Special Report

Solar’s Unstoppable Growth Story

aranca

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Contents

Solar Fundamentals and Demand Drivers

Demand for solar power comes from residential, commercial and farms, supported by policies

What is a Photovoltaic (PV) Cell?

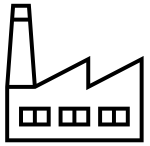
- A PV cell is a square slice of silicon. When sunlight strikes the silicon, it induces a voltage across the wafer.
- Almost all commercial PV cells are made from crystalline silicon (c-Si), which accounts for about 95% of the global market.
- Individual cells are wired in series (to raise voltage) and in parallel (to raise current). Most residential modules contain 60 cells, while commercial or utility panels often use 72 cells.
- A 60-cell module typically produces 250–300W and measures about 1.65m × 1.0m; 72-cell modules exceed 400W and are roughly 1.95m × 1.0m.

Demand Drivers

Residential rooftop

- Rising adoption as costs plummet and incentives such as net metering improve project economics.
- Falling panel and inverter prices have cut average installation costs by over 70% in the past decade, making solar competitive with retail electricity rates.

Commercial & industrial



- Corporations are signing long-term power purchase agreements (PPAs) to meet ambitious ESG goals and lock in fixed energy prices.
- Large rooftops, parking lot canopies, and brownfield sites at factories and warehouses offer prime real estate for high-capacity installations.

Utility-Scale Farms

- Record-low auction bids in regions such as the Middle East, India, and Latin America underscore the competitiveness of utility-scale solar.
- Gigawatt-scale projects harness economies of scale, driving energy costs to levels that undercut conventional power sources.

Regulatory Tailwinds

- Solar is benefiting from regulatory support such as the U.S. Inflation Reduction Act (IRA), Europe's REPowerEU plan, and China's 1.2 TW solar capacity target by 2030.
- The IRA has slashed financing costs and spurred domestic manufacturing of modules and inverters, while REPowerEU is accelerating the rollout of renewable projects.

Source: *The Economist: Sun Machines; SolarPower Europe; IEA (2024), Share of renewable electricity generation by technology, 2000-2030, IEA, Paris;*

