

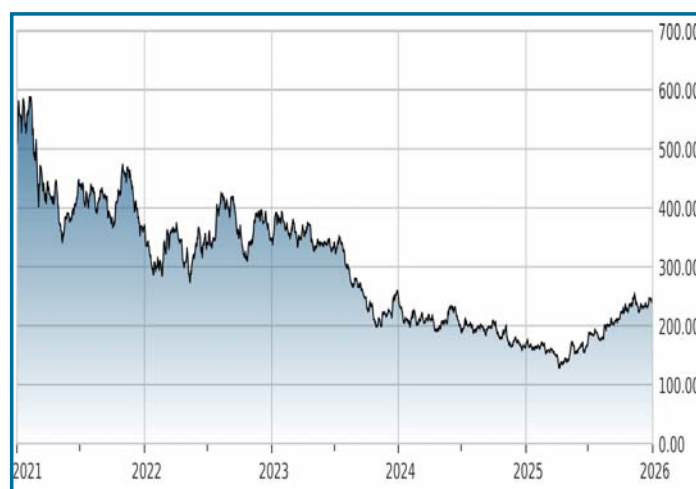
SOLAR SECTOR UPDATE

MAC Global Solar Energy Stock Index (SUNIDX) is licensed as the tracking index for the U.S.-based Invesco Solar ETF* (NYSE ARCA: TAN) and European-based Invesco Solar Energy UCITS ETF* (London: ISUN LN & RAYS LN) (Xetra: SOLR GY) (Borsa Italiana: SOLR IM) (Swiss: SOLR SW).

Note: Index performance does not reflect transaction costs, fees or expenses of the Invesco ETFs.

For more information, visit: www.Invesco.com*

MAC Global Solar Energy Index (SUNIDX)



Solar stocks rally to 2-year high as US solar industry moves forward and China curbs excess production

The MAC Global Solar Energy Index is up +46% year-on-year and has soared by +86% from April's 5-year low. The MAC Solar Index in 2025 rallied by +27%, overcoming some of the losses seen in the previous three years (-37% in 2024, -26% in 2023, and -5% in 2022). Before those losses, the Index experienced extraordinary gains of +245% in 2020 and +67% in 2019.

The MAC Solar Index rallied to a 2-year high in November 2025, more than overcoming the weakness seen after the November 2024 US election. Solar stocks rallied after Republicans' changes to US solar policy following their November 2024 election victory proved less severe than expected. Also, the markets expect profitability in the solar sector to improve as the Chinese government and top Chinese solar companies work on a plan to slash excess manufacturing capacity.

Solar stocks also received support after the US Federal Reserve cut its federal funds target range by a total of three-quarters of a percentage point in late 2025, adding to the one percentage point

rate cut seen in late 2024. The markets are currently expecting a further one-half percentage point rate cut by the end of 2026. Lower interest rates are beneficial for the solar industry, as they result in lower financing costs for solar projects.

The "One Big Beautiful Bill Act" (OBBBA), approved by the Republican Congress and President Trump in July 2025, cut back solar incentives but was not as negative as the markets had feared. Republicans phased out the solar buyer tax credits well before the Inflation Reduction Act (IRA). However, the OBBBA fully retained the IRA's 45X solar manufacturing credits through 2032, which have been the main impetus behind the boom in US solar manufacturing over the past several years. In addition, the OBBBA left in place generous incentives for battery storage, which maintains the attractiveness of pairing solar and battery facilities to create a 24/7 electricity solution.

The solar market is awaiting IRS guidance on how the Foreign Entity of Concern rules will be interpreted for purposes of qualifying for tax credits. That guidance is expected by late January 2026. Also, the solar market is gauging the extent to which the Trump administration is imposing permitting obstacles for new solar installations that require federal permits.

The OBBBA's early phase-out of the tax credits for solar buyers will undercut solar installation growth. However, the early elimination of buyer credits does not change the fact that solar electricity is cheaper to install than natural gas or nuclear electricity before any subsidies are taken into account. Even without subsidies, many utilities will continue to choose solar due to its low unsubsidized cost, speed of installation, and 24/7 availability when paired with storage.

As Bloomberg New Energy Finance (BNEF) puts it, "Even without tax credits, the case for renewables and batteries remains strong in the US with top-line electricity demand growing swiftly for the first time in a decade, thanks to data-center buildout and electric vehicle sales. US natural gas is cheap, but turbines to convert it to electricity are expensive and hard to procure."

BNEF expects US electricity demand from data centers to more than triple by 2035 due to AI demand, forcing utilities and data center operators to install new electricity generation resources.

SOLAR PV GROWTH OUTLOOK

Wood Mackenzie also remains positive about solar in a post-subsidy America, saying, "There is always the potential for policy changes to impact deployment, but solar is currently the dominant form of new energy generating capacity in the US. The benefits of solar -- its cost competitiveness, benefits to the environment, low water use, and continuously improving technology, to name a few -- have spurred demand from utilities, independent power producers (IPPs), and corporate off-takers who see solar as the path to US energy independence."

It is also important to note that solar energy is growing rapidly around the world, even in countries without government subsidies. This bolsters confidence that US solar will thrive even without buyer subsidies.

In the wake of the new OBBBA law, Wood Mackenzie is currently forecasting a base-case total US solar install volume for 2025-2030 of 246 GW, which is only 4% below its pre-OBBBA outlook. Wood Mackenzie's worst-case scenario is an 18% decline in 2025-2030 solar installs to 202 GW versus its pre-OBBBA outlook. Those declines would be much milder than the debacle that some expected when Republicans took over Washington in November 2024.

Although the reduced US solar stimulus is a negative factor for solar firms operating in the US, it is essential to recognize that the US accounts for only 8% of global solar sales. That means that 92% of the world's solar sales are not directly affected by US politics. While US politics plays a substantial role in US stock investor sentiment, the fact remains that solar is a global industry where US developments are usually overshadowed by the sector's prospects in the rest of the world.

Global solar stocks have been under pressure over the past two years, primarily due to a sharp decline in polysilicon and solar module prices resulting from a surge in production capacity. The decline in solar prices has occurred even though global demand for solar remains very strong. The decline in solar product prices has been a negative factor for the profit margins of polysilicon, wafer, cell, and module manufacturers, which in turn has been a negative factor for stock prices.

However, those manufacturers constitute only about 28% of the total weight in the MAC Solar Index. The other 72% of the Index weight is in installers and operators of solar facilities, as well as manufacturers of non-module solar components, including inverters, solar glass, and solar trackers. Those sectors would benefit from the higher demand and unit sales resulting from lower module prices.

Indeed, the sharp decline in solar module prices seen over the past two years has a silver lining since it is likely to boost unit sales over the longer term as solar energy becomes even cheaper than its competition and extends its lead as the most widely chosen source of new electricity capacity in most of the world.

Meanwhile, the global oversupply situation is slowly being resolved as Chinese solar companies curb production and delay or cancel their capacity expansion plans. Companies are phasing out old production lines and are shutting down facilities for maintenance. Additionally, non-competitive, low-quality solar manufacturers are being driven out of business altogether.

Also, the Chinese government has launched a new initiative to manage disorderly competition by forcing Chinese solar companies to reduce their production. On July 3, 2025, China's Minister of the Ministry of Industry and Information Technology, Li Lecheng, met with the leaders of 14 solar companies and solar industry associations to announce that the government will increase oversight of the solar industry and take "forceful measures." A Chinese press report stated that the government may "severely" punish companies that sell at prices below their cost of production. There is also speculation that the government will implement strict energy-use limits for polysilicon production, effectively outlawing obsolete and inefficient producers.

Meanwhile, top Chinese polysilicon producers have moved ahead with a plan to create a polysilicon inventory platform company, whose job will be to manage global polysilicon inventory with a view to stabilizing polysilicon prices within a specified range. The new entity will also be responsible for buying and shutting down obsolete polysilicon production facilities.

The new inventory platform company, named "Beijing Guanghe Qiancheng Technology Co, was recently capitalized at \$425 million. The world's largest polysilicon producer, Tongwei Co, owns 30.35% of the new entity, followed by 16.79% ownership by GCL Technology Holdings Ltd, 11.13% ownership by Xinjiang Daqo New Energy Co, and other ownership interests held by smaller Chinese polysilicon producers. The plan is for the owners to progressively raise the contributed capital in the future to strengthen the entity's ability to manage polysilicon supply.

In any case, solar product pricing has recently stabilized. Polysilicon prices edged to a new record low of \$4.22 per kilogram in June 2025 but moved sharply higher starting in late August. Spot polysilicon prices in December were at \$6.50 per kg, up 54% from June's record low. Meanwhile, the prices of silicon and thin-film modules are moving sideways, slightly above the recent record lows, according to PV Insights.

The recent rise in polysilicon prices allowed several large Chinese polysilicon producers to return to profitability in Q3-2025. Many large Chinese module producers are still suffering losses, but those losses generally narrowed in Q3-2025.

Despite recent obstacles for solar stocks, the good news is that demand for solar energy remains strong, serving as a key solution on both economic and environmental grounds. Solar stocks have regained their footing in recent months, now that US legislative uncertainty has been resolved and excess Chinese production

SOLAR PV GROWTH OUTLOOK (CONTINUED)

capacity is being addressed.

Bullish longer-term factors for solar stocks include (1) the global push to reduce carbon emissions as many countries have adopted net-zero emissions goals to add to their Paris Climate Agreement goals, (2) strong demand for solar by many global corporations that have adopted net-zero emissions goals, (3) strong economic demand for solar now that solar is cheaper to build than fossil fuel or nuclear power in most of the world, (4) the pairing of solar with ever-cheaper battery systems to provide a 24/7 electricity solution, and (5) the need for many nations to improve their energy security and independence by building domestic electricity infrastructure such as solar, thus insulating themselves from the risk of importing fossil fuels from hostile countries and regions.

Global solar surges in 2024 and is set to remain the world's primary source of new electricity capacity

Global solar installations in 2024 rose sharply by +33% to a new record of 592 GW(dc)*, adding to the surge of +76% seen in 2023 and posting the sixth consecutive year of double-digit growth, according to Bloomberg New Energy Finance (BNEF). Global investment in solar projects totaled \$521 billion in 2024, according to BNEF.

