



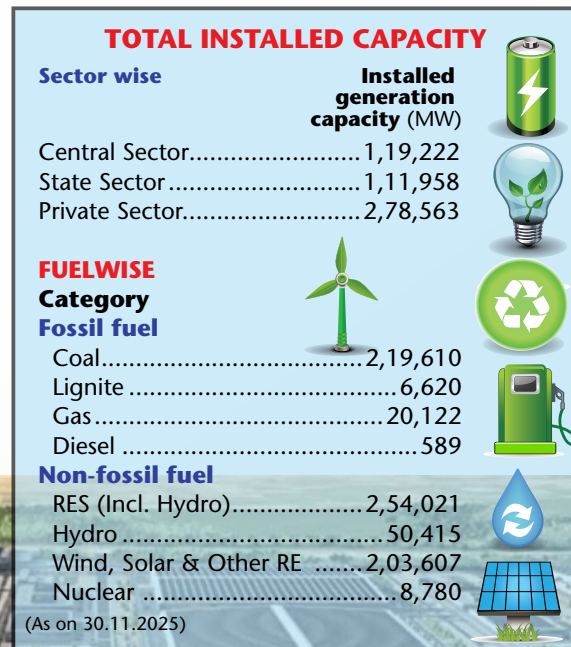
# ENERGY TRANSITION: A promising report card

## Clean energy begins to develop an edge in fresh capacity addition

Circa 2025 may have signed off after delivering the most satisfying statistical report card to stakeholders in the Indian renewable and even the larger energy space. The kind of capacity addition witnessed during the course of the calendar year has truly been unprecedented. In fact, the pace has been so rapid that the country has achieved a critical capacity-bound target much before the set deadline. As a result, India's positioning in the global renewable sweepstakes has attained its best-ever ranking – a bronze position on the podium in the combined solar and wind segments (next only to China and the US) – and further improvement in this ranking now almost seems guaranteed. “The capacity addition that we have seen in the recent past has exceeded my expectations,” comments Dr Ajay Mathur, former Director General of the International Solar Alliance (ISA). “What is happening right now can simply be dubbed a rally phase. Things remaining normal, I don't see any let-up in it till 2030,” adds Chintan Shah, Founder, SustCred and member of the advisory board of the Independent Power Producers Association of India (IPPAI).

The exuberance that engulfs the renewable energy fraternity today finds reflection in states such as Rajasthan, Gujarat, Maharashtra, Karnataka and Tamil Nadu. If you are driving on the highways of these states covering specific pockets, chances are you may catch a glimpse of a solar or wind park from a distance. Such sites have begun surfacing in other states too.

The story seems set to become larger and



Green Energy Project, Jamnagar



bolder. While further capacity addition, the quantitative factor, will continue to be the fulcrum, the medium-run journey of India's energy transition process will also include other components. These include renewable resources assuming a more comprehensive character; the creation of battery storage back-up systems at a very large scale, making round-the-clock power supply a reality; and the development of more robust transmission infrastructure that matches the growing capacity and results in easy and uncomplicated evacuation mechanisms. In the evolving energy transition narrative, developments on the fossil fuel side will also be equally important, particularly in terms of further scale-building. There are clear indications that coal-based electricity generation – the traditional mainstay – will continue to play a dominant role for a long time. Added to this is the emphasis on peripheral segments such as hydrogen gas, biogas, and nuclear energy, where momentum is expected to build following Parliament's recent nod to the SHANTI (Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India) Bill. There is also a policy-driven 'Make in India' intervention to build components locally.

The long and short of it is that the energy mix cauldron is set to witness considerable churn as India's largest sector, in capex terms, races ahead with expansion and consolidation on multiple fronts. "As per an estimate, the total capex in India's energy sector in the calendar year 2025 alone was a staggering ₹3.5 lakh crore. Tell me, in which other sector will you find this kind of capex play currently? The sector is going to maintain a similar capex trajectory over the next 3-4 years," says Shah.

### The transition journey

"India is witnessing energy transition at a scale unmatched globally. Capacity additions since 2014 show the pace of change. Solar power capacity has grown from less than 33 GW in 2014 to 128 GW today. Wind capacity has increased from about 21 GW to 54 GW, with another 30 GW in the pipeline. India's total non-fossil fuel capacity has reached 257 GW. International delegations frequently express disbelief at the scale of installations until they observe projects across states," Union Minister for New and Renewable Energy Pralhad Joshi commented at a function recently. "India has also achieved its goal of generating 50 per cent of its electricity from non-fossil sources 5 years ahead of the 2030 target. This progress reflects the combined strength of policy, industry participation and long-term planning in renewable energy," he added.

