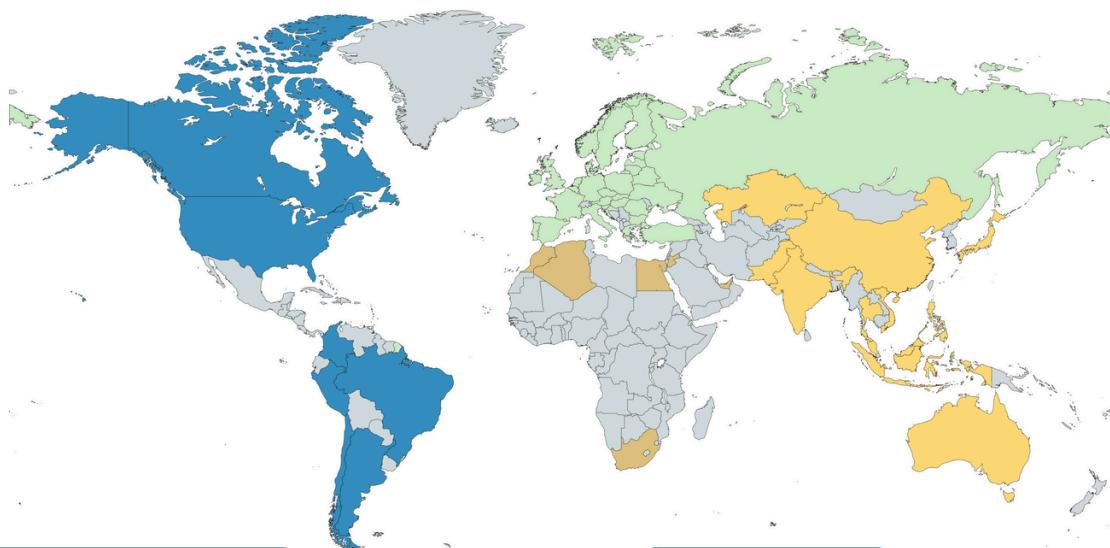
## Regional Highlights

### Americas

- USA led with 47.1 GW, 85% utility-scale, reaching 225 GW total.
- Brazil installed 14.3 GW, 60% distributed systems, 52.1 GW cumulative.

### Europe

- Germany remained Europe's largest market by far with 17.2GW, and crossed the 100 GW cumulative milestone
- EU installed 66 GW total, 13 countries >1 GW, 58% distributed/self-consumption
- Curtailment emerging: Spain 650+ hours negative prices, Germany new "solar peak" laws



### Middle East & Africa

- Saudi Arabia led with 3.7 GW, record \$12.9/MWh tender bid.
- South Africa slowed to 1.2 GW, C&I segment growing for price stability.
- Mega-projects advancing: Multi-GW hydrogen facilities. Rural mini-grids expanding.

### Asia Pacific

- China dominated with 357.3 GW (59% global share), more centralised systems
- India rebounded to 31.9 GW, 75% utility-scale with PLI manufacturing expansion.
- Pakistan surprised at 18 GW (distributed), Japan contracted to 5.6 GW - lowest since 2012

## Emerging Segments

### Agrivoltaics



- Strong growth in Italy (540 projects tendered), USA, Germany, China.
- Dual land-use addressing food security and energy needs.

### Floating PV



- At least 8.7 GW global capacity by end of 2024.
- Major projects in China, India, Chinese Taipei, Europe

### Infrastructure-Integrated PV



- EU potential: 403 GW along roads and railways.
- Growing adoption of vertical PV and canopy systems.

### BIPV



- ~350 MW installed in Europe in 2024
- Switzerland achieving 5-10% of total installations.
- Mandatory solar policies spreading (Austria, France, Japan, USA)



## Key Policy Support Mechanisms

1

### Feed-in tariffs

are being phased out in competitive markets, like Korea, France and China.