Global solar installations grew at a compound annual rate of +38% during the five years from 2019 to 2024, making it one of the world's fastest-growing industries. BNEF estimates that solar installations in 2025 grew by +11% year-over-year. BNEF is forecasting that global solar installations in 2026 will fall slightly by -1% to 649 GW.

Even though the growth of annual solar installations is expected to come back to earth after the torrid pace seen in the past several years, the world will still be installing a huge amount of new solar capacity each year, adding to the cumulative solar capacity that the world uses to produce electricity (i.e., the total capacity of all existing solar plants).

Specifically, BNEF forecasts that global cumulative solar capacity will grow at a compound annual rate of +21% over the 2024-2029 period. Cumulative global solar capacity in 2024 rose by +36% to 2.3 terawatts (TW) and showed compound annual growth of +29% over the 5 years of 2019-24, according to BNEF.

Utility-scale solar accounted for more than two-thirds of global solar installations in 2024, with most of the rest involving rooftop solar on homes and businesses, according to the IEA PVPS's "Snapshot of Global PV Markets 2025" (pp. 10-11).

* Please note that solar capacity in this report is quoted in terms of direct current (DC), i.e., the DC output capacity from the solar system before an inverter converts the power to AC on the grid. DC is the solar industry's most common way of quoting solar capacity.

Regarding total electricity use, solar accounted for 7% of global electricity generation in 2024, up from 5% in 2023, according to the International Energy Agency (IEA).

The IEA expects total global electricity usage to show strong annual growth of +4% over the next four years, driven by increased air conditioning ownership, the need for more data centers to handle artificial intelligence, and the need to charge more electric vehicles. The IEA says that renewables will meet 95% of the world's increased electricity demand through 2027.

In fact, solar accounted for 72% of total new global electricity generation installations in 2024, far exceeding the next largest source, wind, at 18%, according to the International Renewable Energy Agency's (IRENA) "Renewable Capacity Statistics 2025." As a whole, renewables accounted for a record 92.5% of total electricity installations in 2024, leaving fossil fuel and nuclear power in the dust for new global electricity installations.

The reason renewables are being relied upon to meet new electricity needs is their low cost and rapid construction. Not only are renewables the most economical solution for building new electricity capacity, but they also help slow the effects of global warming.

BNEF has determined that solar and wind are now the cheapest sources of new electricity generation in countries that account for 82% of the world's power supply.

Even though the Trump administration has pulled the US out of the Paris Climate Agreement for the second time, the rest of the world will continue to battle climate change. At the COP28 conference in Dubai in December 2023, the world consensus was to pursue an "orderly transition" away from fossil fuels and to achieve tripling of renewable energy by 2030 and net-zero emissions by 2050. Most of the world, excluding the US, is moving ahead with those goals.

China pushes ahead with market-based solar pricing

Solar energy is a key industry in China. China needs low-priced solar to expand its electricity capacity and support its economic growth targets. China also needs solar energy to build new electricity generation facilities that reduce its reliance on coal, improve air quality, and meet its carbon emission reduction targets.

China installed 338 GW of solar in 2024, up sharply by +30% from 2023, according to BNEF. That added to the massive growth rates of +55% in 2022 and +144% in 2023. China's solar installations grew at a compound annual growth rate of +59% in the five years from 2019 to 2024, according to BNEF. BNEF is forecasting slower solar installs in China over the next few years, with growth of +10% in 2025, followed by a decline of -14% in 2026.

The Chinese government is heavily relying on solar energy to meet

SOLAR PV GROWTH OUTLOOK (CONTINUED)

its climate targets. In September 2025, the Chinese government announced a new goal of reducing emissions by 7-10% from peak levels by 2035, compared to its previous goal of peaking carbon emissions by 2030. The government also announced a goal of increasing installed wind and solar capacity to 3,600 GW by 2035, which is more than six times the 2020 level. China also adopted a goal for the share of non-fossil energy (including renewables, hydro, and nuclear) to exceed 30% by 2035. The Chinese government aims to achieve carbon neutrality by 2060 as part of its Nationally Determined Contribution (NDC) under the Paris Climate Agreement.

China has been installing utility-scale and rooftop solar on a massive scale across the country. However, to help meet its ambitious renewable energy targets, China has also been building a vast array of solar and wind projects in its desert regions. The first phase of 97 GW of solar and wind started in 2021 and ran smoothly, thus leading the government to expand the project. The Chinese government announced another 455 GW of desert solar and wind projects, with 200 GW slated for completion by 2025 and an additional 255 GW by 2030. Those plants will mainly deliver the electricity to the nation's more densely populated eastern regions.

In February 2025, Chinese government regulators announced a new policy, known as Regulation No. 136, that fully moved China to market-based pricing for solar electricity. Solar electricity from projects implemented after June 1, 2025, must be sold through market transactions, thus replacing the previous system of a fixed contract price based on the coal-fired power price. The new program means that 100% of solar electricity is now being traded in the power market, up from 50% in 2024.

Under the new policy, a "Contract for Difference" (CfD) program provides some revenue protection for solar developers of projects commissioned after June 2025. For solar projects commissioned before June 2025, the CfD program will guarantee the original pricing terms.

China's new pricing policy is designed to transition its solar industry into a mature, market-driven power sector by striking a balance between market exposure, revenue certainty, and investment quality. It marks the end of universal fixed pricing and marks the beginning of a new era in renewable energy commercialization.

China's solar installs surged in the first half of 2025 as developers sought to beat the deadline for the old pricing system. Chinese solar installs in the second half of 2025 have dropped back now that the new system has taken effect.

US solar industry is moving forward under new solar policies

The US solar industry is moving forward now that Congress finalized its policy changes. The value of the US solar market was \$70 billion in 2024, according to the Solar Energy Industry Association's (SEIA) Solar Data Sheet. The SEIA reports that there are now more than 10,000 solar businesses in the US employing 279,447 persons. There are now 5.4 million solar systems installed in the US, and a new solar system is installed every 54 seconds. There is already enough solar in the US to power 40 million households.

US annual solar installations in 2024 rose sharply by +35% year-over-year to a record 50.6 GW, adding to the surge of +58% seen in 2023, according to BNEF. BNEF estimates that new US solar installations in 2025 grew slightly by +1% year-over-year to 51.1 GW, due to policy uncertainty and consolidation following two years of sharp gains. BNEF is forecasting that US solar installs will fall by -14% in 2026 and then show little change during 2027-2029.

The fact that the US is expected to install an average of 44 GW of solar capacity per year over 2026-2030 means that cumulative US solar capacity (i.e., the total capacity of all existing US solar plants) will continue to show solid growth in the near term. BNEF forecasts that US cumulative solar capacity will grow by +16% to 323 GW in 2026, adding to the projected 2025 growth rate of +22% to 279 GW.

Solar energy is trouncing its competitors in newly installed electricity capacity. Specifically, solar energy accounted for 66% of all new US electricity-generating capacity in 2024, marking the sixth consecutive year it led, according to Wood Mackenzie. Solar's 66% market share was far ahead of an 18% share for storage, a 10% share for wind, a 4% share for natural gas, and a 2% share for "other." New installations of coal and nuclear electricity-generating capacity in 2024 were not large enough to even qualify for an individual category.

Solar beat natural gas by a margin of 16-to-1 for new US electricity plant installations in 2024. With Republicans currently in control of Washington, there have been calls for a greater reliance on natural gas for electricity production. However, NextEra Energy CEO John Ketchum told the "CERAWeek by S&P Global" conference in Houston in March 2025 that gas-fired electricity generation can only meet a sliver of the electricity demand increase required by the end of the decade, and that the cost of gas plants, in any case, has soared in the last 18 months.

In its Levelized Cost of Energy report released in June 2025 (see p. 16 in this report), Lazard said that the LCOE of natural gas plants as of early 2025 rose just mildly from the previous year's level, but that "turbine shortages, rising costs and long lead times are expected to drive steep LCOE increases for gas technologies

SOLAR PV GROWTH OUTLOOK (CONTINUED)

in the near-term."

Aside from cost issues, there is currently a shortage of new gas turbines available, with turbine manufacturers experiencing delivery backlogs that extend into 2029. Moreover, this bottleneck is not expected to improve, as the three largest gas turbine manufacturers have stated that they do not plan to expand turbine manufacturing capacity due to their own supply chain and labor constraints. Also, they are uncertain whether the demand for turbines will be sufficient by the time new manufacturing facilities can be built.

The shortage of turbines and the high cost of gas-fired plants have already caused some utilities to cancel plans for new gas-fired electricity generation plants. For example, Texas is currently having difficulty getting companies to build new gas power plants in the state.

Following the 2021 Texas electricity blackout, the state established a \$10 billion energy fund in 2023, with about half of that fund dedicated to supporting natural gas plants. However, plants accounting for nearly half of the applications for that fund have already been abandoned due to ballooning costs and supply chain delays. Utilities dropping the gas projects included Constellation Energy and the US unit of France's Engie. Analysts from Citibank said the Texas fund is "falling apart," and more gas projects are likely to be scrapped due to "pure economics."

US solar growth in 2024 was led by the utility sector, with a +33% surge in installations to a record 41.4 GW, according to Wood Mackenzie. The utility solar sector, which accounted for about 82% of all new US solar installations in 2024, benefited from strong demand and the increased availability of modules as US domestic module production came online. Wood Mackenzie forecasts that 356 GW of utility-scale solar power will be installed over the 10-year period from 2025 to 2035.

Utility-scale solar accounted for 5.2% of total US electricity generation in 2024, according to the US Energy Information Administration (Short-Term Energy Outlook, Table 7d). The EIA forecasts that utility-scale solar's share of total US electricity generation will increase to 6.8% in 2025 and 8.0% in 2026. The relatively low penetration rate seen thus far for solar energy indicates ample room for solar to continue growing rapidly in the coming years, meeting new electricity demand and replacing more expensive options such as natural gas, coal, and nuclear.

US residential solar installations in 2024 fell by -32% yr/yr to 4.2 GW, according to Wood Mackenzie. The residential sector was undercut by net metering changes in California and other states, sustained high interest rates, and consumer hesitation ahead of the November 2024 election.

The US commercial sector experienced +8% year-over-year growth in solar installations in 2024, reaching 2.1 GW, as more

corporations sought to capitalize on the solar benefits of lower costs and zero emissions. Meanwhile, community solar saw strong growth of +35% to a record 1.7 GW.

