Technology Collaboration Programme
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International Energy Agency
Photovoltaic Power Systems Programme

Task 1 Strategic PV Analysis and Outreach

PVPS

Snapshot of Global PV Markets

2026

Report IEA-PVPS T1-49:2026

INTERNATIONAL ENERGY AGENCY

PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

Snapshot of Global PV Markets 2026

IEA PVPS

Task 1 – Strategic PV Analysis and Outreach

April - 2026

Report IEA-PVPS T1-49: 2026

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What is IEA PVPS TCP?

The International Energy Agency (IEA), founded in 1974, is an autonomous body within the framework of the Organization for Economic Cooperation and Development (OECD). The Technology Collaboration Programme (TCP) was created with a belief that the future of energy security and sustainability starts with global collaboration. The programme is made up of 6.000 experts across government, academia, and industry dedicated to advancing common research and the application of specific energy technologies.

The IEA Photovoltaic Power Systems Programme (IEA PVPS) is one of the TCP's within the IEA and was established in 1993. The mission of the programme is to "enhance the international collaborative efforts which facilitate the role of photovoltaic solar energy as a cornerstone in the transition to sustainable energy systems." In order to achieve this, the Programme's participants have undertaken a variety of joint research projects in PV power systems applications. The overall programme is headed by an Executive Committee, comprised of one delegate from each country or organisation member, which designates distinct 'Tasks,' that may be research projects or activity areas.

The IEA PVPS participating countries are Australia, Austria, Belgium, Canada, China, Denmark, Finland, France, Germany, India, Israel, Italy, Japan, Korea, Lithuania, Malaysia, Morocco, the Netherlands, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, Türkiye, the United Kingdom and the United States of America. The European Commission, Solar Power Europe and the Solar Energy Research Institute of Singapore are also members.

What is IEA PVPS Task 1?

The objective of Task 1 of the IEA Photovoltaic Power Systems Programme is promoting and facilitating the exchange and dissemination of information on the technical, economic, environmental and social aspects of PV power systems. Task 1 activities support the broader PVPS objectives: to contribute to cost reduction of PV power applications, to increase awareness of the potential and value of PV power systems, to foster the removal of both technical and non-technical barriers and to enhance technology co-operation.

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COVER PICTURE

22 MW system in Les Essards, France
Credits: ABO Energy France SARL

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EXECUTIVE SUMMARY

Photo: istock.

Global PV markets continued to expand in 2025, with at least 608 GWp of new capacity installed and a further possible 90 GWp identified through expert estimates, **bringing total annual installations to 698 GWp.** This represents continued growth, although at a lower rate than last year, of 16%. **Global cumulative installed capacity approached 3 TW**, confirming the transition of PV to a central component of electricity systems.

China remained the dominant market, accounting for around 60% of annual additions and maintaining a leading position in cumulative capacity. Growth outside China continued, with **the European Union, the US and India remaining the next largest markets**, although their relative contributions evolved. **Nearly 40 countries installed at least 1 GW in 2025**, indicating continued geographic diversification despite the concentration of global growth.

Market structure remained differentiated by segment. **Centralised installations accounted for approximately 60% of new capacity**, supported by continued deployment of large-scale projects, particularly in China, India and several emerging markets. Distributed PV also expanded, driven by self-consumption and prosumer activity, and remained structurally important in a growing number of countries. At the same time, the increasing scale of installations and the emergence of hybrid systems combining PV with storage are contributing to changes in system design and reporting practices.

The rapid expansion of cumulative capacity is increasing the role of PV in electricity supply. **Global theoretical PV penetration reached approximately 10.5% of electricity demand and 12.0% of electricity consumption**, with several countries reaching significantly higher levels (up to 30%). As penetration rises, system-level effects such as curtailment, negative prices and grid constraints are becoming more prominent, influencing both market dynamics and investment conditions.

Policy and market frameworks are evolving in response to these developments. While PV remains highly competitive, **policy design is increasingly shifting from deployment support towards integration, with greater emphasis on storage, flexibility, market-based remuneration and grid management**. At the same time, support for distributed PV is being adapted to reflect higher penetration levels, with increasing focus on self-consumption, load shifting and system value.

Persistent global manufacturing overcapacity and low module prices continued to support deployment in 2025, while placing sustained pressure on manufacturers. This divergence between strong market growth and constrained industrial profitability remains a defining feature of the sector. In parallel, policies aimed at supporting local manufacturing have continued to develop, although their effectiveness varies across regions.

Looking ahead, the conditions for continued PV deployment are increasingly shaped by system integration rather than technology cost alone. Grid capacity, storage deployment, market design and regulatory frameworks are becoming determining characteristics of future growth. As a result**, the key question for PV markets is no longer simply the scale of deployment, but the conditions under which additional capacity can be integrated into reliable and economically sustainable electricity systems**.

A Snapshot of Global PV Markets 2025

Key figures 2025

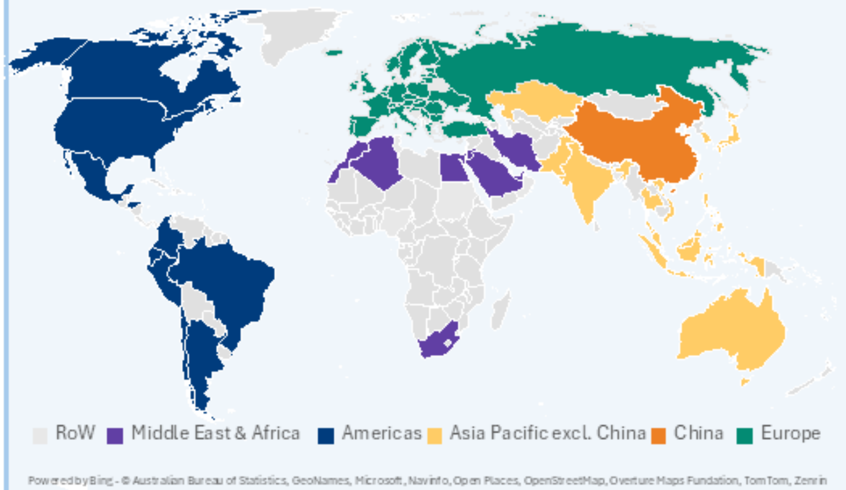
3 TW was the cumulative capacity all over the world by the end of 2025

39 countries installed at least **1 GW** of PV in 2025

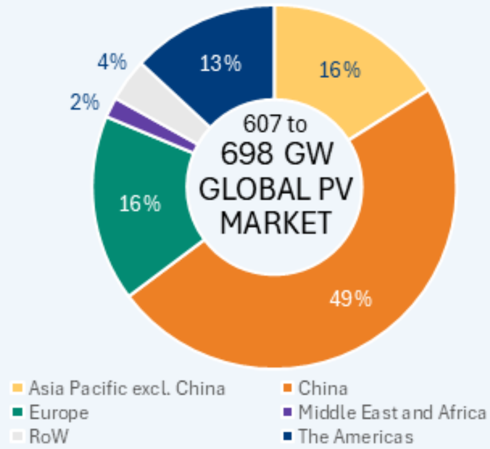
26 countries had at least **10 GW** of cumulative capacity by the end of 2025

TOP PV MARKETS 2025

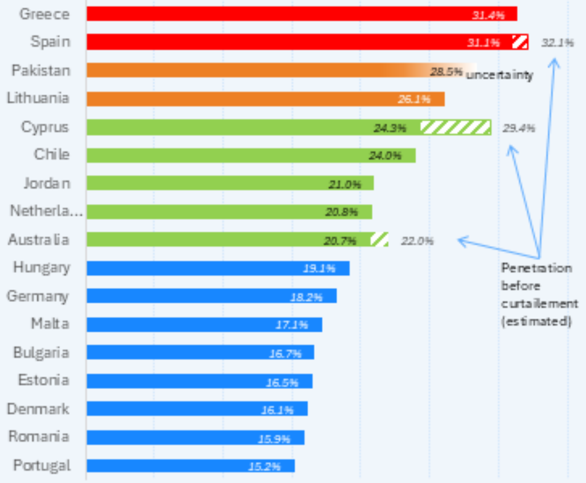
CHINA	EU	INDIA
350 to 415 GW	69 GW	56 GW



REGIONAL SHARE OF CUMULATIVE CAPACITY

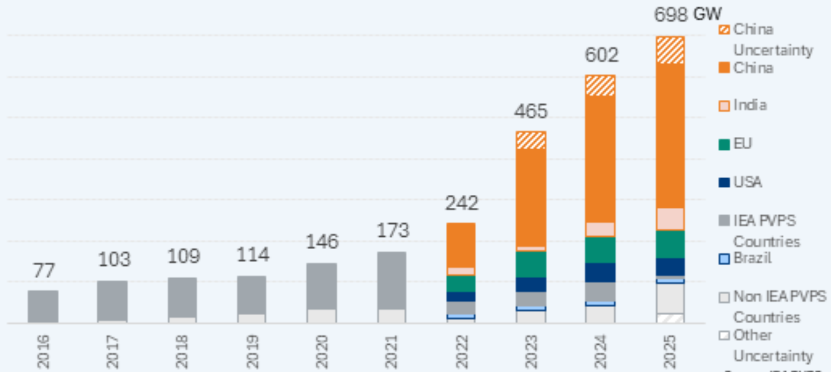


MIN. PV PENETRATION IN 2026



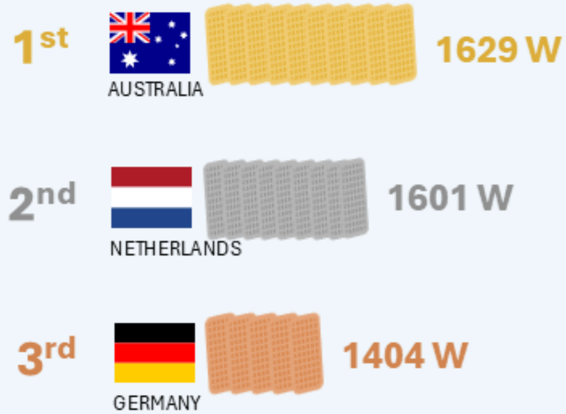
Source IEA PVPS, Becquerel Institute, Pospief, RTE, Montel Analytics, Aurora Energy Research, Volt Robotics, Ember, CyprusGrid, Rystad Energy, Bundesnetzagentur

EVOLUTION OF ANNUAL PV INSTALLATIONS



Source IEA PVPS

PV PER CAPITA END 2025



1 SNAPSHOT OF THE GLOBAL PV MARKET IN 2025

IEA PVPS continues to produce unbiased reports on the development of PV across the world, based on information from official government bodies and reliable industry sources. This 13 th edition of the "Snapshot of Global PV Markets" aims at providing preliminary information on how the PV market developed in 2025. The 31 st edition of the PVPS "Trends in Photovoltaic Applications" report will be published in Q4 2026.