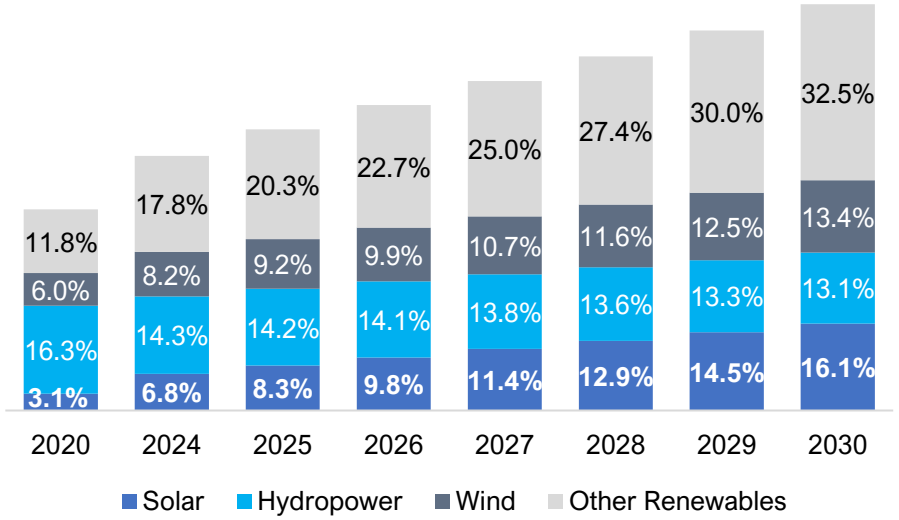
Robust Growth of Solar – Capacity

Solar PV market expected to grow at 22.7% annually through 2032

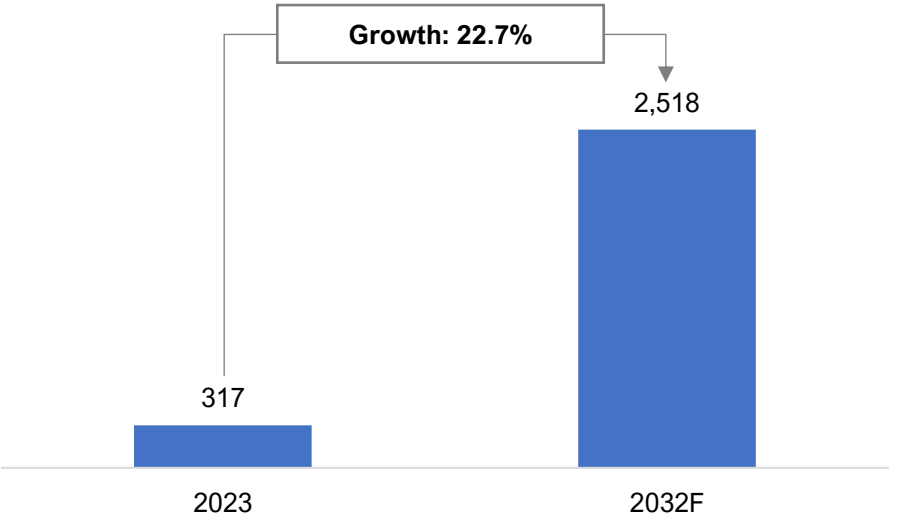
Explosive Demand

Time required to install 1 Gigawatt of Solar Power Capacity over the years:

Share of Solar energy is rising in total energy capacity:



Global Solar PV Market (USD bn)



- Solar capacity has grown at a breakneck speed. It is expected to surpass wind and hydropower capacity before the end of the decade, according to IEA forecasts.
- The IEA expects that this rapid growth will continue.
- Historically, as per Nat Bullard, **actual solar installations have surpassed IEA forecasts by 235%** so the growth could be significantly higher.
- The global solar PV market is expected to have a compound annual growth rate (CAGR) of 22.7% between 2023 and 2032.

Source: *The Economist: Sun Machines; Fortune Business Insights; IEA (2024), Share of renewable electricity generation by technology, 2000-2030, IEA, Paris.* ***Note:*** *F: Forecast*

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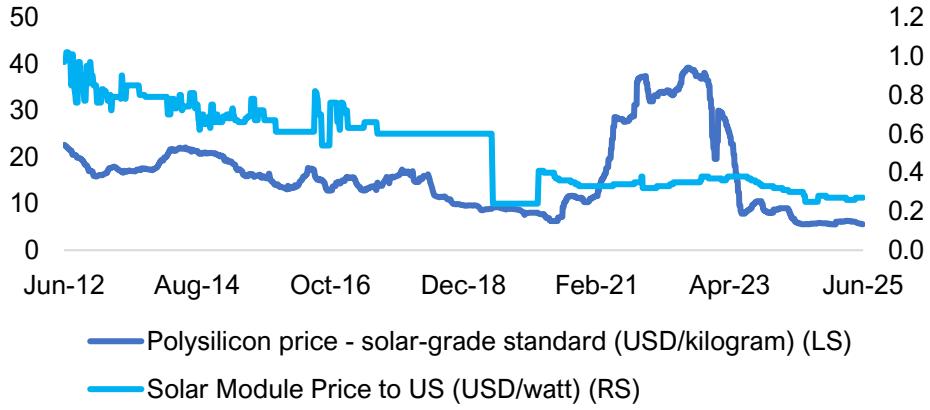
Robust Growth of Solar – Cost Efficiencies

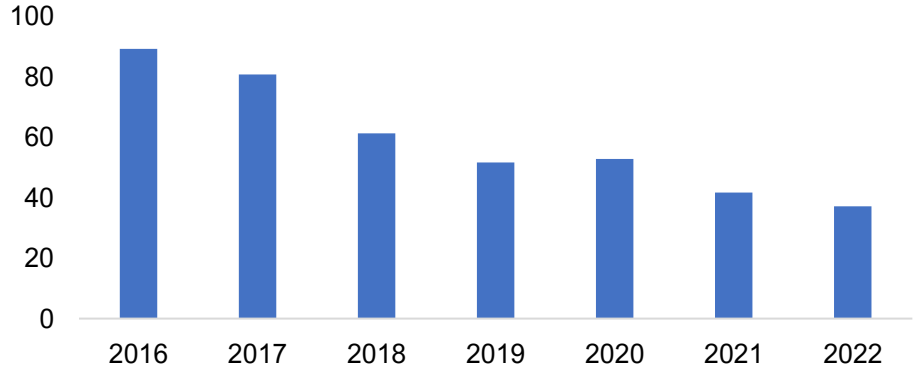
Declining costs and prices of components help drive demand

Costs Declining for Solar Components and for Auctions

Solar Components Prices



Solar PV Global Average Auction Price (USD/MWh)



- **Price Decline:** Solar project costs have declined significantly over the past decade, with polysilicon prices falling by 65% and solar module prices decreasing by 60%.
- **Auction Prices:** The declining costs have also led to a significant reduction in global average auction prices, which fell by 58% between 2016 and 2022. For example, in India, out of the auctions held in 2024, the cheapest tariff was INR 2.15/KWh (equivalent to USD 25/MWh), quoted by Waaree Group for a 170 MW solar project.
- **Rationale:** These price declines are attributed to technological innovations and improving economies of scale. Additionally, government subsidies have further reduced costs.