Republicans curb solar buyer subsidies but leave solar manufacturing subsidies in place -- The Republican-controlled Congress on July 3, 2025, passed its OBBBA reconciliation bill, which President Trump signed on July 4. That bill contained legislative amendments for the solar stimulus measures defined initially in the Biden administration's "Inflation Reduction Act" (IRA), passed in 2022.

The original IRA law offered two major tax incentives for solar buyers, which substantially reduced the bottom-line cost for solar developers and operators. Buyers could choose either incentive, but not both.

The first buyer incentive was the Section 48E Clean Electricity Investment Tax Credit (ITC), which the IRA law set at up to 30% of the cost of purchased solar equipment (including inverters and batteries). The original IRA provided the credit through 2032, with step-downs to 26% in 2033, 22% in 2034, and zero in 2035.

The second buyer incentive was the Section 45Y Clean Electricity Production Tax Credit (PTC), whereby the IRA law offered a credit of up to 1.5 cents/kWh for generators of solar electricity. The original IRA law provided the credit through 2032, with step-downs to 75% of the credit in 2033, 25% of the credit in 2034, and zero in 2035.

However, Republicans' OBBBA law ended the buyer 48E ITC and 45Y PTC credits for solar buyers much earlier than the IRA, providing the credit only for (i) projects that begin construction between July 2025 and July 2026 (with no completion date requirement), or (ii) facilities that begin construction after July 2026 but can place the facility in service by December 31, 2027.

The Treasury released guidance in mid-August 2025 defining how to meet the "beginning of construction" rules to qualify for the credits. The new rules state that projects can comply only if they show "physical work of a significant nature," which is more restrictive than the former requirement of spending at least 5% of the project cost. However, small projects under 1.5 MW can still qualify under the old rule requiring 5% of the project cost.

The "beginning of construction" rule was less restrictive than the markets had been expecting. In other good news, the new rule was forward-looking and did not apply retroactively, allowing projects to qualify for the credits if they had already met the old 5% rule before the OBBBA was passed.

While the OBBBA law sharply curbed solar and wind credits, it was very generous with the 48E and 45Y credits for battery storage, not only leaving the IRA credits in place but also extending them by a year. Specifically, the OBBBA law maintained the battery

SOLAR PV GROWTH OUTLOOK (CONTINUED)

credits through 2033, with step-downs to 75% of the credit in 2034, 50% of the credit in 2035, and a zero credit in 2036.

The OBBBA law was very generous with nuclear, geothermal, and hydropower credits, leaving the IRA's existing 48E and 45Y credits in place through 2033. However, those electricity technologies are limited in scalability and have long build times, meaning they do not present much competition for solar. Moreover, nuclear power continues to have very high costs, even after receiving subsidies.

Additionally, nuclear power remains so hazardous that no electric utility could operate a nuclear power plant from a risk standpoint without liability protection from the US federal government's Price-Anderson Act, which caps the liability of a nuclear operator and ensures compensation for the public in the event of a nuclear accident or sabotage.

It is also worth noting that the majority of nuclear waste from nuclear power plants is currently stored on-site in spent fuel pools or dry cask storage systems. That is because the US government, despite four decades of debate, has been unable to build a permanent nuclear waste repository anywhere in the United States. That means there is currently radioactive waste at various nuclear power plants across the US that is subject to leaks or terrorist attacks.

Even advanced nuclear reactor developers, such as TerraPower, X-energy, and Oklo, face uncertainty about what to do with their radioactive spent fuel, thereby dampening enthusiasm for the newer and smaller nuclear reactors. That assumes that their monumental cost issues can ever be overcome.

Another tax credit in the original IRA law is the Section 25D Residential Clean Energy Credit, which offered a 30% tax credit for residential solar and storage systems installed from 2022 through 2032, with step-downs to 26% in 2033 and 22% in 2034.

The OBBBA law eliminated the residential solar tax credit on a short time frame for homeowners, i.e., as of December 31, 2025. However, the bill is more lenient in allowing third-party ownership (TPO) companies to receive the 48E ITC credit for home-based solar systems that are either leased or provided to homeowners under power purchase agreements, allowing those TPO companies to charge homeowners less for the solar electricity. The OBBBA law allows the 48E ITC credit for TPO systems through 2030 if safe-harbored by starting construction before July 4, 2026.

To support US domestic solar manufacturing, the original IRA law provided \$30 billion to implement a Section 45X Advanced Production Credit for US solar manufacturers through 2032. The credit covers the entire solar supply chain, from polysilicon to modules, as well as inverters and batteries.

The purpose of the 45X production credit is to encourage

companies to build factories in the United States to manufacture solar modules, inverters, and batteries, thereby stimulating employment in the country and reducing the need for the United States to import this equipment.

In a big win for the US solar industry, the OBBBA law retained the 45X production credit, with the intent of keeping newly built US solar factories open and encouraging the construction of additional factories.

The OBBBA law retained the IRA's same expiration schedule for the 45X production, providing the credit through 2029, with step-downs to 75% of the credit in 2030, 50% in 2031, 25% in 2032, and zero in 2033.

In a new measure that was not in the original IRA law, the OBBBA law has a "Foreign Entity of Concern" (FEOC) screen that disallows the 45X production credits for factories owned or operated by a prohibited foreign entity or that receive material assistance from a prohibited foreign entity.

There are also FEOC restrictions on the 48E ITC and 45Y PTC credits, which prohibit foreign entities from receiving the credits. In addition, facilities that began construction after December 31, 2025, cannot receive material assistance from a prohibited foreign entity.

The countries currently covered by the FEOC rules are China, Russia, Iran, North Korea, and Cuba. China is obviously the primary concern for the solar industry, as a significant portion of the world's polysilicon, solar wafers, and solar cells originates in China or is produced by Chinese-owned companies operating outside the country.

Depending on how the FEOC language is implemented, it may be challenging for even US entities to qualify for the tax credits, as their supply chains may extend back to products produced in China. The new FEOC rules also apply to battery credits.

In any case, the IRA's original 45X production credit, implemented in 2022, has been highly successful thus far. Many solar factories have been built in the US over the last several years as a result of the credit.

Indeed, US solar module manufacturing capacity soared sixfold to 42.1 GW by the end of 2024, up from 7 GW in 2022 before the IRA law was passed, according to Wood Mackenzie. US solar module manufacturing capacity then increased further to 60 GW by the end of Q3-2025, which is more than enough to supply all US solar installations in the coming years without the need for any module imports.

However, the US still needs to import nearly all the solar cells used in the modules assembled in the country. As of the end of Q1-2025, only 2 GW of solar cells were manufactured in the US,

SOLAR PV GROWTH OUTLOOK (CONTINUED)

according to Wood Mackenzie. Yet, solar cell manufacturing in the US could grow quickly to 9 GW by the end of 2025, according to Wood Mackenzie, depending on industry reaction to the changes in the OBBBA law.

US solar industry navigates new Trump tariffs -- The global solar industry has been a victim of aggressive tariffs from governments worldwide for more than a decade. The tariffs have increased the bottom-line costs for solar homeowners and utility developers and have caused significant problems for solar manufacturers.

The goal of most tariffs is to protect domestic manufacturers from overseas competition. More often than not, however, tariffs simply restrict the supply of imported goods and increase prices for the country's consumers.

Over the past decade, the US government has employed import tariffs in an attempt to promote US solar manufacturing. The import tariffs primarily just restricted the supply of modules available to US solar developers and increased the price of US modules relative to global price levels. It wasn't until the US government, with the Biden administration's Inflation Reduction Act, offered a substantial manufacturing subsidy that solar companies began building solar module assembly plants in the US on a significant scale. As mentioned earlier, Republicans in the OBBBA law preserved the solar manufacturing subsidies.

Over the past decade, the US government has employed three distinct solar-specific tariffs: Section 301 tariffs, anti-dumping and countervailing duty (AD/CVD) tariffs, and Section 201 tariffs.

The Trump administration is continuing to use those three solar-specific tariffs, but has radically expanded the use of tariffs by imposing so-called "reciprocal tariffs" on the importation of nearly all goods worldwide. These tariffs are in addition to the solar-specific tariffs.

President Trump introduced his reciprocal tariffs on April 2, 2025, by claiming a national emergency under the International Emergency Economic Powers Act of 1977. In May 2025, the US Court of International Trade ruled that Mr. Trump's reciprocal tariffs were illegal under US law and invalidated them. However, a US Appeals court stayed that decision and allowed the Trump administration to collect those tariffs while the legal challenge wound its way through the US appeals system.

The US Supreme Court heard oral arguments in the case in November 2025 and is expected to issue a ruling by early 2026. If the US Supreme Court declares the reciprocal tariffs invalid, then the US government may have to refund the tariffs already collected. However, the Trump administration will likely try to impose the same tariffs with a different legal justification, meaning the tariff issue would not be over.

The reciprocal tariffs are currently making it even more expensive for US solar companies to import products from overseas, including batteries, solar modules, and upstream solar components such as polysilicon, solar wafers, and solar cells, for which the US has a limited domestic supply.

The current US tariff of about 20% (10% reciprocal tariff plus a 10% penalty tariff for fentanyl trafficking) on most imports from China is less important to US solar companies, as imports of solar products from China into the US are already negligible due to decade-long solar tariffs. However, the battery storage industry is exposed to the increased Chinese tariffs because about 70% of the lithium-ion batteries used in the US for electric vehicles and storage are imported from China.

Of more direct importance to the US solar industry are the high reciprocal tariffs on India, Malaysia, the Philippines, and Vietnam, as these are countries from which US companies do import solar products. While the US now has sufficient domestic production of solar modules to meet its domestic demand, it still imports solar wafers and cells from overseas, resulting in higher import costs due to the reciprocal tariffs.

In addition to the reciprocal tariffs, President Trump in March 2025 levied a national security tariff on imports of steel, aluminum, and their derivative products under Section 232 of the Trade Expansion Act of 1962. That import tariff is currently set at 50% for both steel and aluminum imports, except for the UK, which is at 25% due to a US-UK trade deal. The steel and aluminum tariffs have increased the cost of inputs for producers of solar trackers and solar module frames.

The Trump administration in July 2025 launched a separate probe into polysilicon imports based on national security concerns and Section 232 of the Trade Expansion Act of 1962. The US produces very little polysilicon, meaning US solar module and cell manufacturers at present must import nearly all polysilicon and polysilicon wafers. A decision on Section 232 polysilicon tariffs is expected by March 2026, but could come much sooner.