1.1 EVOLUTION OF ANNUAL INSTALLATIONS

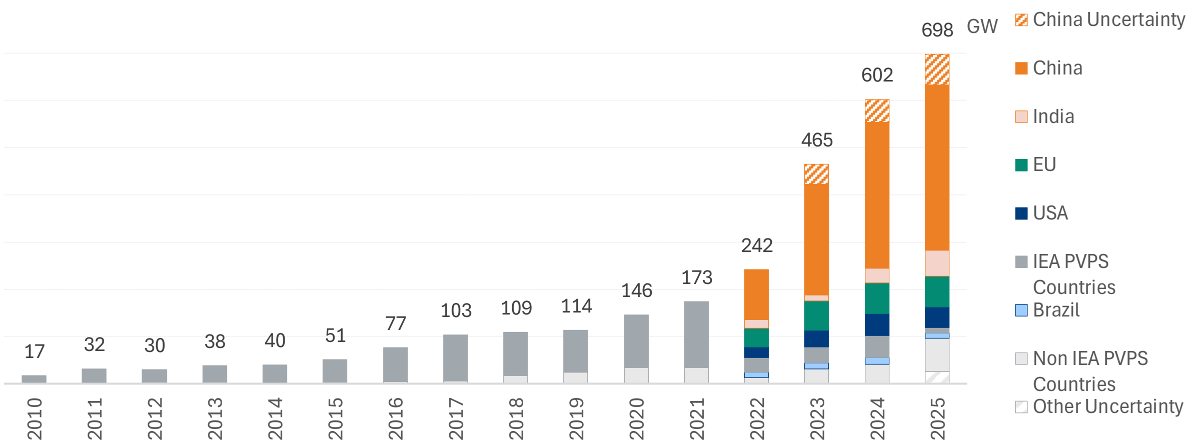
At least 608 GW of new PV capacity was installed in 2025, with a further 90 GW[1] identified by IEA PVPS experts, bringing the estimated global market to 698 GW.

This compares with a 2024 range of 554.1 GW to 602.2 GW and confirms a further increase above the 600 GW threshold recorded last year.

Annual growth reached 16% in 2025, compared with 28% in 2024 and 93% in 2023. China continued to account for around 60% of new annual capacity, in line with its 59% share in 2024, while its year-on-year growth rate slowed relative to the previous year.

Fourteen countries installed more than 4 GW and nearly 40 countries are estimated to have installed at least 1 GW, compared with 33 countries above 1 GW in 2024 and 29 in 2023.

FIGURE 1: EVOLUTION OF ANNUAL PV INSTALLATIONS



Source IEA PVPS

For the third consecutive year, the three largest markets outside China, namely the EU[2], the USA and India, represented around 23% of new annual capacity, although the relative contribution of each market continued to vary. The 2025 market remained driven by China, while growth outside China moved towards around 300 GW and market developments became more uneven across regions. The underlying market structure also remained differentiated by segment, with decentralised PV broadly steady and utility-scale installations continuing to expand.

The progression from 602 GW in 2024 to nearly 700 GW in 2025 places the market one step closer to the 1 TW annual threshold that the experts have identified as the scale required to mobilise current manufacturing capacity.

[1] *The minimal annual volume of 349.8 GW for China considers official China reporting; the maximal annual volume of China 415 GW considers a further 65.2 GW that may have been installed; the range in volumes is linked to the estimated choice of inverter load ratio (ILR) or AC to DC conversion ratio of Utility scale systems in China. Additional uncertain volumes are present in smaller markets. For many figures, these two values have been represented with full (minimum) and additional shaded (maximum) bars. If not otherwise specified, compiled data refers to the higher estimated values.*

[2] *For the purpose of this report, IEA PVPS countries are those that are either member in their own right or through the adhesion of the EU.*

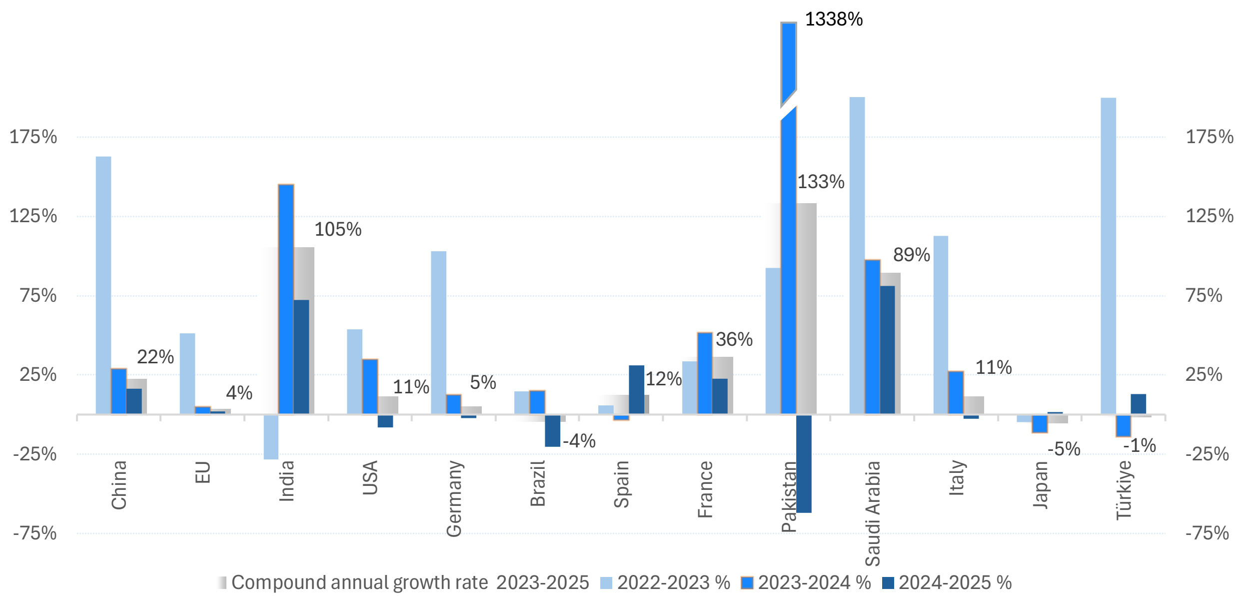


FIGURE 2: EVOLUTION OF NEW ANNUAL CAPACITY IN SOME MAJOR MARKETS - COMPOUND ANNUAL GROWTH RATE 2023 - 2025

Source IEA PVPS

The 2025 Snapshot described a 2024 market in which manufacturing capacity exceeded demand, module prices declined through the year, and historical stocks remained high in China and Europe; all data indicates that these conditions continued into 2025, even as controlled manufacturing volumes contributed to some price stabilisation at the end of 2024 and into early 2025.

In this context, continued Chinese supply to international markets remained a key factor behind deployment in new annual capacity and increased module manufacturing capacity outside China. Module prices in China fell by more than 60% from early 2023 levels, manufacturers' margins decreased and cumulative losses approached USD 5 billion from early 2024 according to compiled company reports.

Under these conditions, deployment bottlenecks in a growing number of markets shifted away from module CAPEX and increasingly towards permitting, grid connection, grid congestion and the evaluation of curtailment and negative price risk. IEA PVPS also notes that curtailment, negative prices and grid access constraints are becoming more material as penetration rates rise.

Within the additional 90 GW identified by IEA PVPS experts, part of the volume reflects installations estimated above official government or industry association statistics, which can lag behind market developments and may not fully capture changes in DC/AC ratios from systems with co-located storage or AC caps due to grid connection limitations. AC to DC conversion assumptions, especially for utility-scale systems (in China, India), can materially affect annual totals, and that differences between reported, estimated and commissioned volumes are increasing. Additional uncertainty also arises where systems have been installed but not yet commissioned by years end, or where imported modules have entered short-term inventories rather than immediate deployment. In that context, annual installation estimates need to distinguish as clearly as possible between imported, delivered, installed and commissioned volumes.

Equipment price reductions continued to support PV competitiveness in 2025, but the divergence between market expansion and manufacturing profitability remained pronounced. IEA PVPS had already identified in 2024 that low module prices stimulated both centralised and prosumer markets while placing substantial financial pressure on industrial actors. In 2025, this gap between PV market growth and manufacturing balance sheets remained visible, with implications for warranty exposure, bankability and long-term operation and maintenance performance under sustained price compression.

Growth remained uneven across major markets in 2025, with year-on-year changes continuing to differ significantly by country. Several markets still recorded positive growth, although generally at lower rates than in the previous year, including China, India, Saudi Arabia, Türkiye and Italy. In the European Union, market growth remained positive but limited, while France and Spain also continued to expand.

By contrast, annual additions declined in several large markets, with lower 2025 volumes than in 2024 in the USA, Brazil, Germany, Pakistan and Japan. Figures also show that recent market trajectories remain highly contrasted, with very high compound growth over 2022 to 2025 in countries such as

Pakistan and Saudi Arabia, while more mature markets recorded lower growth rates or short-term contractions.

1.2 FOCUS ON THE TOP MARKETS IN 2025

The Chinese market grew again in 2025, the rate once again slowing; it is certain that at least 349.8 GW was installed based on official reporting, while additional estimates bring total installations to a possible 415 GW[3], compared with 357 GW in 2024 and 277 GW in 2023. With a steady 65.7 GW of annual installations, the European Union maintained its second position, up from 64.4 GW in 2024. India reached third place with 55.9 GW, ahead of the USA at 43.2 GW. Growth in India appears to be driven both by faster utility scale deployment ahead of domestic content deadlines and an acceleration in distributed solar as support policies continue to be deployed.