Few dispute Joshi's claim of energy transition at an "unprecedented scale". The previous year saw several other moments of achievement in India's energy transition journey. On 29 July, for instance,



the country reached its highest-ever renewable energy share in electricity generation, as renewables met 51.5 per cent of the country's total electricity demand of 203 GW. Official data from the Central Electricity Authority (CEA) on installed generation capacity as of the end of November 2025 further amplifies this transformation. The total installed capacity stood at (see graph) 509 GW. Of this, the share of fossil fuels was reported at 48.4 per cent, with coal as the main driver at a hefty 43.1 per cent share of the total installed capacity. The share of non-fossil fuel sources had crossed the halfway mark, standing at 51.6 per cent. The main contributors – solar, wind and hydro – accounted for 26.1 per cent, 10.6 per cent and 9.9 per cent respectively. By contrast, the share of renewables at the end of 2024 was reported at 45.3 per cent. Growth in 2025, therefore, followed a quantum leap trajectory.

"India's energy transition has clearly moved from policy intent to on-ground execution. Sustained capacity addition, policy continuity, and strong investor interest indicate that the direction is well established. Renewable energy capacity has crossed 266 GW, with solar and wind together exceeding 190 GW, placing India among the leading clean-energy markets globally," says Rajiv Ranjan Mishra, MD, Apraava Energy, which currently has an operational portfolio of 1.5 GW with another 1 GW under development. "India's energy transition is among the fastest evolving globally. Government initiatives such as the National Solar Mission, wind policy support, and targets like 500 GW of renewable capacity by 2030 have created a strong policy backbone," says Parag Sharma, CEO, Zelestra India.

Those closely associated with the sector over the past few decades go so far as to describe it as an amazing, even incredible, story. A brief background helps place this in context. Around 2010, renewable capacity stood at close to 18 GW, with a dominant contribution of 13 GW from wind energy. "At that point in time, solar was viewed more as a fad. But from there to now – to a



India is witnessing energy transition at a scale unmatched globally

**Pralhad Joshi**  
Union Minister  
New and  
Renewable Energy



trajectory of over 200 GW – the story has assumed epic proportions,” points out Vinay Rustagi, President of Premier Energies, who founded the solar industry think tank Bridge to India around 2010 and spearheaded it until recently.

Wind energy, which was initiated in the country in the 1980s, had gradually taken on the role of a supplementary contributor. As senior industry stakeholders note, the scene began to change with the unveiling of the National Solar Mission in 2009. In the same year, Gujarat, under the stewardship of the then chief minister and now India's Prime Minister Narendra Modi, set the ball rolling for large-scale solar projects through a dedicated policy, the first state in the country to do so, which introduced a competitive bidding mechanism. Subsequently, viability gap funding (VGF) and other forms of subsidy came into play to encourage new entrants.

It was only around the middle of the last decade, however, that the sector began showing the first signs of a major take-off, following the newly elected NDA government's announcement of the solar park and ultra-mega power project schemes. These were initially set up with a target of achieving 20,000 MW, which was doubled at a later stage. Around the same time, an external factor also came into play. There was a steep decline in solar module manufacturing costs in China, which had already taken the driver's seat in global supply after beginning large-scale production a decade earlier. This encouraged players in India, who were then almost entirely dependent on China for modules: a dependency that still remains to a considerable extent. “This, coupled with the decision to waive inter-state transmission charges, really acted as a catalyst and gave a major boost to solar production. Since then, we have seen rapid scaling up,” Rustagi explains.

### Changing complexion

In recent years, particularly after the Covid crisis, the complexion of the renewable game has changed significantly, driven by stronger policy interventions. These include the ₹24,000 crore

PLI scheme for solar module manufacturing, and the announcement of the LPS (late payment surcharge) scheme under the Electricity Rules, 2022, which made it mandatory for discoms to pay within the stipulated timeframe or bear penalties. “This has been a major initiative which came as a shot in the arm for serious players,” Shah points out. The government has also introduced a strong ‘Make in India’ element to ensure that local capabilities are developed domestically in component manufacturing.

For instance, it has now been made mandatory for module manufacturers to either set up their own cell manufacturing units or source from domestic manufacturers, many of whom have begun setting up operations in the country at a rapid pace. “By making domestic cell manufacturing mandatory, India is sending a clear signal: solar manufacturing can no longer be about assembling components; it must be about owning the technology curve. Manufacturers with older technologies, limited scale, and no backward integration will find it increasingly difficult to survive,” comments Prashant Mathur, CEO, Saatvik Solar. Privately, however, many developers are complaining about the higher costs they have begun to bear owing to the shift towards local procurement.