Regarding other types of solar tariffs, the Obama administration in 2012 imposed Section 301 tariffs on solar modules and cells imported from China to address concerns that Chinese solar manufacturers were dumping subsidized products in the United States. In May 2024, the Biden administration then doubled the Section 301 tariffs on Chinese solar modules and cells to 50% from the original level of 25%. In December 2024, the Biden administration raised the duty to 50% from 25% on solar wafers and polysilicon, thus covering the entire Chinese solar supply chain with 50% tariffs.

The higher 50% Biden tariff had little impact since the US imported virtually no solar modules or cells directly from China due to the original Obama tariff. However, the Biden administration temporarily exempted solar cell and PV wafer manufacturing

SOLAR PV GROWTH OUTLOOK (CONTINUED)

equipment from the tariff as of January 1, 2024, allowing companies building manufacturing facilities in the United States to import the factory machinery they need to build their US factories.

President Trump's US Trade Representative (USTR) in early December 2025 extended the Section 301 exemption for solar manufacturing equipment to November 10, 2026, which was a positive factor for companies looking to set up solar manufacturing plants in the US.

Some Chinese companies responded to the original 2012 Chinese tariffs by building new factories in Southeast Asia to import solar components from China and circumvent the US tariff. To address this concern, the US Department of Commerce (DOC) imposed anti-dumping and countervailing duty (AD/CVD) tariffs on four companies in August 2023, concluding that they had circumvented the Chinese tariffs. Those factories were located in Malaysia, Thailand, Vietnam, and Cambodia.

The AD/CVD investigation, which began in March 2022, sparked a flurry of order cancellations and project delays among US developers in 2022 due to uncertainty about the extent of the tariffs. However, the Biden administration announced in June 2022 that any tariffs resulting from the investigation would be suspended until June 2024, thereby giving US solar developers time to shift their solar module purchases to alternative sources. However, that tariff suspension ended in June 2024, and the US government began collecting AD/CVD tariffs on US solar imports from those four companies.

Then, in September 2025, the US Court of International Trade ruled that the Biden administration's 2-year tariff moratorium in 2022-24 was invalid and ordered the retroactive collection of those duties, which could total as much as \$54 billion. However, that ruling was appealed and the appeals court blocked the US government from collecting retroactive tariffs, pending a final ruling on the appeal.

In June 2024, the US Department of Commerce (DOC) initiated a new, more extensive AD/CVD investigation into solar factories in Malaysia, Thailand, Vietnam, and Cambodia. In April 2025, the DOC announced final AD/CVD duties, with exact levels varying by company and country. The average duty was 34% for Malaysia, 375% for Thailand, and 396% for Vietnam, according to Bloomberg News. The rates for some companies in Cambodia were as high as 3,521% because they refused to cooperate with the DOC's inquiry.

In July 2025, the US Department of Commerce (DOC) began a new AD/CVD investigation against solar producers in India, Indonesia, and Laos. The DOC was expected to announce AD/CVD duties on solar companies in those countries by late December, but the announcement was apparently delayed by the 43-day US government shutdown from October 1 through November 12, 2025.

Separately on the tariff front, the Biden administration, in February 2022, extended the Section 201 tariffs imposed by the first Trump administration on imported solar modules at 14.25% until February 2025 and 14.0% from February 2025 until February 2026. The Section 201 tariffs apply globally, with limited exemptions for countries such as Canada, Mexico, Indonesia, Jordan, and South Africa, among others.

However, in its 2022 extension of Section 201 tariffs, the Biden administration left open two significant loopholes. First, the Biden administration exempted the first 5 GW of imported solar cells from the Section 201 tariff. Second, the Biden administration maintained the exemption for bifacial modules, which the first Trump administration introduced. The bifacial module exemption provided a significant break for US solar developers and buyers, as large utility-scale projects widely utilize these modules. Bifacial modules allow light to be absorbed by both the front and back of the module as light bounces off the ground.

In early 2024, the Biden administration tightened the Section 201 duties by removing the exemption for bifacial panels, meaning those panels became subject to a 14.25% duty. However, the Biden administration maintained the 5 GW of exempted cell imports to enable US module factories to import the solar cells they need to assemble into their solar panels. As of August 1, 2024, the Biden administration more than doubled the solar cell exemption to 12.5 GW to ensure that US factories had sufficient duty-free cells to assemble their modules.

Regarding the history of the US Section 201 tariffs, the first Trump administration, in January 2018, imposed a Section 201 tariff of 30% on imported solar cells and modules in an attempt to protect the few US solar manufacturers that existed at the time. The initial Section 201 import tariff of 30% for 2018 stepped down to 25% in February 2019, 20% in February 2020, and 15% in February 2021. The tariff was set to expire in February 2022, but, as mentioned earlier, former President Biden extended the tariff until 2026.

US solar importers deal with Xinjiang restrictions -- US solar imports and installations have been disrupted over the past several years by the US government's actions to block some solar imports from the Xinjiang region of China, following allegations of forced labor at some companies located in Xinjiang. However, that situation has now largely been resolved as solar companies either met the US government's documentation requirements or acquired the necessary modules elsewhere.

The Xinjiang issue began to affect the solar industry in June 2021, when the US government imposed a "Withhold Release Order" blocking the import of polysilicon products produced by five companies based in China's Xinjiang province. This action was taken due to allegations that the companies were associated with government-run forced labor programs involving the Uyghur Muslim minority. China's government denied the allegations of

SOLAR PV GROWTH OUTLOOK (CONTINUED)

forced labor and objected to what it claimed was US interference in its internal affairs.

The targeted companies were hamstrung in trying to defend themselves against the forced labor allegations by China's Anti-Foreign Sanctions Law, which makes it illegal for Chinese companies to cooperate with US requirements aimed at avoiding sanctions. The Chinese law makes it nearly impossible for Chinese companies to defend themselves against allegations of using forced labor without getting themselves into trouble with the Chinese government.

Going beyond the initial Withhold Release Order, the US Congress passed the Uyghur Forced Labor Prevention Act (UFLPA) in December 2021, which was signed into law by former President Biden and took effect in June 2022. That law bans the importation of products made in Xinjiang unless the importer can provide convincing evidence that the products were not produced with forced labor. The UFLPA does not impose a total ban on importing goods from Xinjiang but rather imposes a "rebuttable presumption" of a ban that can be overcome with proper documentation.

The Xinjiang restrictions were significant for the global solar industry because factories in the Xinjiang region produced about 45% of the world's solar-grade polysilicon as of 2020, according to Bernreuter Research. Factories in Xinjiang do not assemble any significant number of solar modules, but they do produce a significant amount of polysilicon.

However, the importance of Xinjiang polysilicon has been reduced by a sharp increase in the number of polysilicon factories built outside Xinjiang. As a result, Wood Mackenzie reports that the share of the world's polysilicon produced by Xinjiang factories decreased to less than one-quarter of the world's supply by 2023.

The global solar industry has addressed labor issues in Xinjiang by diverting supply chains away from the region and enhancing the documentation of their supply chains to prove there are no forced-labor products in their supply chains.

The US-based Solar Energy Industries Association (SEIA) developed the ANSI/SEIA 101 Solar and Energy Storage Supply Chain Traceability Standard to address the forced labor problem. US solar and energy storage companies can use that standard to comply with US Customs and Border Protection's (CBP) traceability requirements and the UFLPA requirements ([link](#)). The American National Standards Institute (ANSI) approved the standard in October 2025.

Companies that comply with the ANSI/SEIA traceability standard can prove that imported products do not contain any raw materials, components, or finished products banned by the UFLPA law. The standard was created with real-world situations in mind, along with some input from the CBP. The new standard should help reduce

seizures by the CBP of imported products caused by insufficient documentation.

The ANSI/SEIA 101 traceability standard for supply chains should also be useful for companies to qualify for subsidies by meeting the OBBBA's Foreign Entity of Concern (FEOC) rules, which are expected to be released in January.

The Solar Stewardship Initiative has launched a similar standard for European countries, known as the "Supply Chain Traceability Standard," in an effort sponsored by trade bodies SolarPower Europe and Solar Energy UK.

Europe has also acted to block products tied to allegations of forced labor. In December 2024, European regulatory authorities implemented the "EU Regulation on Prohibiting Products Made with Forced Labor on the Union Market" (FLR). The FLR prohibits companies from selling or exporting products made in whole or in part with forced labor to or from the EU market, as defined by the International Labor Organization. The ban will take effect in December 2027, without the need for national legislation.

Other US solar policy issues -- When Donald Trump took office for his second term as President in January 2025, he made a series of announcements affecting clean energy. He announced the withdrawal of the US from the Paris Climate Agreement for the second time, beginning a year-long process to complete the exit. He revoked the US International Climate Finance Plan, which provides aid to developing nations for reducing emissions. Mr. Trump also revoked all US federal and national goals for reducing emissions. The Trump administration is also reviewing new clean energy loans, grants, leases, and permits.

Although President Trump dropped the Biden administration's previous US climate commitments, those commitments could be reinstated by a future president. The Biden administration, in April 2021, announced a new Nationally Determined Contribution (NDC) under the Paris Climate Agreement of a reduction in US greenhouse gas emissions by 50-52% by 2030 from 2005 levels. That was nearly double the previous commitment made by the Obama administration, which was a 26-28% cut in greenhouse gas emissions by 2025 from 2005 levels. The Biden NDC also included the target of achieving net-zero carbon emissions in the US economy by 2050. The Biden administration also pledged to reach a 100% carbon-free electricity sector by 2035 and reach net-zero greenhouse gas emissions by 2050.

Europe continues to strengthen policy support for solar

European solar installations in 2024 grew by +4% year-over-year to a record 65.5 GW, according to industry association SolarPower Europe in its report, "EU Market Outlook for Solar Power: 2024-2028." That followed a banner year in 2023, when solar installations surged by +53%.

SOLAR PV GROWTH OUTLOOK (CONTINUED)

Solar energy's share of total electricity generation in Europe rose to 11% from 9.1% in 2023 and 7.6% in 2022, according to energy think tank Ember. In 2024, solar energy surpassed coal for the first time, with solar's 11% share of total EU electricity usage exceeding coal's 10%. European gas-generated electricity fell for the fifth consecutive year in 2024.