2

### Competitive tenders

remain a major tool for utility-scale deployment

3

### Self-consumption

is the primary driver in residential and commercial sectors

4

### Net billing

replacing net metering in many regions

5

### Mandatory solar

in expansion (EU Solar Strategy, California, Tokyo, Delhi)

6

### Subsidies and tax breaks

still available in some regions, often targeting specific applications

## Technology and Manufacturing

### Module Production Reached 726 GW

+18.5% from 2023



- China: 627 GW (86% of global production)
- India: 24 GW
- USA: 23 GW

### Technology Shifts

- **TOPCon cells** surged from 30% to 70% market share
- **N-type wafers** replaced P-type as dominant tech
- **Bifacial modules** reached 77.6% of Chinese production
- 98% of modules are **crystalline silicon**

## Challenges



### Grid Integration Limits

Rapid PV expansion is outpacing grid adaptation. Rising curtailment, congestion, and negative prices highlight the urgent need for new grid infrastructure, large-scale storage deployment, and flexible demand-side management.



### Market Overcapacity

Persistent global overcapacity in PV manufacturing has pushed module prices to unsustainable lows, squeezing profit margins and threatening industry stability. Consolidation pressures and uneven demand continue to challenge market balance.



### Supply Chain Concentration

The PV sector remains highly dependent on Chinese manufacturing for modules and materials, creating geopolitical and market vulnerabilities. Diversification efforts are advancing but face cost, policy, and scalability constraints.



### Sustainability and End-of-Life

As PV deployment accelerates, end-of-life management and recycling lag behind. Improving material circularity and minimizing waste will be essential to ensure the sector's long-term environmental sustainability.



## Future Outlook



### Accelerating deployment amid manufacturing overcapacity

Global PV is expected to continue rapid growth despite current manufacturing overcapacity (1 405 GW/year capacity vs. 726 GW production). Market consolidation likely as module prices stabilize and weaker manufacturers exit. China's market controls may slow capacity additions while diversification to India, USA, EU advances.



### Grid integration and storage become critical

As PV penetration exceeds 10% globally and reaches 20-30% in leading markets, curtailment and negative pricing will intensify. Grid reinforcement, storage deployment (China added 37 GW in 2024), and demand-side flexibility are urgent priorities. Co-located solar+storage becoming standard in some countries.



### Diversification into dual-use applications

Agrivoltaics, floating PV (8.7 GW globally), BIPV, and infrastructure-integrated systems will gain market share as land-use conflicts intensify. The EU's 403 GW potential for roadside/railway PV and mandatory building solar policies (EU Solar Strategy, California, Tokyo) will drive innovation in specialized segments.



### Sector coupling unlocks new markets

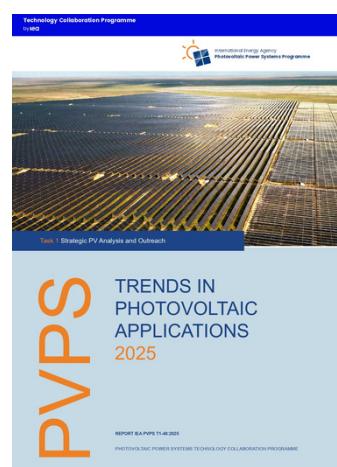
Green hydrogen production (60 countries with strategies), EV charging integration (22% of car sales now electric), and electrified heating/cooling will create demand beyond traditional electricity markets. Major projects in MENA, Australia advancing with multi-GW solar-to-hydrogen facilities targeting industrial decarbonization.

## Want to know more?

If you are interested in more insights and detailed data, explore the full [Trends in Photovoltaic Applications 2025 report](#).

### About IEA PVPS Task 1

Task 1 supports the global deployment of PV by analysing market trends, policy drivers, and industry developments. It provides comprehensive reports like *Snapshot of Global PV Markets* and *Trends in PV Applications*, helping stakeholders make informed decisions.



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