Challenges in the US

- **U.S. Policy Shift away from Renewables:** The new Republican administration is unwinding incentives for investing in renewable energy. As a result, stock prices of solar firms have declined this year. Furthermore, companies such as **Sunnova** and **Mosaic** have filed for bankruptcy amid policy uncertainty.
- That said, despite the rollback of friendly policies in the U.S., the prospects of the global solar industry remain strong, driven by continued economies of scale and the world's growing need for energy. Low cost of solar energy; high demand from data centers, driven by the AI theme; and long-term PPAs could continue to spur growth.

Source: *Bloomberg, IEA, MERCOM*

Emerging Trends

Energy storage and long-distance transmission to reduce supply-demand imbalances

The Problem: Demand Supply Imbalance

Solar power generation, being dependent on the sun, suffers from a critical drawback.

- Midday oversupply can drive wholesale prices below zero as solar farms dump excess generation.
- After sunset, solar output collapses to zero, creating steep evening demand spikes.
- The resulting “duck curve” imbalance strains grids with rapid ramp-up and ramp-down needs.

Solution 1: Energy Storage

- Lithium-ion batteries co-located with PV capture excess energy during sunny hours, then discharge after sunset, smoothing the supply curve.
- Advanced flow batteries and green-hydrogen plants, which convert excess electricity into hydrogen for later reconversion, are also gaining pilots in Europe and Asia. Lithium-ion batteries dominate new builds due to rapid response, high round-trip efficiency (c.85%), and modularity.
- Projects such as **Tesla**’s Hornsdale Power Reserve in South Australia (currently 150 MW) pioneered large-scale Battery Energy Storage Systems (BESS) in 2017, slashing ancillary-service costs and stabilizing the grid.
- **Fluence** has deployed 14.8 GWh as of December 2024 globally, including the 150 MW/150 MWh Hazelwood BESS in Victoria, Australia, which is Australia’s first coal-to-battery repowering.
- **LS Power**, via its REV Renewables platform, operates the largest non-utility energy-storage portfolio in the U.S., with 2.3 GW of combined lithium-ion battery (c.0.7 GW) and pumped-storage hydro (c.1.6 GW) capacity, providing firm, dispatchable power and critical grid services.
- Flow batteries, compressed-air energy storage, and green hydrogen are in pilot phases, targeting multi-day and seasonal storage.

Solution 2: Long-Distance Transmission

- Another way is to build long-distance transmission lines that can transport excess supply generated in one area to another with a supply shortage. Wide-area “supergrids” built with high-voltage direct-current (HVDC) lines shift power across time zones, exporting midday surpluses to regions still in darkness. Modern HVDC links lose as little as 1.6% per 1,000 km of transmission, enabling cost-effective bulk transfers.
- Projects such as Europe’s SuperSmart Grid and China’s UHV network aim to interconnect solar-rich deserts with distant demand centers, balancing generation and consumption on a continental scale.
- Formerly ABB’s Grid business, **Hitachi Energy** supplies converter stations and HVDC systems. In December 2024, it secured over €2 billion in contracts with Germany’s Amprion to build four 2GW converter stations, enabling bulk transfer of North Sea wind and solar energy to the Ruhr industrial region.
- **Siemens Energy** offers both Voltage-Source Converter (VSC) and classic HVDC technology. In late 2024 it partnered with a Latin American utility on a 3GW interconnection project and in Europe is active on offshore corridors integrating wind and solar farms.
- These companies’ technologies and projects are laying the groundwork for supergrids that can shift solar surpluses across regions and time zones.