Slower European solar growth in 2024 was caused by weaker residential installations and the stabilization of electricity prices after the surge in 2022-23, driven by Russia's invasion of Ukraine. Yet, utility-scale solar continued to show strong growth in 2024, accounting for 42% of European solar installations, up from 36% in 2023.

Looking ahead, EU solar installations are expected to ease slightly by -1% to 5.1 GW in 2025, according to forecasts from SolarPower Europe. European solar growth is expected to slow in the near term as issues are addressed related to fast growth, such as grid congestion and permitting delays. Also, residential solar demand stalled in 2025 due to reduced government support measures and less electricity price pressure on homeowners.

The EU has aggressive climate and renewable energy goals. In September 2022, the European Parliament approved raising the target for the share of renewables in the EU's electricity mix to 45% by 2030, up from 40% in June 2022 and the previous target of 32%. The European Commission set the new 45% target as part of the REPowerEU plan to cut the EU's dependence on imported Russian natural gas. The actual target is 42.5%, but a 2.5% "indicative top up" allows for a 45% target to be reached.

The EU is relying on its renewable energy target to meet its pledge under the UN Paris Climate Agreement to reduce its greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels, and to achieve net-zero emissions by 2050.

Europe was thrown into an energy emergency after Russia invaded Ukraine in February 2022, which forced Europe to slash its dependence on Russian oil and gas. Russia's invasion of Ukraine brought the importance of domestic energy security to the forefront once again, much as it was in the 1970s when OPEC's oil embargo caused long gasoline lines and a global recession. Fossil fuels often originate in hostile, inhospitable locations, making them an expensive and unreliable source of energy for importers.

As a result of Russia's attack on Ukraine, the EU formulated a plan called REPowerEU to slash its dependence on Russian fossil fuels. A key strategy of REPowerEU is to rapidly expand renewable electricity production to replace fossil fuels, such as natural gas and coal. The REPowerEU proposal aims to ensure that 740 GW of cumulative solar capacity is in place by 2030, requiring approximately 440 GW of new solar capacity to be installed between 2025 and 2030.

The REPowerEU strategy includes several key measures to accelerate solar installation, including larger government solar auctions, government support for identifying suitable land sites, streamlined permitting, and simplified solar Power Purchase Agreements (PPAs) to make them more attractive to small and medium-sized companies.

US passage of the IRA law galvanized European policymakers into taking more aggressive actions to build a domestic solar manufacturing base. The European Commission formulated the "Green Deal Industrial Plan," which focused on four key pillars: regulation, financing, skills, and trade.

As part of the Green Deal Industrial Plan, the EU's "Net-Zero Industry Act (NZIA)" took effect in June 2024. The NZIA aims to utilize European-manufactured products for at least 40% of its clean energy deployment. The NZIA imposes domestic content requirements for European public auctions and tenders for renewable energy capacity, thus seeking to support European manufacturers. The NZIA also seeks to promote the training of workers for solar manufacturing plants and ease regulatory burdens on European solar manufacturers.

In February 2025, the European Commission unveiled the Clean Industrial Deal, which aims to provide €105 billion in funding to support European clean industrial manufacturing.

The EU currently has manufacturing capacity of 25 GW of PV-grade polysilicon, 12 GW of PV modules, and 2 GW of kPV cells, according to the EU publication "Clean Energy Technology Observatory, Photovoltaics in the EU" ([link](#)). The EU manufactures no PV-grade silicon ingots or PV wafers. The EU is much bigger player in inverters and trackers, with manufacturing capacity of 142 GW of PV inverters and 121 GW of mounting structures, representing global market shares of 23% and 34%, respectively.

India becomes a major module exporter as production capacity soars

India's government is pushing very hard for solar energy to help modernize its infrastructure, boost its global business competitiveness, expand electricity access in rural areas, and meet its climate goals.

India is pursuing national goals of achieving 500 GW of renewable energy capacity by 2030 and net-zero emissions by 2070. India's government has also set ambitious goals to increase its cumulative solar capacity by +49% to 186 GW by 2027 and nearly triple it to 365 GW by 2032, from its current level of 125 GW, according to its 14th National Electricity Plan (NEP14).

Solar is already the biggest source of new electricity in India, accounting for 73% of new annual electricity capacity additions in 2024, according to Mercom Capital Group. That means

SOLAR PV GROWTH OUTLOOK (CONTINUED)

solar energy in India trounced other sources of new electricity generation in 2024, including wind, natural gas, coal, and nuclear.

In 2024, India installed the third most solar capacity of any country in the world, behind China and the US, with installations of a record 32.9 GW, up 143% year-over-year, according to BNEF. India's solar installations showed a compound annual growth rate of +24% over the five years from 2019 to 2024.

BNEF forecasts that India's solar compound annual growth rate over the 5 years from 2024 through 2029 will be +14%, more than doubling annual installations to 68 GW by 2030.

India's government has pushed hard for a homegrown solar industry in recent years, combining tariffs on imported solar products with a large subsidy program for building solar factories in India.

As a result, India's domestic solar manufacturing capacity has expanded rapidly in the past several years. India's solar panel manufacturing capacity more than doubled to 74 GW by March 2025 from 38 GW in March 2024, according to India's Ministry of New and Renewable Energy (MNRE). India's solar cell manufacturing capacity also more than doubled to 25 GW in March 2025 from 9 GW a year earlier, reducing India's reliance on importing Chinese solar cells.

India's domestic solar module manufacturing capacity reached 125 GW by the end of 2025, which is roughly three times domestic demand, making a huge amount of modules available for export, according to a report from Wood Mackenzie.

To build a domestic solar manufacturing industry, India's government provided a substantial \$3 billion in funding for its solar PV manufacturing "Production Linked Incentive" (PLI) scheme, which offers subsidies to companies that establish large solar manufacturing plants in India.

India's government has also used tariffs to block imports of Chinese solar modules and encourage Indian solar installers to buy Indian modules. Effective April 1, 2022, India's government imposed a basic customs duty of 40% on certain imported solar modules and a 25% duty on imported solar cells.

As another trade protection mechanism, India maintains an "Approved List of Models and Manufacturers" (ALMM) of solar modules that are approved for installation in India in government projects and projects under government programs. That list was originally designed as a minimum quality requirement. However, it is actually a domestic content requirement, as no non-Indian solar manufacturers are included on the list.

The ALMM previously applied only to solar modules. However, the government now requires that all projects with bid submission dates after August 31, 2025, must use both ALMM-listed

solar panels and cells. BNEF reports that Indian companies have announced plans to build a total of 70 GW of solar cell manufacturing capacity.

The Indian government plans to extend the ALMM restriction to solar wafers as of June 1, 2028. In the meantime, however, Indian companies are free to import solar wafers to use in their Indian domestic manufacturing operations for solar cells.

Japan's solar slows while much of the rest of Asia/Pacific shows growth

Solar installations in Japan in 2024 decreased by -15% year-over-year to 4.3 GW, marking the fourth consecutive annual decline, according to BNEF. However, BNEF expects a resumption of growth in 2025 and a compound annual growth rate of +7% through 2030.

Japan's annual solar installation growth slowed through 2024 due to reduced subsidies. Yet, the Japanese government's subsidy support for solar energy will continue in the coming years through a feed-in tariff (FIT) program for both residential and commercial-industrial projects.

In April 2022, the Japanese government launched a feed-in-premium (FIP) support program for large-scale solar projects. The FIP program provides solar electricity producers with a premium over wholesale electricity prices as an incentive, unlike the old FIT system, which specified a fixed electricity price. The new system aims to transition the Japanese solar market to unsubsidized parity.

The Japanese government is pursuing aggressive solar targets to help meet its emissions goals. In July 2021, the Japanese government almost doubled its solar target to a cumulative capacity of 108 GW by 2030. The Japanese government has a Nationally Determined Contribution (NDC) of a 60% cut in emissions by 2035 and a 73% cut by 2040 from 2013 levels. Japan aims to achieve net-zero carbon emissions by 2050.

Solar in Japan is also expected to receive support in the coming years from Japanese corporations seeking to sign solar power purchase agreements to meet their corporate renewable energy goals. Corporate demand is expected to be a key factor driving the development of subsidy-free solar in Japan in the coming years.

Elsewhere in the Asia-Pacific region, Taiwan is expected to see strong solar installations in the coming years as the government promotes solar energy to meet its climate goals. Solar installations in Taiwan in 2024 decreased by -31% to 1.9 GW, but BNEF expects strong growth of +24% in 2025 and +9% in 2026.

There is also strong solar demand in Taiwan from corporations seeking to meet their renewable energy goals. Additionally, there is a growing demand for solar power in Taiwan to replace the

SOLAR PV GROWTH OUTLOOK (CONTINUED)

impending closure of coal plants, in line with the government's goal of achieving net-zero emissions by 2050.

Taiwan's government aims to obtain 50% of its total electricity from renewable sources by 2035. The government has announced an aggressive cumulative solar capacity target of 31 GW by 2030, which would be more than double its current capacity of 14 GW.

Solar installations in South Korea in 2020 increased sharply by +51% to a record 5.6 GW, but then declined in 2021-23. In 2024, solar installations grew by +6% to 3.2 GW, according to BNEF.

Corporate demand for solar power is expected to grow sharply after South Korea's government revised its electricity laws in 2021, allowing clean energy developers to sell electricity directly to corporations through power purchase agreements.

South Korea's 11th Basic Plan for Electricity Supply and Demand, approved in February 2025, set a cumulative solar capacity target of 55.7 GW by 2030 and 77.2 GW by 2038, which would require aggressive annual installations to reach, as its capacity in 2024 was only 30.3 GW.

The South Korean government's current goal is to derive 20% of total electricity generation capacity from renewable sources by 2030. In 2025, the South Korean government raised its Nationally Determined Contribution (NDC) under the Paris Climate Agreement to a 53-61% reduction in emissions by 2030 from 2018 levels.

In Australia, solar installations in 2024 decreased by -20% to 4.5 GW, following a +19% increase in 2023, according to BNEF. Australian solar installations have demonstrated a strong 18% compound annual growth rate over the past decade.

Australia's government has pledged to reduce emissions by 43% by 2030 from their 2005 level and reach net-zero emissions by 2050. The government is also targeting 82% renewable generation by 2030, up from the current level of 27%.