Another critical trend that has emerged is the gradual exit of plain vanilla projects. There is a broader understanding that standalone solar or wind projects do not make a strong business case in the long run due to the challenge of intermittency: the inability to produce power on a consistent basis. Consequently, the clarion call now is for hybrid projects. Preferences are clearly tilted in favour of WASH (wind and solar hybrid) or FDRE (firm and dispatchable renewable energy) projects. “Beyond capacity additions, what is particularly encouraging is the increasing adoption of round-the-clock renewable supply by commercial and industrial consumers. Companies are actively seeking private renewable power solutions for reliability, cost predictability, and sustainability, which is accelerating the transition and demonstrating strong market-driven momentum,” comments Akshay Hiranandani, CEO, Serentica Renewables.

The emphasis on a solar-wind mix is also signalling a revival in capacity addition in wind energy. India's tryst with renewables may have begun with wind, but in the latter part of the last decade, when scale-building gained momentum, solar stole a march, as the ability to extract energy from wind sources is restricted to four to five states, largely coastal. Wind is now on a serious comeback trail, thanks to the round-the-clock or hybrid model, where developers maximise sunshine during the day and windy conditions after evening hours.

The apex global body of wind power developers,



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**Dr Ajay Mathur**  
Former Director General  
International Solar Alliance



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MD, Aprava Energy



*Earlier, solar was viewed more as a fad. But from there to now – to a trajectory of over 200 GW – the story has assumed epic proportions*

**Vinay Rustagi**  
President  
Premier Energies

the Global Wind Energy Council (with members in 80 countries), released a report in New Delhi last year titled 'Wind at the Core: Driving India's Green Ambitions and International Influence', predicting India's wind energy capacity would jump to 107 GW by 2030, from 53 GW currently. The council's report confirmed that India is now the third-largest wind energy manufacturing hub in the world. It also highlighted wind as a hugely untapped resource in the country: against a potential of 1,164 GW, only 4.5 per cent has been utilised so far. "Scaling India's wind capacity to over 100 GW by 2030 can unlock economic growth, manufacturing expansion, and wider energy access," said Ben Backwell, CEO of the Global Wind Energy Council.

Speaking at the same event, Santosh Kumar Sarangi, Secretary, Ministry of New and Renewable Energy, asserted that his ministry is committed to efficiently tapping this least-cost energy option. "We have a pipeline of 30 GW for wind energy in the next few years," he said. "Even with a conservative approach, we will reach 85 GW by 2030. With a little facilitation, we can easily reach 107 GW." Industry players confirm that the segment is bouncing back commendably. "India's wind energy sector is currently undergoing a phase of renewed momentum, charting the country's path towards a reliable, affordable, and clean energy future – thanks to significant technological leaps, strategic hybridisation, and favourable policy support," opines Devansh Jain, Executive Director, INOXGFL Group.

The most critical element, however, is the addition of battery storage to generation, bringing optimal efficiency to the value chain with round-the-clock or power-on-demand delivery capabilities. While this has pushed up capex, falling storage battery prices have emerged as a major cushion. "Integrating battery storage does increase the upfront costs of renewable power generation because it adds capital expenses on top of the cost of solar or wind farms. However, recent trends show that storage costs are falling rapidly in India, narrowing the cost gap with generation and improving overall economics," says Simarpreet Singh, CEO, Hartek Group. He points out that tariffs for battery energy storage systems (BESS) in India have dropped from about ₹10.18 per kWh in 2022-23 to around ₹2.1 per kWh in recent competitive bids – close to average solar tariffs – making storage far more affordable than before.

A spate of policy interventions has been introduced to encourage the adoption of battery storage at the plant level. These include a CEA advisory on co-locating ESS with solar projects, extension of ISTS charge waivers for BESS and PSP projects until June 2028, the introduction of a second tranche of the VGF scheme through the Power Sector Development Fund (PSDF), and amendments to the VGF



scheme mandating minimum local content of 20 per cent of total project cost, along with localised EMS (energy management system) software in BESS projects. In addition, most central and state utilities have now made storage back-up a mandatory component in their tenders.

"In 2025, we have seen another major trend. For the first time, the cost of battery-storage-backed renewable production has fallen below the settled price of a new thermal project. This is significant," Mathur points out. According to analysis, the average bidding price of renewable projects with storage currently ranges between ₹3.30 and ₹5.10 per kWh. In contrast, the average bidding price for new thermal units, as seen in recent tenders, has hovered between ₹5.78 and ₹6.08 per kWh.

According to a recent report by the India Energy Storage Alliance, 2025 was a landmark year for India's energy storage sector, as a significant number of BESS tenders were issued by various renewable energy implementing agencies (REIAs) across states, with projects progressing from planning to execution. During the year, five new BESS projects with a cumulative capacity of 575 MWh were commissioned. The government had earlier issued an advisory recommending the inclusion of ESS equivalent to at least 10 per cent of installed capacity in all future solar projects. In line with this direction, agencies such as SECI, NHPC, and NTPC issued multiple solar tenders integrated with ESS during the year. Additionally, 65 tenders were issued with a total capacity of over 58.5 GWh. These included 43 standalone BESS tenders, 16 solar-plus-BESS tenders, and six FDRE tenders.