This is the first time since 2019 that the USA did not rank among the top three markets – a drop across the board being responsible: utility scale volumes dropped, likely due to increased costs for structural and electrical components and overheads and continued electrical component bottlenecks. Increased interest rates and economic uncertainty as the change of government came into effect seems to have hampered the decentralised market in parallel.

Beyond the top four, the 2025 annual ranking confirms further changes among the leading markets. Germany moved to fourth place, while Pakistan, Brazil, Spain, Italy and France remained in the top ten, confirming the continued weight of these established markets despite lower relative growth than in previous years. Pakistan stayed in the top Ten, despite a reported drop (although here there is a range of uncertainty in reported volumes). France rose to eighth place, reflecting another year of market expansion. Saudi Arabia entered the Top Ten annual ranking in 2025 as several very large-scale systems were commissioned. Japan, Türkiye, Australia and South Korea remain just outside.

[3] *The minimal annual volume of 349.8 GW considers official China reporting; the maximal annual volume of 415 GW considers a further 65 GW that may have been installed.*

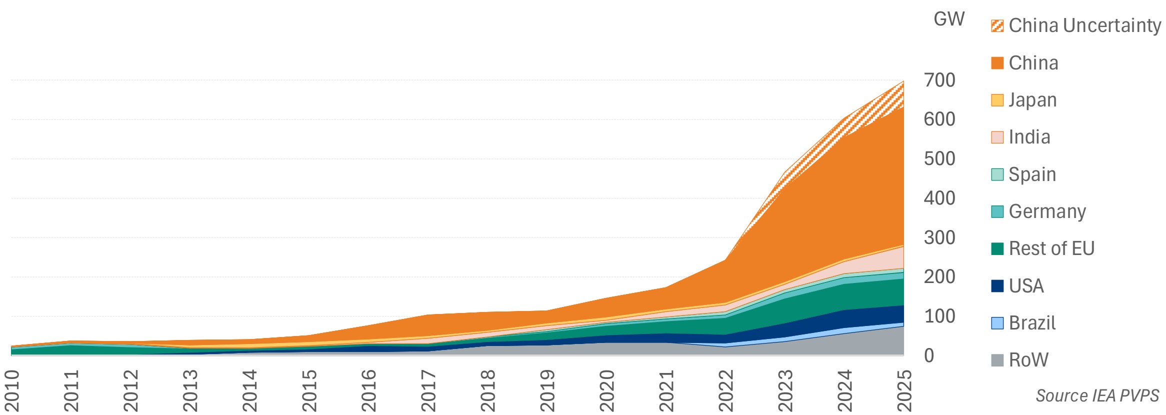
TABLE 1: TOP 10 COUNTRIES FOR ANNUAL AND CUMULATIVE INSTALLED CAPACITY IN 2025

FOR ANNUAL INSTALLED CAPACITY			FOR CUMULATIVE CAPACITY		
1	China	415.0 GW*	1	China	1463.5 GW*
(2)	*European Union*	65.7 GW	*(2)*	*European Union*	406.0 GW
2	India	55.9 GW	2	USA	268.2 GW
3	USA	43.2 GW	3	India	180.5 GW
4	Germany	16.9 GW	4	Germany	117.3 GW
5	Pakistan	15.8 GW	5	Japan	102.7 GW
6	Brazil	13.8 GW	6	Brazil	66.0 GW
7	Spain	11.3 GW	7	Spain	59.0 GW
8	France	7.4 GW	8	Pakistan	52.2 GW
9	Saudi Arabia	6.8 GW	9	Australia	44.3 GW
10	Italy	6.5 GW	10	Italy	43.5 GW

Note: The EU groups 27 European countries, of which Germany, Spain, France, Italy also appear in the Top Ten, either for the annual installed capacity or the cumulative installed capacity. The European Commission is a member of IEA-PVPS through its Joint Research Centre (EC-JRC).
*IEA-PVPS preliminary assessment is higher than official China reporting

Source: IEA PVPS

FIGURE 3: EVOLUTION OF MAJOR MARKETS



Source IEA PVPS

Over the period 2021 to 2025, cumulative rankings remained far more stable than annual rankings, reflecting the effect of sustained market development over several years. China retained a dominant first position by a wide margin, followed by the European Union and the USA, which continued to rank second and third respectively. India remained the fourth largest cumulative market in 2025, while Germany held fifth place, confirming its continued commitment to solar. Japan retained sixth place in cumulative terms, despite its lower annual ranking, while Brazil and Spain remained seventh and eighth respectively. Australia and Italy completed the cumulative top ten.

At least 6.5 GW new capacity was needed to reach the Top Ten in 2025, up from 5.6 GW in 2024 and 4.9 GW in 2023

Australia, Spain and Italy continued to rank within the top ten cumulative markets, reflecting sustained deployment over the past decade. Pakistan entered, as we correct historical values and based on 2 consecutive years of high installations. Overall, the comparison between annual and cumulative rankings highlights the increasing diversification of leading markets, with several newer markets entering the top annual rankings while cumulative capacity remains concentrated in long-established markets.

1.3 MARKET SEGMENTATION

Both distributed and centralised PV segments continued to expand in 2025, with total installations reaching 698 GW, up from 602 GW in 2024 and 471 GW in 2023. Centralised installations increased from 369 GW in 2024 to 410 GW in 2025, while distributed PV grew from 233 GW to 286 GW over the same period. The centralised segment accounted for a steady 59% of new capacity in 2025.

This evolution was driven primarily by China. India saw a marked increase in centralised deployment, from 24 GW to 43 GW, alongside distributed growth from 8.0 GW to 10.3 GW and 1.8 GW of off-grid additions. Continued utility-scale growth in the USA and several emerging markets also contributed. The very large size of individual power plants continues to push centralised PV additions above distributed growth in capacity terms, even where distributed markets remain active in system numbers.

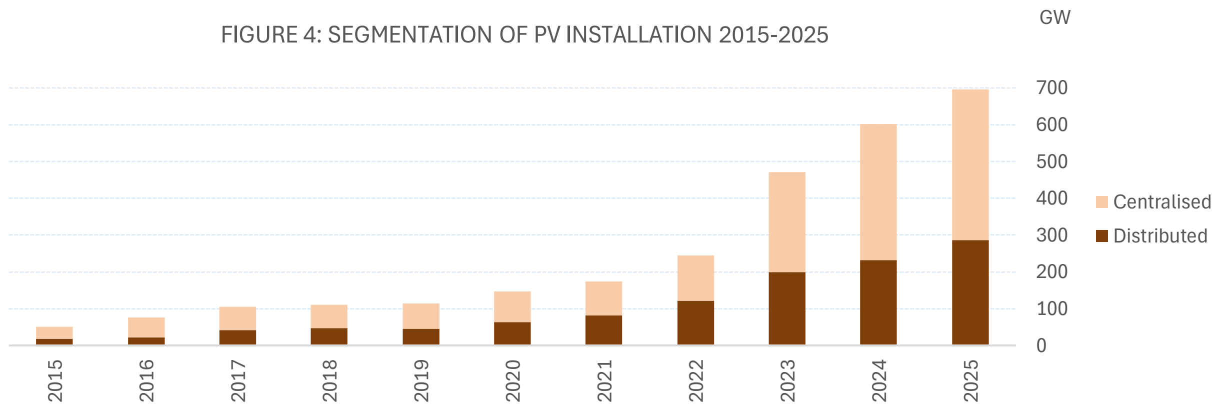
Of the volume of capacity that has been extrapolated and estimated to be above documented or documented AC figures in the 2025 global total, 65 GW relates to the conversion of reported AC utility-scale volumes into DC equivalents, especially in China, where the scale of the centralised market makes the effect particularly significant. Smaller uncertainties of the same type also affect India and some South American countries. In these markets, official reporting does not always distinguish clearly between AC and DC capacity, and the lack of consistent information on DC/AC ratios creates a significant range in annual market estimates.

In 2025, distributed installations exceeded centralised additions in Australia, Japan, most established Western European rooftop markets, Brazil, South Africa and a number of smaller emerging markets. Pakistan again stood out as a largely distributed market. These figures confirm that distributed PV remains structurally important in the increasing number of self-consumption and prosumer-driven markets, even though the centralised segment dominates global capacity additions.

Some markets remained almost entirely utility-scale. Saudi Arabia added 6.8 GW in 2025, almost entirely centralised, while the United Arab Emirates added 1.3 GW on the same basis. Spain remained strongly centralised, with 10.2 GW of centralised additions compared to 1.1 GW distributed. The continued stability of commercial and residential electricity prices has no doubt contributed to the reduction in growth of the self-consumption market in Spain, as in other European countries. Markets with high land and geographical constraints such as Belgium, Switzerland and the Netherlands remained predominantly distributed.

New applications such as floating PV and large PV plants combined with storage are more often found within the centralised segment, while agriPV, parking canopies and other niche applications can be found across both segments.

FIGURE 4: SEGMENTATION OF PV INSTALLATION 2015-2025



Source IEA PVPS, Becquerel Institute

2 GLOBAL CUMULATIVE INSTALLED CAPACITY

In 2025, the global cumulative installed PV capacity approached 3 TW (2 973 GW), compared with 2 276 GW in 2024, confirming the continued rapid expansion observed in recent years. It took more than 40 years to pass 1 TW in 2022, but less than three years to move close to 3 TW. This change in scale confirms that PV has moved beyond the status of a high-growth market and now represents a major component of electricity infrastructure in an increasing number of countries.

China continued to dominate cumulative installed capacity in 2025, reaching 1 464 GW, compared with 1 048.5 GW in 2024, almost 50% of the global cumulative capacity. As in 2024, the gap with all other markets widened further. The European Union remained in second place with 406.0 GW of cumulative capacity (475 GW for Europe), while the USA stayed in third position with 268 GW. India consolidated fourth place with 180 GW, followed by Germany with 117 GW and Japan with 103 GW. Japan still retained a significant lead over the following markets, and any change in ranking around fifth or sixth place would still require several years of sustained annual additions, for example from Brazil and Spain.