Latin America becomes major solar player, with Brazilian dominance

Latin America has emerged as a significant player in the solar industry, driven by rapid growth in Brazil, Mexico, and Chile.

Annual solar installations in the fifteen largest Latin American countries in 2024 rose by +23% to 25.7 GW, adding to the growth rates of +64% in 2022 and +15% in 2023, according to BNEF. Solar growth in Latin America has exhibited a compound annual growth rate of +28% over the past five years.

Solar growth in Latin America is heavily concentrated in Brazil, which accounted for 74% of the region's solar installations in 2024. In 2024, Brazil ranked fourth globally in annual solar installations,

behind only China, the US, and India.

Brazil's solar installations in 2024 increased by +20% to 19.0 GW, showing a compound annual growth rate of +46% over the five years through 2024.

Chile was the second-largest Latin American solar player in 2024, with 1.8 GW of solar installations (+10% year-over-year), accounting for 9% of total Latin American installations. Chile's solar installations showed a compound annual growth rate of +38% over the last five years.

Colombia was the third-largest solar player in Latin America in 2024, with 1.8 GW of installations (+438% year-over-year), accounting for 6.9% of the region's total installations. Mexico was the fourth-largest solar player in 2024, with 1.6 GW of installations (-4% year-over-year), accounting for 6.4% of total Latin American installations.

Solar in Africa is set to rapidly expand, led by South Africa and Egypt

While solar energy is currently small in Africa, solar installations are set to expand rapidly in the coming years. There are approximately 600 million people in Africa who lack access to electricity, and most of the rest of Africa faces similar challenges, with electricity systems requiring significant expansion and improvement.

There is a significant deficit in energy investment in Africa, considering that Africa accounts for approximately 20% of the world's population but receives only 3% of the world's energy investment, according to the Global Solar Council (GSC).

Africa installed a total of 2.4 GW of solar in 2024, according to the "Africa Market Outlook for Solar PV, published by the GSC. South Africa accounted for the lion's share (46%) of Africa's installations, with 1.1 GW of installations,

The only other major solar player in Africa is Egypt, with 29% of African installations or 700 MW in 2024. None of the other countries in Africa in 2024 individually accounted for more than 4% (or 100 MW) of African installations.

It should be noted that the solar installation figures for Africa are likely understated, as many rooftop and smaller projects slip under the radar of research firms attempting to count installations.

Africa faces multiple obstacles to installing solar energy, including inadequate grid infrastructure, a lack of scalability, loan shedding issues, a three times higher cost of capital compared to developed countries, currency risks, and weak purchasing power for small-scale solutions, among others, according to GSC.

Despite these obstacles, GSC forecasts that African solar

SOLAR PV GROWTH OUTLOOK (CONTINUED)

installations will grow at a compound annual rate of +30% over the four-year period from 2024 to 2028. Specifically, GSC expects annual installations to increase nearly threefold to 6.9 GW in 2028 from 2.4 GW in 2024. Most of that growth is expected to come from utility-scale solar.

There is a strong political will in Africa to lean on solar energy as a means to enhance the electrical systems and infrastructure necessary for economic development and an improvement in the quality of life. GSC notes that African leaders set a target of 300 GW of renewable generation capacity by 2030 as part of the Nairobi Declaration issued in 2023. African leaders expect solar energy to account for a large proportion of the new electricity installations in the near future

SOLAR PV ANNUAL NEW INSTALLATIONS

New global solar PV installations in 2024 rose by +33% to a new record high of 592 gigawatts (GW), according to Bloomberg New Energy Finance (BNEF). That added to the strong growth rates of +76% in 2023 and +39% in 2022. Global solar installations grew at a compound annual rate of 38% over the five years from 2019 through 2024 and increased 33-fold since 2010.

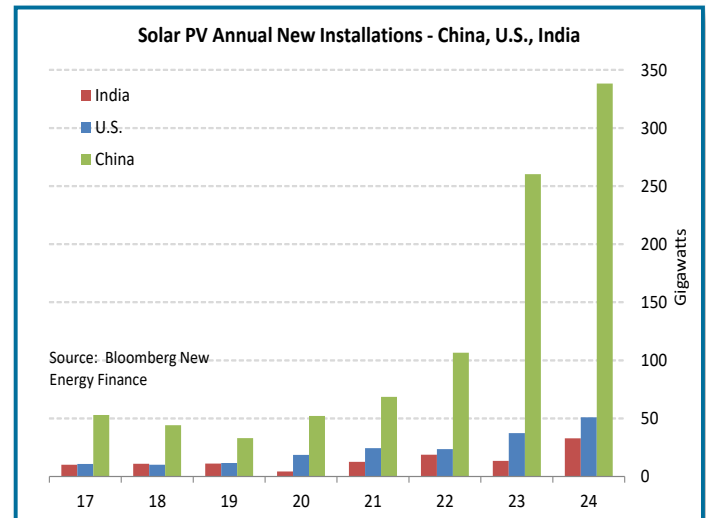
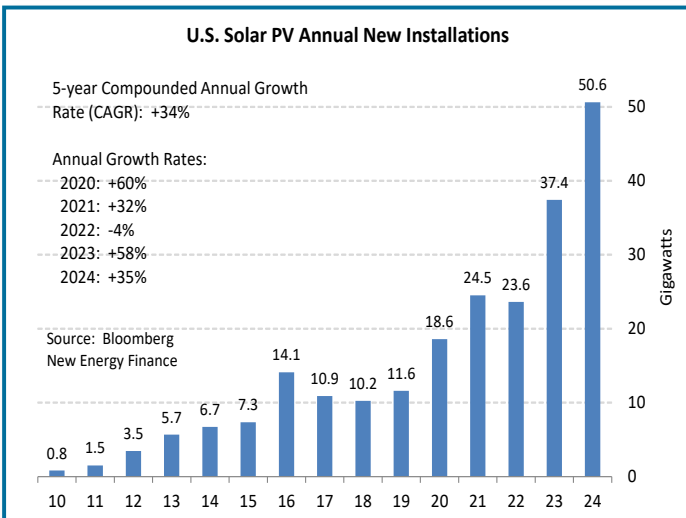
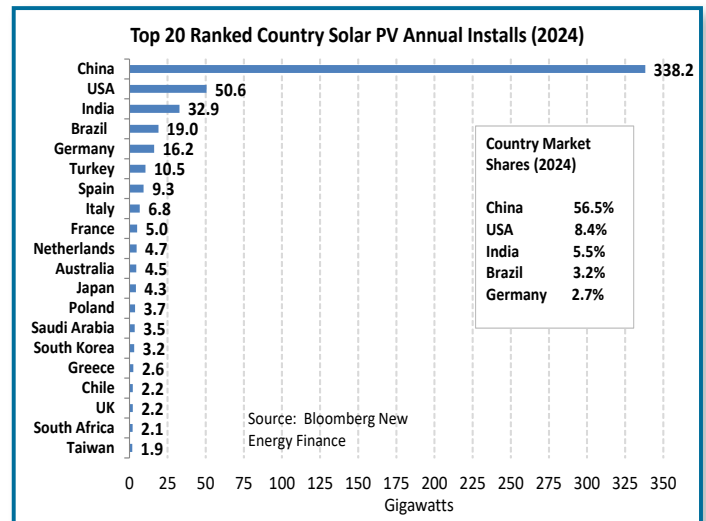
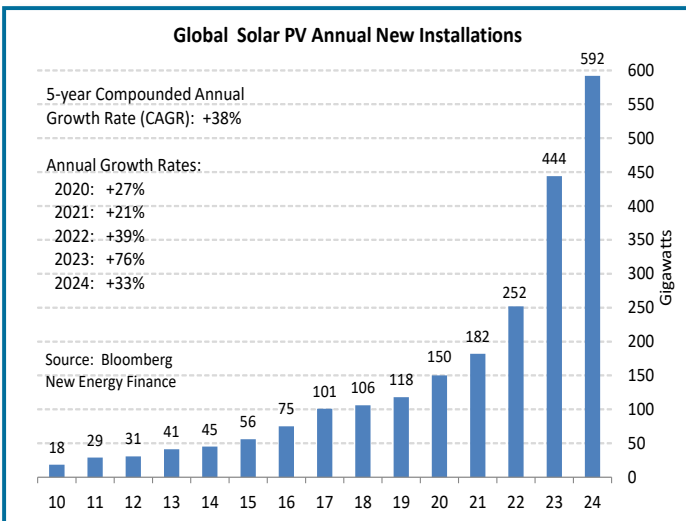
In 2024, China led the world in annual new solar installations for the twelfth consecutive year, with a record 338 GW of installations, representing a +30% year-over-year increase, according to BNEF. The US maintained its second-place position with 51 GW of installations, up 35% year-over-year. India rose to third place from fifth place with 32.9 GW of installations, up +143% year-over-year. Brazil fell to fourth place with 19.0 GW of installations, a +20% increase year-over-year. Germany fell to fifth place with 16.2 GW of installations, up +8% year-over-year.

In 2024, 24 countries had annual installations exceeding 1 GW, more than twice the ten such countries in 2018. That illustrates the

global spread of solar energy and the geographical diversification of the industry. Fitch forecasts that 36 nations will install more than 1 GW of solar by 2029.

Solar growth in Europe in 2024 grew by +4% year-over-year, slowing after the robust 5-year CAGR rate of +44% seen in the previous five years (2018-23). The European countries with the most solar installations were Germany with 16.2 GW, Spain (9.3 GW), Italy (6.8 GW), France (5.0 GW), the Netherlands (4.7 GW), and Poland (3.7 GW), according to BNEF.

US solar PV installations in 2024 rose by +35% to 50.6 GW from 37.4 GW in 2023. US installations grew at a compound annual rate of +34% over five years through 2024 and rose 61-fold from 2010, according to BNEF. The states with the largest number of new PV solar installations in 2024 were Texas with 11.6 GW (-1% year-over-year), California with 5.0 GW (-24% year-over-year), and Florida with 4.7 GW (+47% year-over-year), according to Wood Mackenzie.



SOLAR PV CUMULATIVE INSTALLATIONS

Cumulative solar electricity generation capacity across the world as of the end of 2024 grew by +36% year-over-year to 2.3 terawatts (TW), according to Bloomberg New Energy Finance (BNEF). Over the five years through 2024, global cumulative solar electricity generation capacity has increased by more than threefold, rising at a compound annual growth rate of +29%.