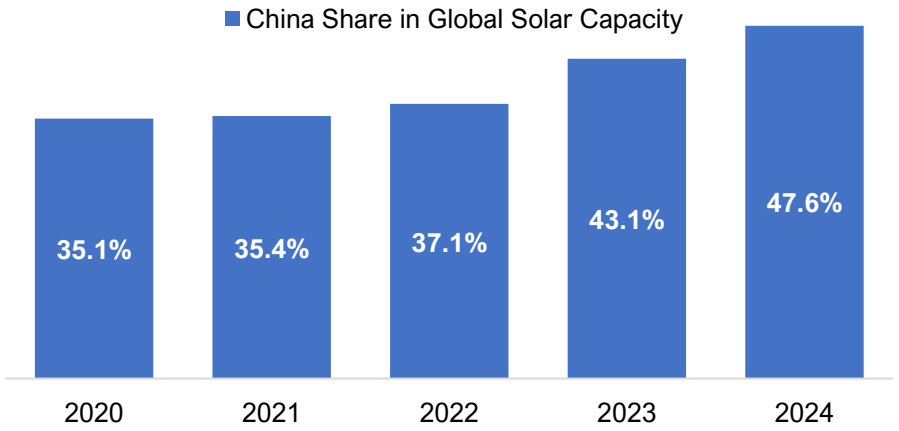
Source: *Company Filings*

Regional Dynamics – Emerging Markets Driving Growth

China dominates the solar market, while India seeks to establish a foothold

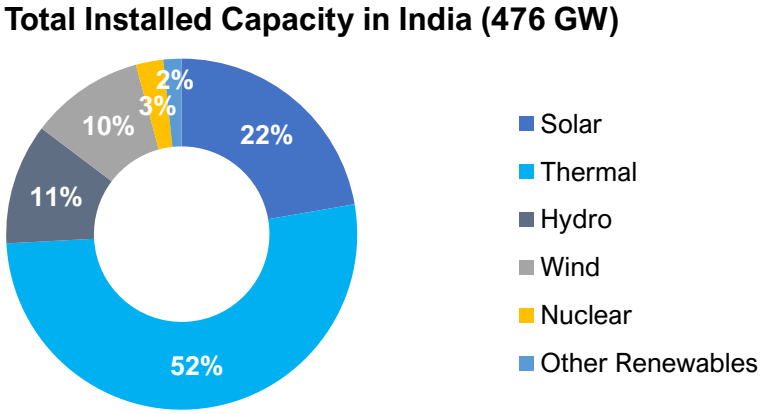
Chinese Dominance

- **High Market Share:** China dominates the world's solar market. In 2024, China had 47.6% of global solar capacity, and its share has been steadily rising. In 2023, Chinese companies made 93% of the world's polysilicon, a key material used to make solar cells. Four leading Chinese firms, viz. **JinkoSolar**, **Trina**, **LONGi** and **JA Solar**, together held c.70% of the global crystalline-silicon module market.
- **Reasons for Dominance:** This dominance can be attributed to the economies of scale and the country's cost-efficient manufacturing processes. Additionally, factors such as strong demand for clean energy, supported by friendly policies, are likely to help maintain the momentum.
- **Bankruptcies and Oversupply:** China's solar expansion, fueled by heavy leverage, has triggered insolvencies and significant losses. Historically, supply gluts have been quickly absorbed by surging demand. Given the sector's robust long-term growth outlook, today's overcapacity may be deployed swiftly.



Growth in India

- As per the Ministry of New and Renewable Energy, India's installed solar capacity reached 100 GW in January 2025, with solar constituting 22% of the country's total renewable energy capacity.
- The Pradhan Mantri Surya Ghar Muft Bijli Yojana commits ₹75 000 crore to support rooftop solar installations for 10 million households, offering 300 free electricity units/month and concessional loans via platforms such as **Tata Power Solar** and **Azure Power**.
- To spur domestic manufacturing, India levies safeguard duties on panels and promotes Tier-I module makers.
- **Adani Green Energy**, which builds and operates solar panels, has rights to build solar farms in Gujarat and Rajasthan. Each of these farms could have the capacity of 30GW of solar panels. The company targets achieving 50GW of renewable capacity by the end of the decade.



Source: *Power Technology, IRENA, MERCOM, The Economist: Sun Machines, Bloomberg, Tata Power Company Filing*

Solar Power

A High-Conviction, Long-Term Growth Story

⚡ Structural Tailwinds Driving Momentum

- Solar PV installations are growing at an annual rate of 22.7%, and capacity could overtake wind and hydropower capacity before 2030.
- Record-breaking capacity additions globally, led by China, India, US, and EU. solar's outlook stays strong, driven by sustained cost declines, surging AI-driven data-center demand, and long-term PPAs.
- Solar now the cheapest source of electricity in many markets (IEA)

💰 Investment Case Strengthening

- Strong policy backing (e.g. IRA in the US, PLI scheme in India, EU Green Deal)
- Accelerating capital inflows into solar infrastructure and supply chains
- Rising corporate PPAs and energy transition targets fueling demand certainty

🔄 Tech + Scale = Lower Costs

- Module and polysilicon costs have fallen by over 60% in the past decade. This cost-efficiency is making solar power increasingly competitive with traditional energy sources.
- Storage, grid, and smart solar tech creating new alpha opportunities
- Advances in battery storage and HVDC transmission are addressing solar's intermittency, enabling round-the-clock energy delivery and cross-regional grid balancing.

🧩 Portfolio Fit

- Aligns with ESG mandates, energy transition themes, and infrastructure alpha
- Offers exposure to high-growth, capital-efficient business models

2500+
Global clients

500+
Strong, professional team across multi-disciplinary domains

120+
Sectors and sub-sectors researched by our analysis

80+
Countries where we have delivered projects

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