The continued increase in cumulative capacity changes the understanding of PV market data. Installed capacity remains the main indicator used to describe market growth, but as higher penetration levels are reached annual dynamics must increasingly be read together with electricity consumption, curtailment and system value. In markets with high PV penetration, new or cumulative annual capacity can overstate the effective contribution to electricity supply during some periods, especially where curtailment and negative prices occur more predominantly during solar production hours. As cumulative penetration rises, these effects increasingly influence project revenues, merchant exposure and the

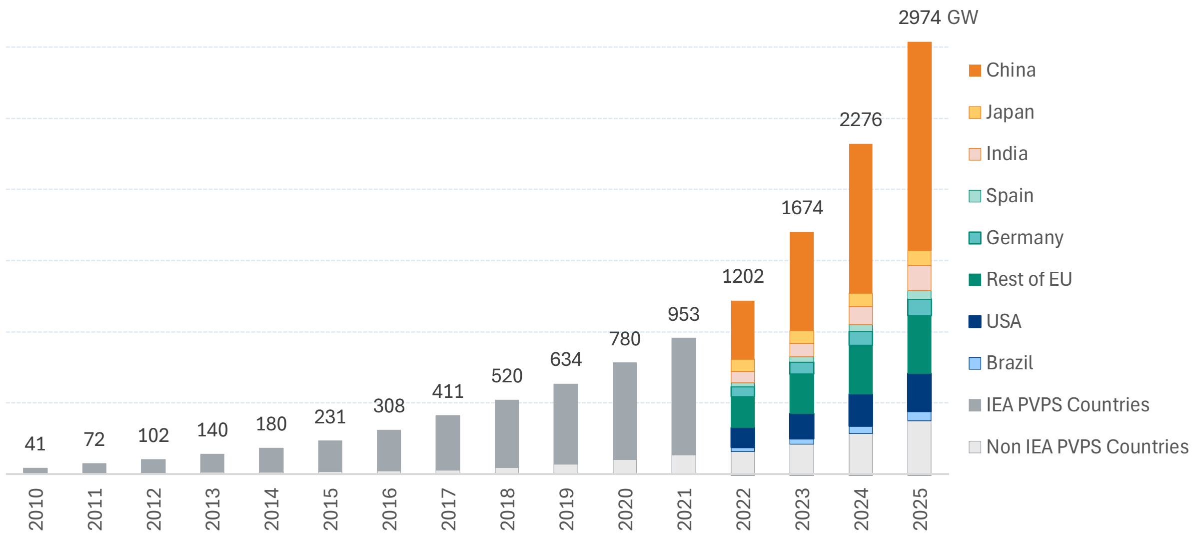


FIGURE 5: EVOLUTION OF CUMULATIVE PV INSTALLATIONS IN MAJOR MARKETS

Source IEA PVPS

appetite for power purchase agreements – and hence the continued deployment of PV.

The growth of cumulative capacity also implies a more significant industry centred on operations and maintenance, repowering and full life-cycle management. A growing share of the global installed capacity (for example, the over 300 GW installed more than 10 years ago) is now reaching an age at which inverter replacement, performance management, revamping and lifetime extension becomes more visible. At the same time, the scale of deployment means that circular economy and recycling readiness is becoming an immediate issue, even if end-of-life waste volumes are still relatively low, and far below the levels expected in the next 10 years.

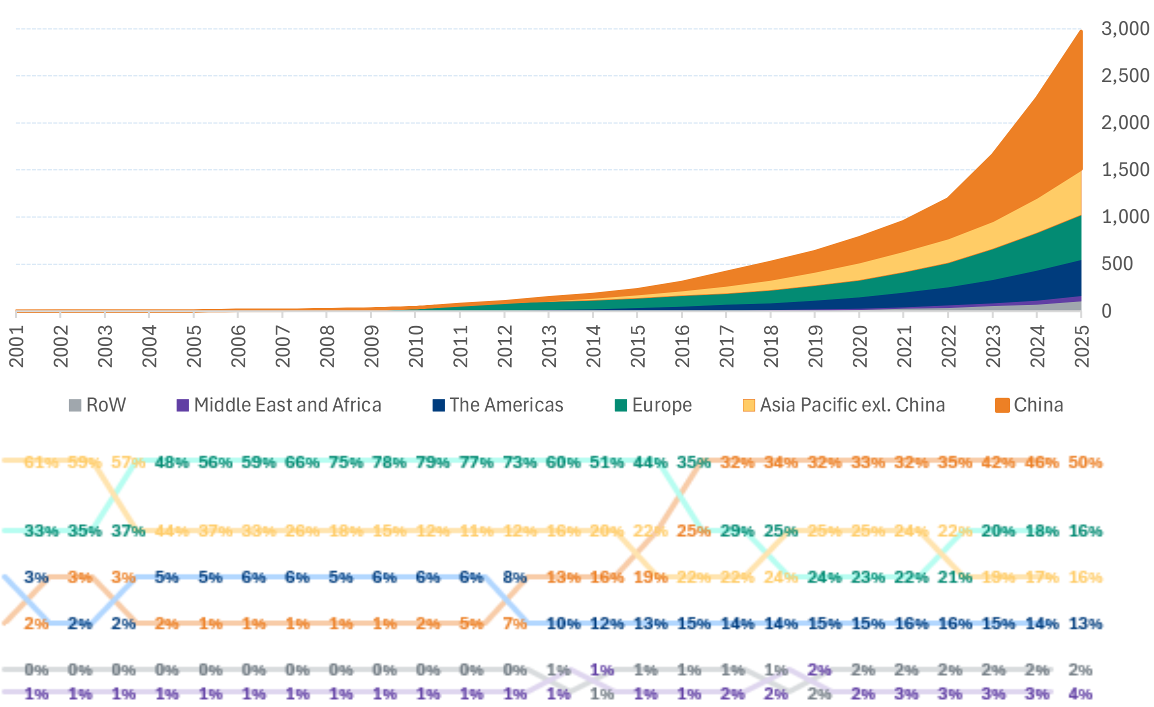
Those countries and markets with high penetration rates are now turning to storage, flexibility mechanisms and grid adaptation to maintain the value of additional PV generation. The expansion of co-located storage and hybrid plants in several leading markets (China, India, USA, Australia) reflects this evolution. Cumulative totals should also be interpreted with caution because differences remain between global datasets, especially regarding AC and DC conventions, connection versus commissioning dates and the treatment of delayed or partially commissioned assets. At current market volumes, these methodological differences can represent several tens of gigawatts.

2.1 EVOLUTION OF REGIONAL SHARE OF PV INSTALLATIONS

With the continued predominance of the Chinese market, it is no surprise that Asia-Pacific leads by regional share. This position strengthened again between the end of 2024 and the end of 2025, as China accumulated capacity faster than any other market and increased its weight in the global total. China alone reached 1 464 GW of cumulative capacity in 2025, (nearly +40% of 2024's cumulative capacity), while the global total approached 3 TW. As a result, the relative shares of other regions declined even where annual installations remained substantial. Europe illustrates this clearly: despite 76.3 GW (65.7 GW in the EU) of new capacity in 2025 and continued growth in cumulative installations to 475.1 GW (of which 406.0 in the EU), its share of the global total fell because additions in China were much larger.

If China is excluded, the remaining Asia-Pacific market is increasingly shaped by annual additions from India and a few of relatively stable markets such as Japan (5.7 GW), Australia (4.5 GW) and South Korea (4.3 GW). Together, these three markets remained significant in cumulative terms, but their role in annual global growth continued to decline. India added 56 GW in 2025, bringing cumulative capacity to 180 GW, while Pakistan, even given the lack of homogenised data collection and the margin of uncertainty, clearly remained among the largest annual markets with an estimated 16 GW, almost entirely in the distributed segment. Lower-cost imports are supporting growth in emerging markets in the region, but volumes are lower and difficult to track, with significant divergences between Trade import/Export data and official tracked installed capacity. In several of these markets, however, imports appear ahead of commissioning of very large arrays (for example solar plus storage installations in the Philippines, with over 1 GW commissioned in early 2026), so shifts in regional shares should be interpreted with caution where shipment and installation timing diverge.

FIGURE 6: EVOLUTION OF REGIONAL MARKET SHARE AND CUMULATIVE CAPACITY



Source IEA PVPS

The European regional market lost further share of global cumulative capacity but continued to expand in absolute terms. Germany remained the largest European market with 17 GW in 2025 and a cumulative total of 117 GW. Spain added 11 GW and reached 59 GW cumulative, while France's new capacity of 7.4 GW brought cumulative volumes to 37 GW, ahead of expected drops in the next years as changes in national priorities and support mechanisms shift the emphasis to other forms of generation. Italy reached 44 GW cumulative and the Netherlands 29 GW. Türkiye, counted within Europe in IEA statistics, continued to expand to 26.2 GW cumulative. Europe therefore continued to broaden its installed base, this was no longer sufficient to maintain regional share under faster Chinese accumulation. In this context, regional growth increasingly depends not only on equipment prices, but also on grid reinforcement, financing conditions and the ability to electrify new usages for increased demand loads such as EVs, heat and industrial electrification.

The Americas continued to be dominated by the USA and Brazil, but their cumulative regional share rose more slowly than that of China. The USA added 43 GW in 2025 to reach 268 GW cumulative, while Brazil added roughly 14 GW (a portion of this is extrapolated above official data as dissemination of small systems escapes tracking methodologies, as in most countries across the world) and reached 66 GW. Growth remained heterogeneous across the region, with smaller markets such as Chile, Mexico and Argentina adding capacity, but at levels insufficient to materially alter regional share. In the USA in particular, the slower increase in cumulative share reflects not only lower annual growth than in 2024 but also the effect of grid connection and interconnection constraints, of which a not insignificant share is from electronic and electric equipment and component availability, which increasingly determine the pace at which announced projects are commissioned.

The Middle East and Africa remained underrepresented in cumulative terms despite rising activity and substantial announced pipelines. Saudi Arabia increased from 6.7 GW cumulative in 2024 to 13 GW in 2025 as some significant large utility scale systems were commissioned, while South Africa reached 12 GW and the United Arab Emirates 8.9 GW. Even so, the regional share remained limited compared with Asia-Pacific, Europe and the Americas. This suggests that a significant part of the region's potential is still in the development and financing pipeline rather than in commissioned capacity.

2.2 LIMITS OF REPORTING CONVENTIONS

IEA PVPS counts all PV installations, grid-connected and off-grid, and complements reported data with expert estimates where installations are known to exist but are not fully captured in official statistics. This approach seeks to reconcile reported values, expert judgement and market evidence in order to provide a coherent basis for international comparison.