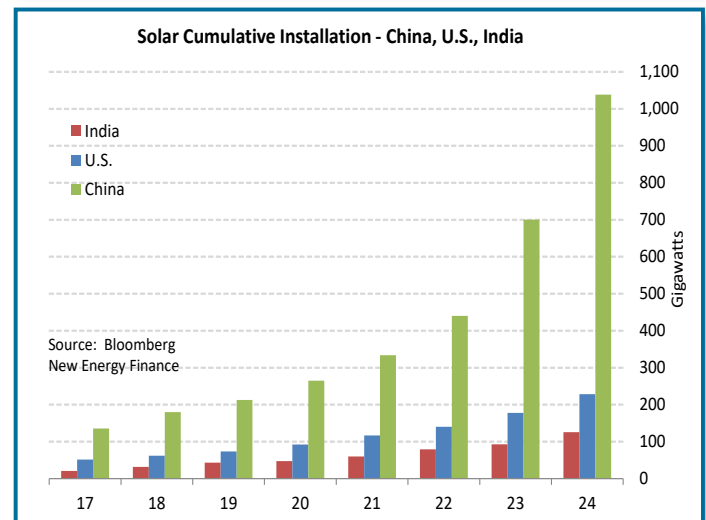
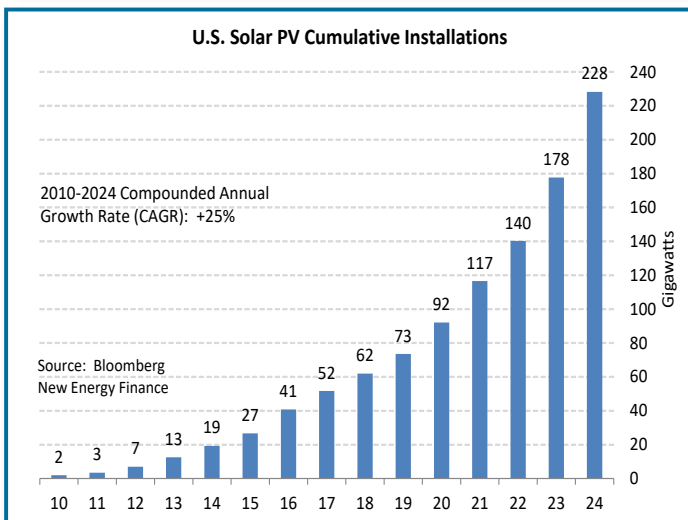
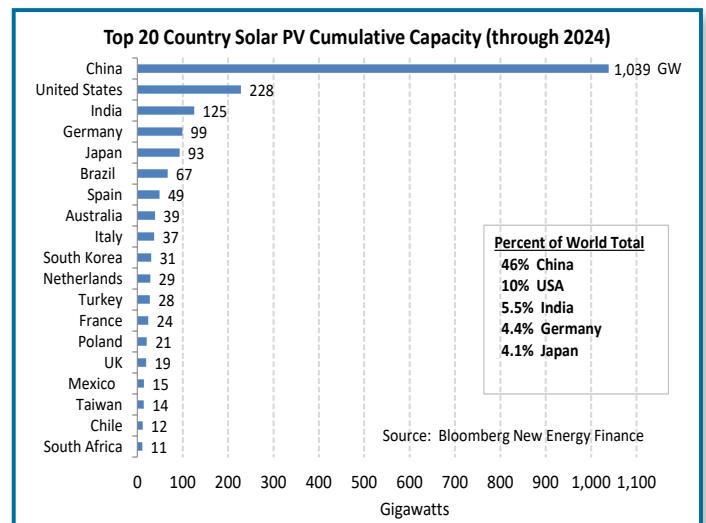
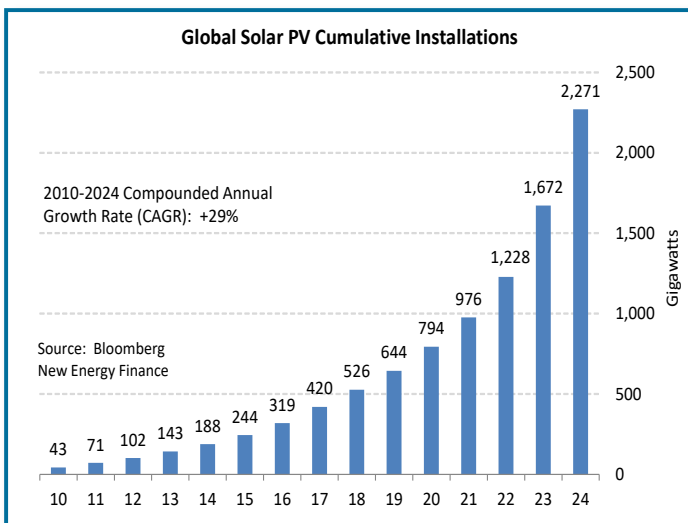
As of the end of 2024, China remained the world's leader in cumulative solar capacity at 1.0 TW, representing a +48% year-over-year increase, according to BNEF. As of the end of 2024, China accounted for 46% of the world's cumulative solar capacity. Over the past five years, China's cumulative installed solar capacity has nearly quintupled, exhibiting a compounded annual growth rate of +37%.

As of the end of 2024, the US remained in second place for cumulative solar capacity. US solar electricity capacity in 2024

rose by +29% year-over-year to 228 GW, representing 10% of world capacity. Over the past five years, cumulative US solar electricity capacity has increased by more than threefold, with a compound annual growth rate of +25%.

India remained in third place with 125 GW of cumulative solar capacity, representing a +36% year-over-year increase. Over the past five years, India's cumulative solar capacity has nearly tripled, showing a compound annual growth rate of +24%. As of the end of 2024, India accounted for 5.5% of the world's total solar capacity.

Germany rose from fifth to fourth place. Germany's cumulative solar capacity in 2024 rose by +20% to 99 GW, representing 4.4% of world capacity. Germany's cumulative solar capacity over the past five years has doubled and shown a compounded annual growth rate of +15%.



LEVELIZED COST OF SOLAR ELECTRICITY

Solar electricity's installation cost is significantly cheaper than fossil fuels and nuclear

The median levelized cost of electricity (LCOE) for newly-built US utility-scale solar PV plants as of June 2025 fell by -5% to \$58 per MWh from \$61 in 2024, according to Lazard's annual "Levelized Cost of Energy Report 18.0," released in June 2025. Lazard's survey of solar LCOE costs ranged from a low of \$38 per MWh to a high of \$78 per MWh.

Lazard's solar median LCOE of \$58 in 2025 was still well above the record low of \$36 seen in 2021. While solar module costs have decreased, overall solar installation costs remain elevated due to high interest rates and inflationary pressures on materials and labor. However, the other sources of electricity have seen similar cost increases due to these interest rate and inflation factors.

The Lazard LCOE figures are calculated with the assumption of no subsidies. Since there are still US tax subsidies for solar buyers through 2027, the actual costs of solar energy are lower than the figures mentioned above.

Solar's median LCOE of \$58 per MWh is substantially cheaper than the median LCOE costs of \$79 per MWh for natural gas, \$122 for coal, and \$181 for nuclear, and slightly below wind's LCOE of \$62. That illustrates the easy economic decision for utilities to choose solar or wind for new electricity plants, since those plants are cheaper to build than fossil fuel or nuclear power plants and can also be installed much more quickly.

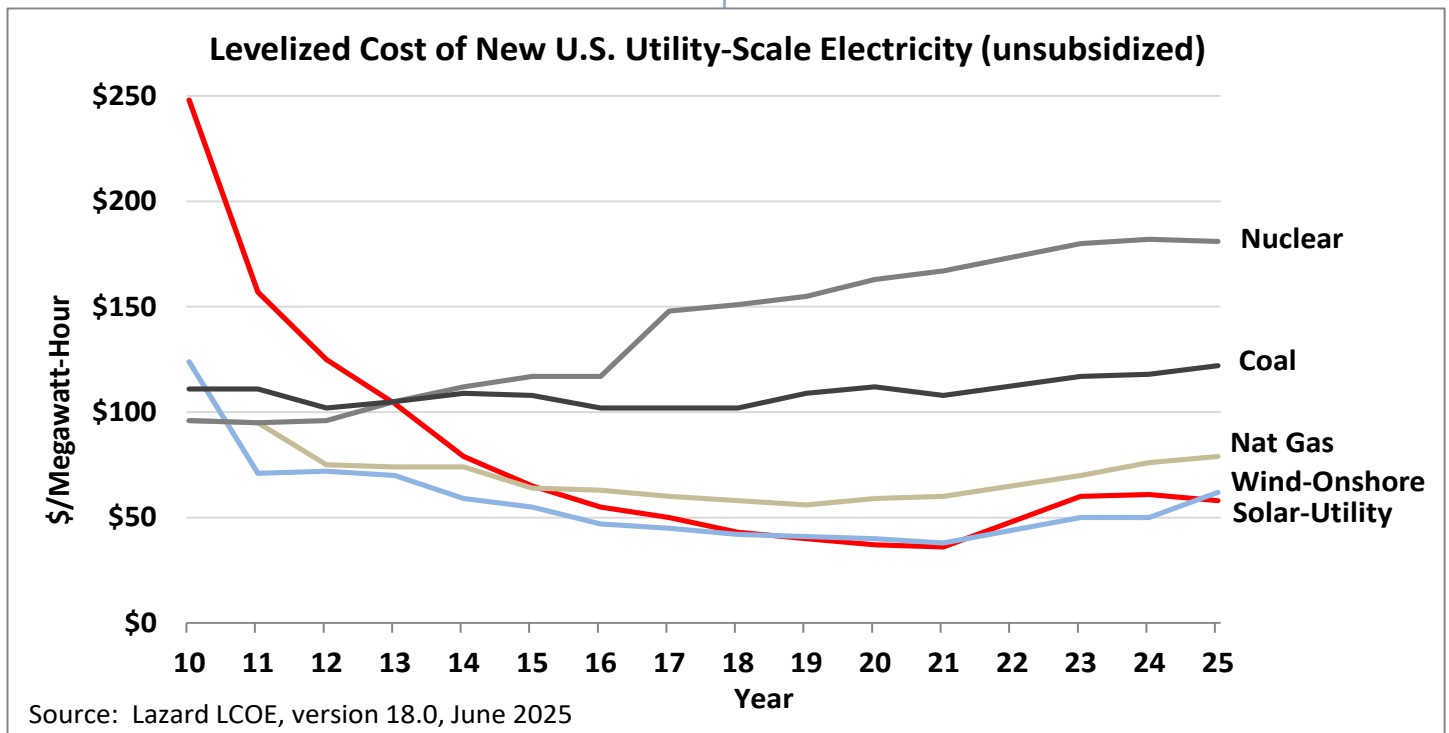
Moreover, the median LCOE cost of \$58 per MWh for building a new utility solar plant is below the Lazard median marginal cost for operating an existing coal plant of \$73, meaning it is cheaper to install a new solar plant than to run an existing coal plant.

Solar has big potential, not just to meet new electricity demand from data centers and electric vehicles, but also as a replacement technology, as many coal and nuclear plants are nearing the end of their useful lives. The average age of US coal plants is 43 years, and the average age of US nuclear plants is 42 years, according to data from the US Energy Information Administration. As coal and nuclear plants are retired, many utilities will decide to switch to building new solar and wind plants because they are less costly and quicker to build.

Solar is even more competitive globally. BNEF has calculated that the LCOE for global solar and wind is below \$40 per MWh, whereas new global coal and gas plants are at least double that cost.

BNEF also finds that it is cheaper to build a new solar plant than to operate an existing coal or gas plant in Europe, India, and Brazil. That means there is an economic incentive to scrap existing coal and gas plants in those areas and replace them with a solar plant.

BNEF reports that solar and wind are the cheapest form of electricity generation in 16 of the G-20 countries, i.e., all G-20 countries except for Indonesia, Russia, Saudi Arabia, and South Korea.



PRICING - SOLAR MODULES, CELLS, AND POLYSILICON

Solar module prices have recently moved sideways near record lows. The world price of standard monocrystalline silicon modules fell to a record low of 8.8 USD cents per watt in January 2025, but then stabilized and is currently slightly above that low at 8.9 cents, according to PV Infolink. Module prices have fallen by -1% year-over-year and by an overall -95% since 2010.

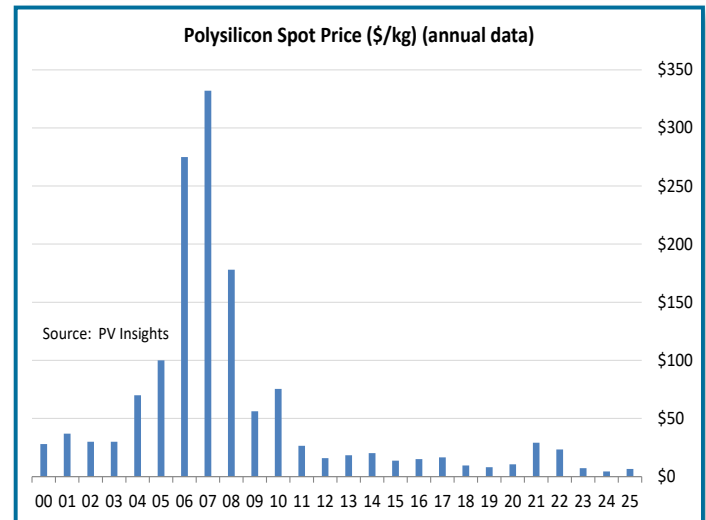
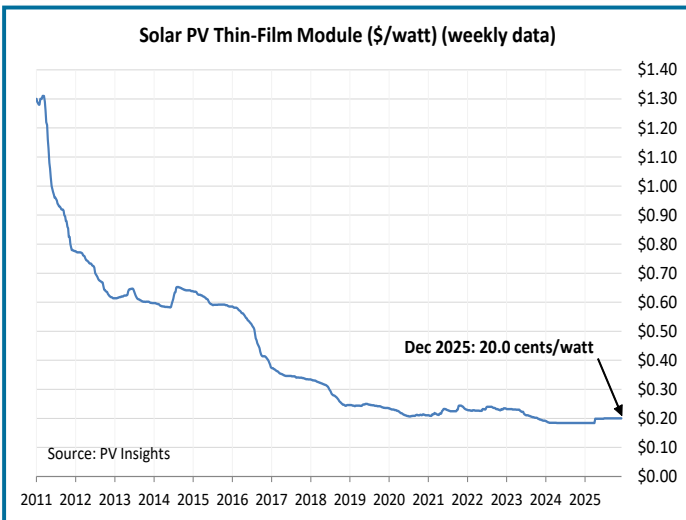
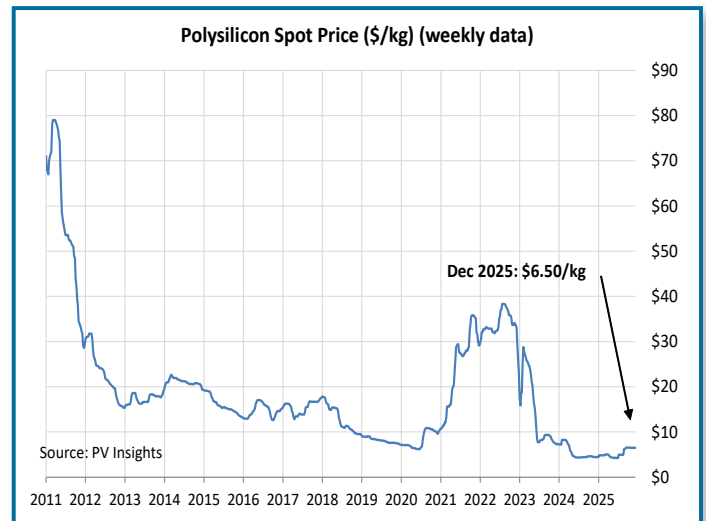
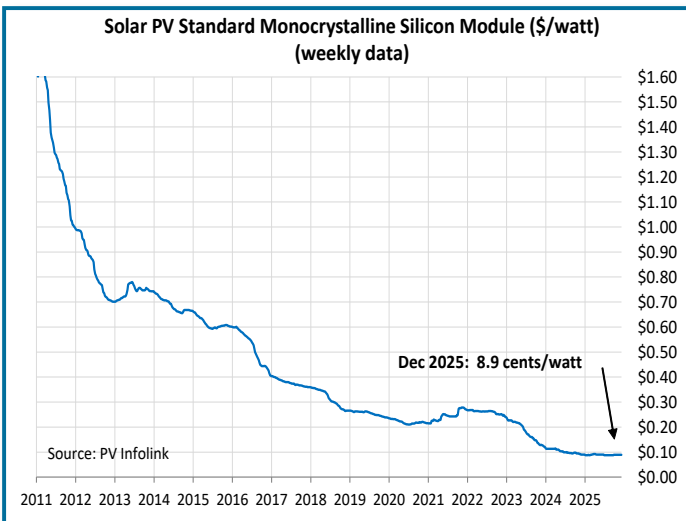
Meanwhile, the price of thin-film modules edged to a record low of 18.4 cents per watt in April 2024 but rebounded slightly to 20.0 cents in April 2025 and has since remained stable, according to PV Insights. Thin-film module prices are up +9% year-over-year, but are down by an overall -85% since 2010.

Solar module prices temporarily rose in 2021 due to strong demand, high polysilicon input prices, pandemic disruptions, higher costs for other materials, and high shipping costs. However, the long-term decline in module prices resumed in 2022-24 due to new production capacity coming online and long-term secular

factors such as technological advancements and manufacturing economies of scale. The decline in module prices should stimulate new demand and higher unit sales as solar becomes even more competitive relative to its competitors.

Spot polysilicon prices fell to a new record low of \$4.22 per kg in June 2025 but have since rebounded to \$6.50, according to PV Insights. Polysilicon prices are up +47% year-over-year, but are down by a total of -91% from the 2010 level.

Polysilicon prices rose sharply in 2021-22 due to strong demand and various supply disruptions, including fires, flooding, regional power rationing, and the avoidance of polysilicon from the Xinjiang province. Polysilicon prices then fell sharply in 2022-24 as a large amount of new polysilicon production capacity came online and various supply disruptions abated. Polysilicon prices have rebounded higher in 2025 due to supply-reduction efforts by Chinese polysilicon producers.



SOLAR JOBS

US solar jobs, as of December 2024, rose slightly by +0.2% to a record high of 280,119 jobs from 279,447 jobs in 2023, according to the latest "National Solar Jobs Census" published in November 2025 by the Interstate Renewable Energy Council (IREC). The report is available at www.SolarJobsCensus.org.

The report is based on IREC's analysis of a rigorous survey administered by BW Research for the US Department of Energy's United States Energy & Employment Report (USEER) 2024.

The US solar industry added 106,312 jobs to the US economy over the 10-year period from 2014 to 2024, representing a 61% increase and a compound annual growth rate of +5%.

Solar jobs resumed their steady rise in 2022-24 after the COVID-19 pandemic undercut job growth in the previous two years. However, solar jobs in 2025 are expected to fall after the Republicans repealed much of the IRA clean energy stimulus law.

Regarding the sector breakdown, the survey found that 64% of US solar jobs in 2024 were in installation and project management, 12% in manufacturing, 12% in wholesale trade and distribution, 8% in operations and maintenance (O&M), and 4.4% in a miscellaneous "all others" category.

The number of solar jobs in the US exceeds that in the fossil fuel industry. Specifically, the 280,119 jobs in the solar sector far exceeded the 123,000 direct jobs in the oil and gas extraction industry and the 41,800 direct jobs in the coal mining industry at the end of 2024, according to figures from the US Bureau of Labor Statistics (see chart on the right).

Globally, solar PV is a huge employer, with 7.1 million solar jobs worldwide at the end of 2023, soaring by +45% from 4.9 million at the end of 2022, according to the "Renewable Energy and Jobs -- Annual Review 2024" from the International Renewable Energy Agency (IRENA), which was published in October 2024.

China is far ahead of any other country in solar jobs, with a total of 4.6 million jobs in 2023, due to its large-scale installation and manufacturing of solar energy equipment, according to the IRENA report. Countries other than China and the US with significant solar employment included Europe, with 757,500 jobs; India, with 318,600 jobs; Brazil, with 264,000 jobs; and Japan, with 115,000 jobs, according to IRENA.