This was already illustrated in the 2024 figures, where the global market was presented as a range from a minimum of 554 GW to a probable 602 GW. Structural uncertainty remains significant even in large and comparatively mature datasets, and annual totals depend increasingly on methodological choices as well as on reported values. This is particularly important where official statistics refer to one reporting boundary, while market reality is better described by another.

2.2.1 AC OR DC NUMBERS?

In this report, figures refer to the nominal installed power of PV systems, expressed in W or Wp on the module DC side.

Some countries, however, report the power output of the PV inverter, or the authorised grid connection power level on the AC side. In these cases, the values indicated in this report have been converted to DC values in order to maintain the coherence of the overall dataset.

The difference between standard DC power and AC power can range from as little as 5% to much higher values depending on system design, local regulation and commercial optimisation. For small systems, this difference may remain limited. For large utility-scale systems, it is now a material reporting issue.

Most utility-scale plants built in recent years have used DC to AC ratios between about 1.1 and 1.5, with the PV array oversized relative to inverter capacity in order to increase annual energy yield. This design choice is increasingly driven by both technical and economic factors: low module prices, growing curtailment risk, storage coupling and limited grid connection capacity all favour system architectures that maximise energy delivered across more hours of the day, rather than instantaneous peak power alone.

Recently commissioned solar-plus-storage projects already show that effective ratios can be higher, with values above 1.7 increasingly observed in some project categories. In India, recent projects with co-located storage have DC/AC ratios above 1.7 including projects such as the NU Energies SJVN project, with 350 MW AC and 600 MW DC, the Infrastructure NHPC project, with 390 MW AC and 700 MW DC.

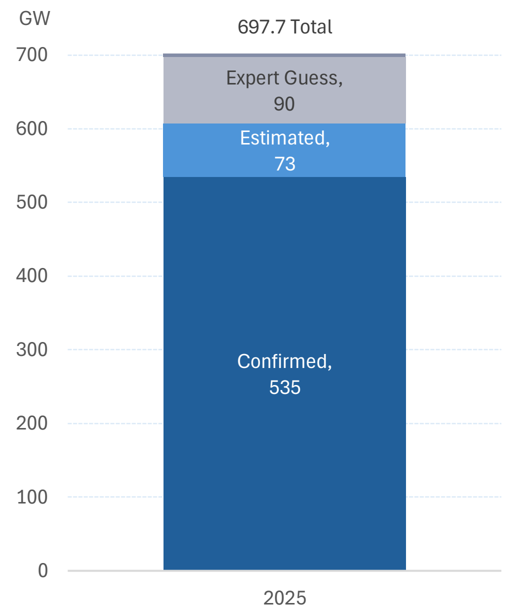


FIGURE 7: FIRST ESTIMATIONS AND REPORTED DATA 2025

Source IEA PVPS, Becquerel Institute

Co-located solar-plus-storage systems designed to provide firm power include storage as part of the overall system architecture, and the relationship between installed PV module power, inverter capacity and contracted or dispatchable AC output can extend well beyond the range usually assumed for conventional PV plants. The first examples already exceed 5. These do not always describe inverter-loading ratios in the strict conventional sense, but they show clearly that in firm-power and storage-coupled projects, AC to DC conversion is becoming increasingly sensitive for market reporting and international comparisons.

2.2.2 DECOMMISSIONING, REPOWERING AND RECYCLING

Depending on reporting practices, historical cumulative capacity (the sum of new annual capacity) may outstrip cumulative operating capacity as systems are decommissioned. Repowered capacities replace some decommissioned capacity but also generally increase operational capacity, as the repowered capacity is higher than the initial plant capacity due to improvements in PV module efficiency.

There is no standardised reporting on these subjects across IEA PVPS countries. Some countries incorporate decommissioning of PV plants in their total capacity numbers by reducing the total cumulative number. Other countries report capacity in operation for that year, and do not include repowered volumes in new annual capacity or decommissioned volumes in operational capacity. Many countries do not track decommissioning or repowering with any consistency.

Repowering is becoming more prevalent as the number of installations reaching 15 to 20 years of age increases — and some industry surveys report that utility-scale systems may be repowered after only 12 to 15 years. Module capacity that has been used to repower systems with defective or underperforming modules may appear in shipped volumes but not necessarily in new annual installations. Real decommissioning is expected to be rare, as land-use constraints and the falling cost of PV on buildings encourage repowering rather than abandonment. Recycling numbers can provide a glimpse of what is happening with regards to repowering and decommissioning in countries where recycling schemes are active, however reporting is often in tonnage and data availability remains too limited for broad international use.

2.2.3 OTHER FACTORS IMPACTING REPORTED PV VOLUMES

The difficulty of tracking small systems and self-consumed generation, even in mature markets adds further complexity to market estimations. The rapid development of micro-systems and plug-and-play applications does not yet represent a major share of total installed volume in mature markets, but it illustrates the growing number of systems that may remain outside conventional reporting channels.

Off-grid applications remain difficult to track in many countries, and behind-the-meter self-consumption reduces the comparability of generation metrics across markets using different metering and settlement systems.

In emerging markets, where low-cost modules have entered the market rapidly through import channels, grid connection, financing, labour availability or administrative procedures can delay final installation or registration. In such cases, differences in import data and official deployment data may indicate either a future installation wave or untracked commissioned systems.

For some distributed markets, the working assumption combines installed capacity already present in the database with additional probable volumes derived from import data. In 2025, this concerns, for example, Algeria, Egypt, South Africa, Indonesia, Malaysia, Pakistan, Thailand, Brazil, Chile and Mexico. These are typically import-heavy fast markets, where apparent demand can rise rapidly through module inflows before full commissioning appears in official statistics for larger systems. They are also markets in which distributed applications are expanding because low module costs are making PV increasingly attractive to households, commercial consumers and small businesses, particularly where electricity prices are rising or where grid operators already apply active demand management.

For Pakistan, we have elected to add an “uncertainty” bar into both historical and 2025 volumes, using expert estimations.

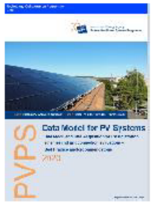
In conclusion, expert-guess volumes are composed mainly of a DC to AC adjustment for the centralised segment in China, estimated at 65.2 GW, together with a smaller distributed component for other markets in the rest of the world of about 25 GW, giving a total expert-guess volume of around 90.3 GW. At current market scale, these methodological choices have a visible effect on global annual totals and on the relative weight of the largest markets in world and regional comparisons.

Methodology transparency therefore remains one of the principal imperatives of the Snapshot, allowing readers to interpret the figures consistently and to understand why official datasets from IEA, IRENA, PVPS or BNEF may differ when they do not measure the same boundary, whether connected capacity, commissioned projects or estimated installations.

2.2.4 Registering systems

In general, IEA PVPS recommends registering PV systems with both the DC power and the AC value. DC power allows a reliable calculation of the energy production whilst AC power allows a better understanding of the theoretical maximum power output of the PV fleet. More information about recommendations to properly register PV plants can be found in the Data Model and Data Acquisition report.

IEA PVPS Report: Data Model and Data Acquisition for PV Registration Schemes and Grid Connection – Best Practice and Recommendations. https://iea-pvps.org/



3 ELECTRICITY PRODUCTION FROM PV

Figure 8 shows how PV could theoretically contribute to electricity demand in key IEA PVPS countries and other major markets in 2026. It gives a comparative view of the contribution that the cumulative installed capacity of PV at the end of 2025 could make to 2026 electricity demand and electricity consumption. Cumulative PV capacity reached 2 974 GW and corresponds to an estimated PV production of 3 378 TWh. Compared with an estimated global electricity demand of 30 844 TWh, this represents a global PV penetration rate of 10.5%; compared with electricity consumption of 27 167 TWh, the estimated PV contribution reaches 12.0%.

PV clearly represents a substantial share of electricity demand in a growing number of countries - there are now 35 countries with an estimated penetration rate over 10% (up from 27 in 2024 and 18 in 2023).

Greece and Spain both appear to have estimated penetration rates over 30% of electricity demand, however curtailment is a real issue in Greece and the penetration rate considering curtailment is lower than indicated. Pakistan could be in the order of 28%, however PV capacity is estimated and the impact of grid instability means an unknown volume is also being curtailed. Cyprus, Lithuania and other countries with smaller volumes of demand also reach high penetration rates over 20% (after estimated curtailment). A number of countries with solid and reliable PV capacity and high electricity demand data are just above or below 20%: the Netherlands, Australia, Germany. Malta, whilst absolute figures are much smaller, also reaches this level.

The two principal PV markets, China and the European Union, continue to illustrate the increasing system relevance of PV, with the EU at nearly 15% and China already above 13% of electricity demand (and perhaps as much as 14% of consumption).

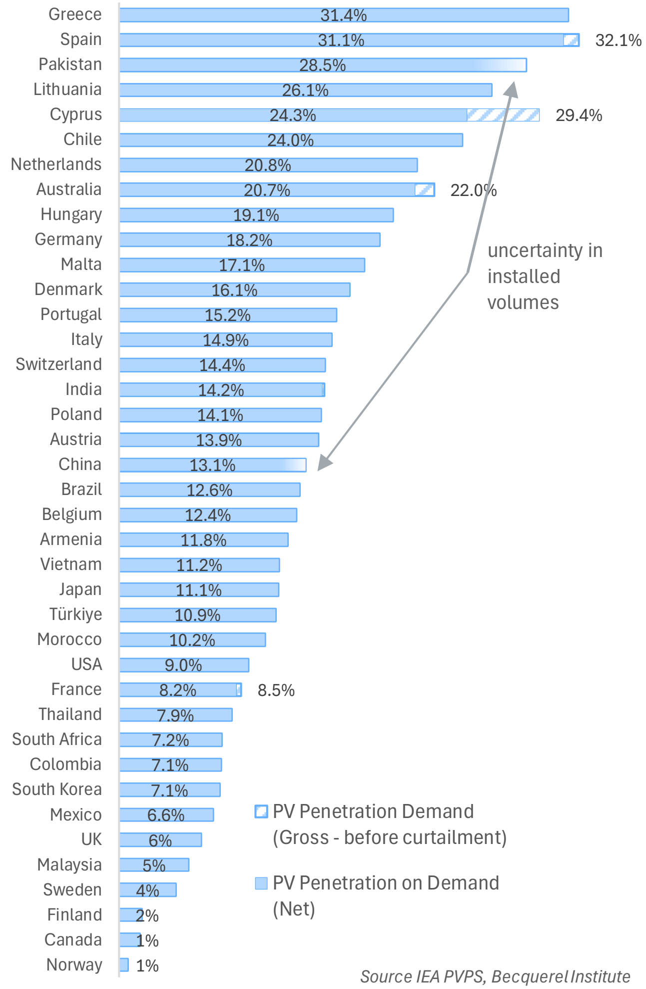
3.1 METHODOLOGICAL CONSIDERATIONS

Figure 8 illustrates PV penetration of electricity Demand. Electricity demand generally refers to the total electricity required in a system, including network (grid) losses, the electricity used within the power sector itself and net electricity imports, while electricity consumption refers to final electricity consumed by end users - consumption is always lower than demand, so PV penetration calculated against consumption is usually higher than penetration calculated against demand. The difference is not negligible at high PV shares, and in countries with older, fragile grid networks, where losses can go over 50% of production. Whilst EU countries tend to be below the global average of approx. 8%, India and Brazil are closer to 15% and China is below 5%. It is important to keep these elements in mind when comparing countries or interpreting global averages.

PV generation is easy to measure for an individual system but more complex to estimate for an entire country. Converting installed capacity into electricity remains subject to uncertainty: solar irradiation varies according to climate and weather, systems on buildings are not always optimally oriented, some installations are partially shaded, older PV systems can experience efficiency losses over time, and self-consumed electricity is generally not metered. In addition, curtailment is not systematically reported, curtailed volume may or may not be estimated (and reported) by grid managers, depending on local remuneration or regulation schemes.

Here, generation is based on the theoretical electricity production from all installed PV, calculated based on cumulative PV capacity at the end of 2025, close to optimum siting, orientation, and yearly weather conditions, and includes utility scale, self-consumption and even off grid system generation. Numbers may differ from official PV

FIGURE 8: THEORETICAL MINIMUM PV PENETRATION 2026



Source IEA PVPS, Becquerel Institute

production numbers in some countries. It is evidently an optimistic evaluation, and should be considered as indicative, providing a reliable estimation for comparison between countries and does not replace official data.

Sources of uncertainty in the PV penetration rate include demand and consumption data (depending on availability, data is for the year 2024 or 2025 – as many countries reported year on year increases in demand and consumption, using 2024 data could lead to over-estimating penetration rates); how different countries report self-consumed electricity (adding, or not, as the case may be, this electricity to official consumption data); the real impact of curtailment on generation. Curtailment has only been indicated for a few countries where curtailment is known to be high and/or official data is published - it has been included to demonstrate that part that is lost but it should be noted that curtailment is prevalent in many more countries.

The increasingly large volumes of installed capacity are making a tangible contribution to electricity consumption around the world.

4 POLICY AND MARKET TRENDS

4.1 POLICY TRENDS

Policy trends continue to vary in response to energy transition, economics and trade dynamics, as well as PV industry and market trends. Rapid policy changes are often a reaction to evolving module prices, project profitability, curtailment and negative price exposure, whilst more structural policy changes can be linked to energy transition goals, the cost of support mechanisms, grid integration needs and local manufacturing stimulus.

The increasing competitiveness of PV has remained a driver for many policy changes, in particular with regard to the shift towards prosumer policies and PPA-facilitating measures. Across Europe and in other countries, where building regulations once mainly encouraged solar, PV is becoming near mandatory or a more common requirement to increase energy autonomy, although the complexity of these mandates can still slow deployment.

Policy support for batteries has also advanced further, especially in countries with grid congestion, high penetration rates or high electricity costs. Policies and market design facilitating storage coupled with distributed and or utility-scale solar now exist in a growing number of countries, and in 2025 are increasingly framed not only as a cost optimisation measure but also as a requirement for system stability. More broadly, a structural shift is emerging from deployment-driven to integration-driven policy design, as curtailment and negative price signals increasingly trigger regulatory reform and system planning.

Policies to support local manufacturing were initiated in past years in several countries and remain widespread. In Europe, the ability of these policies to really support the emergence of local manufacturing remains in question, since sustained low module prices and global overcapacity have kept market conditions highly competitive and continued to weaken local actors. In parallel, recent trade measures have in some regions done less to stimulate new manufacturing policies than to reshape trade flows, reflecting supply chain adaptation under policy pressure. This is particularly visible in Southeast Asia, where changing USA import tariff conditions are reducing the role of some countries as stable export platforms and encouraging rerouting, temporary assembly activity and investment shifts towards more protected or incentivised markets such as India. India, Türkiye and the USA, with the ability to pass legislation in a more dynamic manner, have had more success in increasing manufacturing volumes since 2023.

Some countries revised broader strategic energy plans (China's proposed NDC targets more than 30% non-fossil fuels and 3 600 GW of wind and solar capacity by 2035 whilst Japan's 7 th Strategic Energy Plan sets a revised PV target equivalent to around 203 to 280 GWAC by 2040). Other countries adjusted policy frameworks to reflect the growing importance of storage, flexibility and market-based integration as PV penetration increases.

4.2 REMUNERATION MECHANISMS

Tenders continued to be a popular instrument for developing commercial, industrial and utility systems, whilst PPA (power purchase agreements) and cPPA (corporate PPA, with a consumer) or even merchant PV (electricity sold on the market) are more mainstream. This shift is not only due to the increasing competitiveness of PV, but also to efforts by commercial entities to secure more predictable long-term electricity costs and meet increasingly stringent social and environmental responsibility standards.

Tenders can be exclusively cost based or integrate multiple factors such as land use, carbon footprint or geographical location, and in some countries are also being used to encourage local content, for example to diversify supply chains (EU), reduce trade deficit or build local employment and cost control (Türkiye, India), although trade rules can make this a complex undertaking. Italy's FER-X Transitory Decree demonstrates the continued role of auction-based and direct-access support.

In 2025, remuneration mechanisms increasingly reflected grid and market integration constraints as well as deployment needs: in mature markets, negative prices and curtailment are putting pressure on solar profitability, while policy and market design are increasingly favouring flexible and hybrid configurations.

In parallel, remuneration for new solar projects is moving further toward market-based mechanisms in some countries, notably China (new energy purchase prices are determined through market transactions rather than government-set subsidies), while in others export remuneration for distributed PV is being tightened as penetration rises.

The provision of alternative services by generators (hybrid parcs for larger baseloads or peak shifting with storage, capacity reserves, systems services) is likely to become important to maintain long term profitability as curtailment is actioned both for technical reasons (supply imbalances) and markets reasons (negative prices). Shifting from this reliance on kWh based PPAs or tenders for remuneration is inevitably complexifying management

Whilst the peaking electricity costs through 2022 were a strong motivator for immediate investment, the impact of continued fluctuations was also sufficient to push consumers to look towards more predictable supply costs and continue investing. PPA markets evolved differently across the world in 2024 and 2025. In North America, prices remained broadly firm and later increased under the effect of policy uncertainty and a reduced pool of bankable projects. In Europe, solar PPA prices continued to decline in several markets as supply increased, but rising negative-price exposure and diverging price expectations increasingly complicated deal-making. In this context, remuneration is progressively shifting away from pure kWh-based solar contracts towards more complex structures, including hybrid solar-plus-storage arrangements, that can better preserve long-term project value.

In many countries, increased demand from data centres and other large corporate consumers is becoming a significant driver of the PPA market. In North America, large technology companies continued to sign utility-scale solar PPAs in 2025, while in Australia volumes secured for greenfield solar remained significant as mining and other large industrial consumers pursued long-term decarbonisation and cost-stability objectives. In the MENA region, Saudi Arabia provides a further example of the growing scale of PPA-backed utility deployment: five solar PPAs totalling 12 GW were signed in 2025, while three large-scale projects reached commercial operation certificates during the year.

PPA guarantee funds and other risk-mitigation mechanisms have continued to be developed in some countries to increase investor and banking-sector confidence in off-taker viability, whilst other countries are progressively opening their electricity markets to make more room for PPAs, as in Malaysia, or looking to facilitate wider access through market platforms and regulatory guidance, as in France. More broadly, PPA structures are evolving from simple long-term electricity price hedging tools towards arrangements that must increasingly reflect counterparty risk, flexibility needs and system value.

4.3 PROSUMERS POLICIES

Prosumers, entities that are both producers and consumers of energy, have become active market drivers around the world as PV costs fall and PV penetration rates increase. In reaction to these trends, and to the continued increase in PV competitiveness, direct and indirect support mechanisms continue to be adapted to promote individual self-consumption, collective self-consumption and energy communities, although in mature and/or high penetration markets policy is increasingly being recalibrated to limit grid impacts and cross-subsidy effects.

Prosumer excess generation can be remunerated through net metering, generally more common in emerging markets, or net billing, more common in experienced markets with smart or communicating meters. Remuneration rates vary and can be low to dissuade injections into the grid or, on the contrary, benefit from feed-in tariffs or market premiums. These remuneration rates can also be associated with a range of different constraints, including capacity limits, technical requirements, mandatory building integration or carbon-related criteria.

In 2025, trends point towards lower export remuneration and stronger incentives for self-consumption, flexibility and load shifting, with batteries, EV charging and time-varying tariffs becoming more closely linked to rooftop PV policy.

However, distributed-PV support remains active even where market conditions have become less favourable, for example in Spain, where 11 regional governments launched fiscal subsidy programmes for self-consumption during 2025.

Collective self-consumption, where one or several PV producers supply one or more consumers in the same building or within a limited geographical perimeter with reduced use of the public grid, continues to grow (Austria, France, for example), although the wide range of mechanisms used makes cross-country comparison difficult. The costs of building communities and bringing them to operational frameworks tends to increase initial costs and can rely on incentivise that are sensitive to political will.

4.4 GRID INTEGRATION AND CURTAILMENT

With increasingly high penetration rates of PV in a growing number of countries, transmission and distribution system operators are required to anticipate and actively manage variable generation. Grid congestion and longer delays for connection continue to limit market development in several countries, whilst in others they are accelerating the deployment of shared connections, renewable energy hubs and hybrid plants combining PV with storage or other generation sources. As deployment increases, the challenge is no longer only to connect new capacity, but to ensure its efficient integration and system value.

In some regions, (Australian, USA states, peninsular and island nations, in particular), PV penetration has reached levels where solar generation can cover 100% of demand for several hours. These regions are increasingly acting as test beds for system integration solutions that are likely to be replicated elsewhere. At the same time, more countries are experiencing periods where electricity supply exceeds demand, often coinciding with peak PV generation. This imbalance has impacts such as affecting grid stability (increased voltage), forced cut-off (curtailment) of some generators and the emergence of negative prices on electricity markets.

Curtailment is therefore no longer only a technical issue but also an economic one, directly affecting project revenues, PPA pricing and investment decisions. In response, policies are evolving from a focus on deployment support towards integration and system management. These include regulatory changes giving network operators greater control over generation, the development of compensation mechanisms for curtailed (lost) energy, and the introduction of obligations for generators to provide grid-support services such as voltage and frequency control. The increasing cost of compensation for negative prices or curtailed energy also a subject of discussion in some countries.

Policy measures increasingly promote the deployment of storage and hybrid systems to manage variability and reduce curtailment. In 2025, several countries have already introduced or are testing frameworks linking PV deployment to flexibility requirements, including storage mandates in China and India, hybrid and market-based approaches in the United States and Spain. Austria is providing exemptions from grid fees for storage facilities where they demonstrably serve the grid or wider electricity system.

Increasing use of digitalisation and advanced inverter capabilities in Germany, Japan and the United States is illustrating a broader shift toward integration-driven system design. Indeed, China's new distributed PV rules require new projects to meet "monitorable, measurable, adjustable and controllable" standards, reinforcing the trend toward more actively managed distributed generation.

In Africa, solar is increasingly relevant to grid integration not only because it adds new low-cost generation, but also because hybrid PV-plus-storage systems, mini-grids and decentralised solutions are increasingly being used to support weak or constrained power systems, where the challenge is often as much grid stability and system adequacy as curtailment in the conventional sense. In parallel, utility-scale project pipelines are showing a rising share of solar-plus-storage projects, suggesting that flexibility is becoming more directly integrated into project design as penetration increase

4.5 LOCAL MANUFACTURING POLICIES

The disruptions of 2020 to 2022 highlighted the fragility of the PV value chain at a time when many governments were seeking greater energy resilience. Supporting local manufacturing at different stages of the PV value chain therefore remained an important policy objective in 2025, with governments continuing to use subsidies, public procurement, industrial programmes and trade measures to support domestic production. Whilst persistent low module prices and global overcapacity continued to accelerate deployment, they also increased pressure on local manufacturers and made the effectiveness of support measures more uncertain.

In the EU, local manufacturing continued nominally to benefit from industrial-policy support, including the implementation logic of the Net Zero Industry Act and state-aid flexibility, but the sector remained under strong pressure from low-cost imports. By late 2025, EU monitoring showed that manufacturing capacity in ingots, wafers, cells and modules remained well below NZIA ambition levels, while bankruptcies and project delays continued to illustrate the difficulty of restoring competitiveness through policy support alone. Europe therefore remained a clear example of a region where manufacturing policy is active, but where commercial viability is still constrained by global price conditions.

In the Middle East, manufacturing projects continued to be driven less by supply for local markets than by broader industrial development and export ambitions. This remained visible in Oman, Saudi Arabia, Egypt and Morocco, where announced projects were generally linked to wider industrial strategies rather than to protected domestic demand alone.

In Southeast Asia, USA tariff pressure has not so much stimulated strong new manufacturing policy but rather encouraged supply-chain rerouting and possibly temporary assembly activity, reflecting adaptation under policy pressure and it is not yet clear if this will be stable industrial development.

In the USA, the Inflation Reduction Act framework remains important, and manufacturing capacity continued to expand. However, the 2025 policy environment became more uncertain as broader import tariff policy increased cost pressure on procurement costs and risk across parts of the solar supply chain. Trade barriers therefore did not simply translate into stronger manufacturing competitiveness, and the USA illustrated that industrial support and trade protection can have mixed effects when manufacturers remain dependent on globally sourced inputs. In Brazil, import protection also remained part of the policy response, but the manufacturing discussion became more closely linked to wider concerns over financing conditions, regulatory uncertainty and the competitiveness of local industry under continued low-priced imports.

India remained one of the clearest examples of coherent and impactful support for local manufacturing. Module import barriers, the Production Linked Incentive scheme, Domestic Content Requirements and ALMM rules continued to underpin rapid manufacturing growth, and capacity additions accelerated further during 2025. Australia also maintained support for domestic manufacturing through the Solar Sunshot programme, with a second funding round launched in 2025 to expand capability in selected parts of the solar supply chain.

2025 showed that manufacturing policy is increasingly shaped not only by resilience and local-content objectives, but also by the need to respond to overcapacity, price pressure and shifting trade routes. In that sense, the year was marked as much by supply-chain adaptation under policy pressure as by the direct success of local manufacturing support itself.

4.6 2026 MARKET PERSPECTIVES IN IEA PVPS COUNTRIES

2025 was a year in which grid integration, remuneration pressure and policy recalibration increasingly shaped market outcomes. Across many IEA PVPS countries, PV remains highly competitive, but the main constraints are shifting from equipment cost to grid connection, curtailment and negative prices. The near-term outlook is hence determined by the ability of markets, grids and policy frameworks to integrate additional PV capacity while preserving project value and system reliability.

In China, the policy framework shifted toward more market-based and system-managed growth. Utility-scale solar is now exposed to market-based pricing, while new distributed PV rules have tightened lifecycle management and increased the role of market participation and system control. Looking into 2026, China does not appear to be retreating from scale, but rather reorienting deployment toward stronger integration with storage, grid capacity and smart-system infrastructure.

In the USA, manufacturing and deployment into 2026 is in a more volatile trade and policy environment, but with strong momentum. India is expected to remain one of the main growth markets, supported by continued electricity demand growth, a strong auction pipeline and further expansion of domestic manufacturing. However grid absorption, project execution and the ability of storage and transmission development to keep pace with new capacity are important subjects. Japan and Australia entered 2026 with policy frameworks more supportive of storage, flexibility and distributed-system value than in earlier years, while in France solar deployment is under pressure from shifting political priorities and growth may slow or stall.

The current energy crisis linked to armed conflict in the Middle East is also likely to have repercussions on market conditions, although it remains to be seen whether its effect on electricity prices will prove as strong and persistent as the gas-driven shock seen after the start of the war in Ukraine.

The central market question entering 2026 is therefore no longer only how much PV can be deployed, but under what conditions it can continue to be integrated and benefit from adequate predictable remuneration.

5 PV IN THE BROADER ENERGY TRANSITION

5.1 PV AND OTHER RENEWABLE ENERGY EVOLUTIONS

In 2025, PV again represented more than three quarters of new renewable generation capacity added worldwide. Continued low module prices linked to persistent manufacturing overcapacity, combined with support mechanisms in many countries and continued demand for PV PPAs, meant that PV remained attractive to private and institutional investors and continued to expand faster than other renewable technologies.

Whereas biomass and hydropower installations can generally produce electricity throughout the day and across all seasons, the output of wind and PV depends on the quality and availability of the resource, which varies by location and over time. Offshore wind generally achieves higher capacity factors than onshore wind because of more stable wind conditions, while PV generation depends on solar irradiation and is limited to daylight hours.

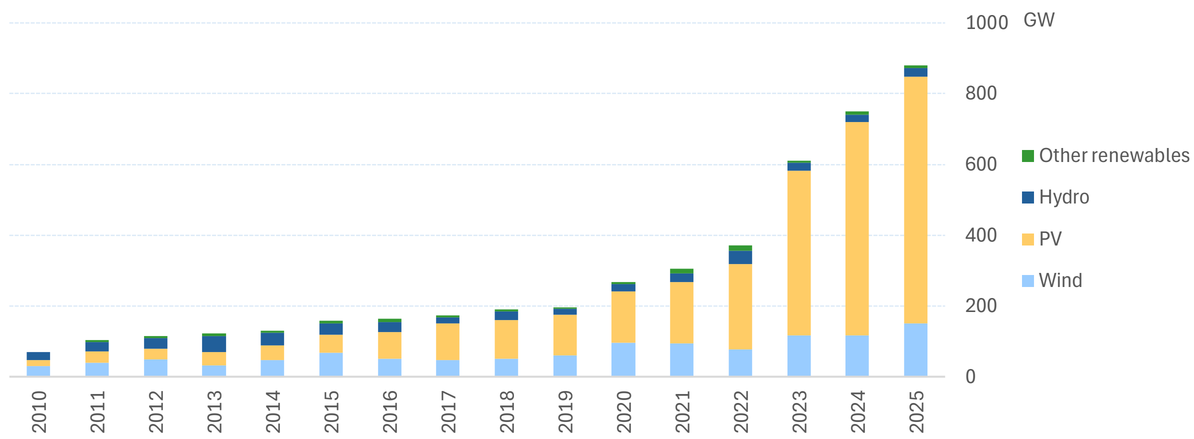
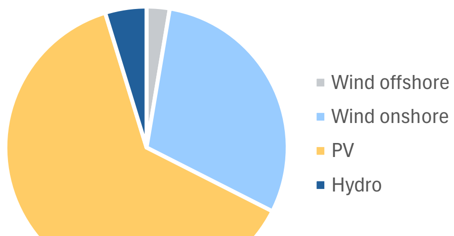


FIGURE 9: EVOLUTION OF ANNUAL RENEWABLE ENERGY INSTALLATIONS

Source IEA PVPS, Becquerel Institute, GWEC, WWEA, IHA, IRENA

FIGURE 10: SHARE OF ELECTRICITY GENERATION FROM NEW CAPACITY INSTALLED IN 2025 BY SOURCE



Source IEA PVPS, Becquerel Institute, GWEC, IHA, IRENA

Because PV has a lower average capacity factor than wind or hydropower, its share of electricity generation remains below its share of installed capacity. Even so, PV accounted for around 60% of new renewable electricity generation in 2025, confirming its central role in the expansion of renewable power systems.

5.2 PV FOSTERING DEVELOPMENT OF A CLEANER ENERGY SYSTEM

Cleaner energy systems can increasingly be built on renewable electricity and the electrification of uses previously supplied by fossil fuels, including transport, heating and parts of industry. Combining renewable generation with storage is proving to be both a cost-effective and cleaner alternative to maintaining ageing fossil-based assets or investing in new thermal capacity, while also reducing exposure to fuel price volatility, import dependence and emissions. In that context, PV is now a cornerstone technology, but its transition value depends increasingly on system readiness rather than module supply alone. As PV penetration rises, storage, forecasting, digitalisation, advanced inverter capabilities, demand-side flexibility and sector coupling are becoming part of core clean-system infrastructure. In some markets, this evolution is already reflected in policy frameworks: India now requires storage to be paired with new utility-scale solar tenders, California requires batteries or battery-readiness for several new building categories with solar PV, and Australia has expanded support linking rooftop PV, batteries and virtual power plant participation.

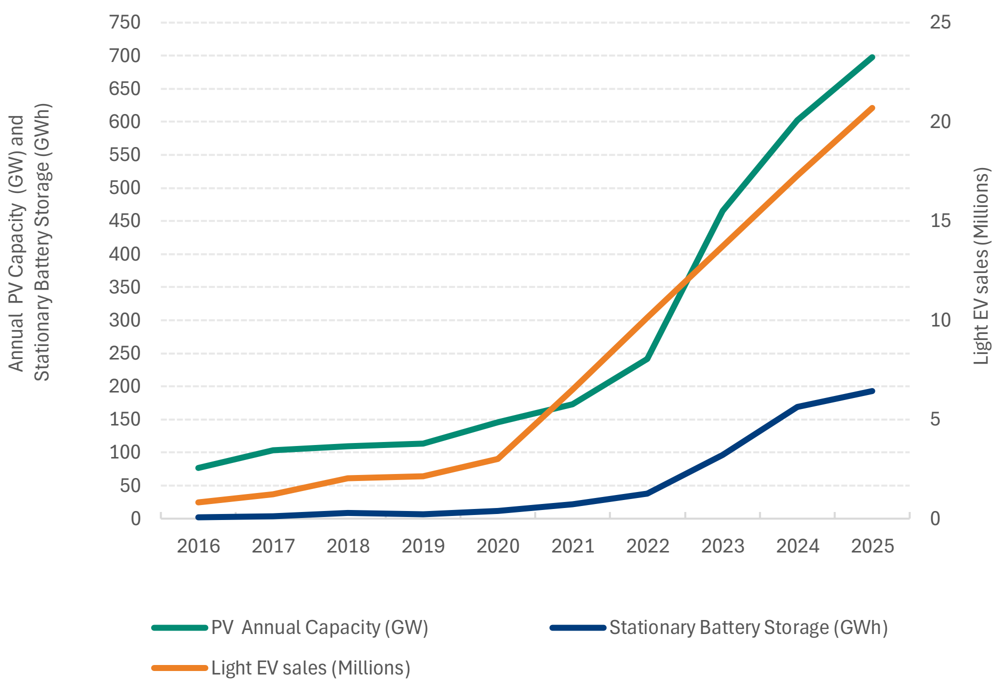
Figure 11 illustrates this convergence clearly: annual PV additions, light EV sales and stationary battery storage all accelerated strongly after 2021, showing that the transition is no longer defined by the growth of individual technologies but by the combined expansion of generation, flexible demand and storage. With electricity demand also increasing in many markets, it is not always possible to determine which technology is driving the others. What is clear, however, is that their simultaneous growth creates reinforcing effects that allow faster acceleration than any one of these technologies could achieve in isolation. This is increasingly supported by policy and market design. In Europe, auctions and procurement frameworks are moving further towards competitive and hybrid structures, while storage projections for 2025 and 2026 indicate another step-up in capacity that is likely to improve PV utilisation and system contribution in many environments.

This evolution also shows that the contribution of PV to decarbonisation depends increasingly on the ability of power systems to absorb and use solar electricity efficiently. In markets such as China, Australia and Germany, strong solar growth combined with curtailment and negative prices has shown that additional clean generation must be matched by storage, grid reinforcement and demand growth if it is to maintain value and support stable revenues. The rise of EVs, electric cooling and other electrified uses can provide part of this demand, while hybrid plants and co-located batteries are increasingly helping to shift PV output towards periods of higher system value.

In parallel, digitalisation and reliability management are becoming central operational issues, with IEA PVPS Task 13 highlighting the growing importance of inspection digitalisation, digital twins, predictive maintenance and performance-risk management as PV fleets scale up.

The energy transition challenge now extends beyond capacity deployment alone: circularity and end-of-life management, land-use compatibility, agrivoltaics, floating PV and long-term reliability are becoming integral parts of cleaner power systems. The key constraint is therefore no longer module availability alone, but the readiness of grids, markets, flexibility resources, financing conditions and regulatory frameworks to integrate very large volumes of PV into reliable and economically sustainable electricity systems.

FIGURE 11: EVOLUTION OF ANNUAL NEW PV, EV AND STATIONARY STORAGE



Source IEA PVPS, Becquerel Institute, IEA after BloomberNEF, Benchmark Mineral Intelligence

6 ANNEX – DATA TABLES

Data is preliminary; values above 10 GW are rounded to whole numbers and those below to one decimal place. Totals may differ from graphs due to PVPS entry and exit years. The additional "uncertainty" volumes described in Section 2.2 are included.

Table 6-1 - Annual new capacity - selected countries

IEA PVPS Countries	2021	2022	2023	2024	2025
Australia	5.0	4.2	4.2	5.3	4.5
Austria	0.7	1.0	2.6	2.5	1.2
Belgium	0.9	1.1	2.5	1.0	0.9
Canada	2.0	0.7	0.8	0.3	0.4
Chile	2.7	1.8	*not PVPS*	*not PVPS*	*not PVPS*
China	55	106	277	357	415
Denmark	0.7	1.8	0.5	0.7	1.4
Finland	0.1	0.3	0.3	0.2	0.4
France	3.6	3.0	4.0	6.0	7.4
Germany	5.7	7.6	15	17	17
India	*not PVPS*	*not PVPS*	*not PVPS*	*not PVPS*	56
Israel	0.9	1.2	1.2	0.9	0.2
Italy	0.9	2.5	5.3	6.7	6.5
Japan	6.5	6.7	6.4	5.6	5.7
Korea	3.9	3.3	3.7	2.5	4.3
Malaysia	0.4	1.0	3.0	1.0	1.4
Mexico	1.6	0.7	*not PVPS*	*not PVPS*	*not PVPS*
Morocco	0.5	0.3	0.7	0.7	0.2
Netherlands	3.6	4.2	4.8	3.4	2.1
Norway	0.0	0.2	0.3	0.3	0.1
Portugal	0.6	1.0	1.3	1.5	1.1
South Africa	0.5	0.1	3.0	1.2	3.6
Spain	5.7	8.5	9.0	8.7	11
Sweden	0.5	0.8	1.7	0.9	0.7
Switzerland	0.7	1.1	1.6	1.8	1.5
Thailand	0.5	0.2	4.6	3.0	2.1
Türkiye	1.5	1.6	4.8	4.1	4.7
United Kingdom	*not PVPS*	*not PVPS*	*not PVPS*	*not PVPS*	2.6
United States	25	23	35	47	43
Total IEA PVPS Countries	**130**	**183**	**393**	**480**	**595**
Brazil	6.0	11	12	14	14
India	14	18	13	32	*PVPS*
Lithuania	0.1	0.1	0.2	0.9	1.1
Pakistan	1.7	3.2	7.6	18	16
United Kingdom	0.4	0.7	1.3	1.9	*PVPS*
Other Non IEA PVPS Countries	23	28	43	55	72
Total Non IEA PVPS Countries	**45**	**61**	**78**	**122**	**102**
Global	**174**	**244**	**471**	**602**	**698**

Table 6-2 - Cumulative capacity - selected countries

IEA PVPS Countries	2021	2022	2023	2024	2025
Australia	26	30	35	40	44
Austria	2.8	3.8	6.4	8.9	10
Belgium	7.1	8.2	11	12	13
Canada	5.8	6.5	7.3	7.6	7.9
Chile	6.2	7.9	*not PVPS*	*not PVPS*	*not PVPS*
China	309	414	691	1049	1464
Denmark	2.3	4.1	4.6	5.3	6.7
Finland	0.4	0.7	1.0	1.2	1.6
France	17	20	24	30	37
Germany	60	68	83	100	117
India	*not PVPS*	*not PVPS*	*not PVPS*	*not PVPS*	180
Israel	3.3	4.5	5.7	6.6	6.8
Italy	23	25	30	37	44
Japan	78	85	91	97	103
Korea	21	24	28	31	35
Malaysia	2.3	3.3	6.2	7.2	8.6
Mexico	8.2	8.9	*not PVPS*	*not PVPS*	*not PVPS*
Morocco	0.7	1.0	1.7	2.4	2.6
Netherlands	14	19	23	27	29
Norway	0.2	0.4	0.7	1.0	1.1
Portugal	1.7	2.6	3.9	5.4	6.5
South Africa	4.4	4.5	7.5	8.7	12
Spain	21	30	39	48	59
Sweden	1.6	2.5	4.1	5.1	5.7
Switzerland	3.7	4.7	6.4	8.2	9.7
Thailand	4.1	4.3	8.9	12	14
Türkiye	11	13	17	22	26
United Kingdom	*not PVPS*	*not PVPS*	*not PVPS*	*not PVPS*	20
United States	120	143	178	225	268
Total IEA PVPS Countries	**756**	**939**	**1315**	**1795**	**2533**
Brazil	14.5	25	38	52	66
India	61	80	93	125	*PVPS*
Lithuania	1.0	1.1	1.2	2.1	3.1
Pakistan	7.6	10.8	18.4	36	52
United Kingdom	14	15	16	18	*PVPS*
Other Non IEA PVPS Countries	104	132	193	248	320
Total Non IEA PVPS Countries	**203**	**264**	**359**	**481**	**441**
Global	**958**	**1202**	**1674**	**2276**	**2974**

REFERENCE

Reise, C., & Farnung, B. (2017). *Uncertainties in PV System Yield Predictions and Assessments*. Report IEA-PVPS T13-12.