In terms of geographical spread, the renewed momentum in the renewable space remains concentrated in a cluster of five to six states, even as others are making efforts to establish a presence. Analysts point to a critical strategic reason behind this concentration. "Rajasthan, Gujarat, Maharashtra, Karnataka, and Tamil Nadu are the major theatres of the current capacity-building exercise. Barring Rajasthan, all are leading industrial states and, therefore, a substantial portion of the increased production can be absorbed locally.



Developers are flocking to Rajasthan because it has vast tracts of wasteland and it is relatively easy to execute projects there,” points out Chintan Shah. Rajasthan leads the pack with nearly 42 GW of installed capacity, followed closely by Gujarat (41 GW), Maharashtra (28 GW), Karnataka (25 GW), and Tamil Nadu (over 26 GW)

### Thermal and other segments

There is no denying the fact that India’s renewable emphasis over the last decade, and the resulting outcomes, have drawn plaudits from global quarters. Quickly reaching a podium position after breaking into the top three markets is a feat appreciated by many. However, there is one critical point that has caused eyebrows to be raised among analysts in the developed world – the continued harnessing of coal resources for power generation. China recently announced that renewable generation has eclipsed its thermal output. “While renewables in India are growing by leaps and bounds, more action in expeditiously reducing thermal-based power is certainly an imperative from an environmental point of view. In the West, especially in Europe, countries are phasing them out with strict timelines attached, and even a large country like China has taken that route,” says Jan Haizmann, CEO, Correggio Consulting and Secretary General (CEO) of the Zero Emissions Traders Alliance (ZETA) in the UAE.

From the government’s side, however, the message is clear. While the country is moving full throttle towards ramping up renewables and

making them the main driver of India’s energy demand in the foreseeable future, it will simultaneously continue to focus on harnessing coal-based power generation. Although fresh infusion of thermal power into the nation’s total installed capacity has been relatively low compared with renewable sources, a significant number of new projects were awarded during the past year. According to the year-end review note of the Ministry of Power for 2025, “13.32 GW of new coal-based thermal capacity has been awarded in FY 2025-26 (till 30.11.2025). Further, 7.21 GW capacity has been commissioned in FY 2025-26 (till 30.11.2025). The total installed capacity of coal- and lignite-based thermal plants now stands at 226.23 GW. An additional 40.35 GW of capacity is under construction, with 7.03 GW expected to be commissioned in FY 2025-26. A further 24.02 GW of capacity is in various stages of planning, clearances, and bidding”. Some of the large-scale thermal projects awarded during the year went to Adani, JSW, and NTPC.

Along with coal, the government is also focused on ensuring the availability of oil to meet demand, which is projected to grow at a CAGR of 4.59 per cent in the coming years. India’s crude oil consumption is expected to rise to around 500 million tonnes by FY40 from 220 million tonnes in FY23. This leaves little room for complacency in efforts to boost domestic production, even as prolonged geopolitical turbulence could create short-term challenges. There is also pressure to significantly expand installed refinery capacity from 258 million tonnes last year to around 450-500 million tonnes by 2030. Both public and private sector majors have drawn up substantial capex plans to meet this challenge.

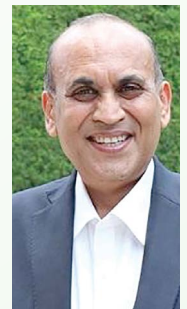
When it comes to gas-based power plants, the segment has not met with much success. As per records, the Central Electricity Authority under the Ministry of Power is monitoring 62 gas-based power stations with a cumulative capacity of nearly 24 GW. However, due to lower availability of natural gas from domestic sources and the high cost of imported LNG, many of these plants have failed to operate effectively, with a majority effectively turning into non-performing assets. “When it comes to power generation, I don’t think the government is viewing gas-based power production as a convenient and viable option now that it has developed expertise in harnessing renewables,” says an analyst.

There are also segments that industry insiders currently describe as peripheral, but which are expected to play an important role in the evolving energy mix over the medium to long term. Green hydrogen clearly tops this priority list. With a dedicated National Green Hydrogen Mission (NGHM), the country has signalled its intention to become a global hub in this segment over the next decade. The first milestone for green hydrogen production



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has been set at 5 MMT of annual output by 2030, and a spate of pilot projects has been initiated, primarily in transport and city gas distribution. Leading industry body CII has recently urged the government to declare clear green hydrogen mandates to gradually scale up demand and usage, and to introduce blending in sectors such as refining, fertilisers, and natural gas, supported by cost-off-set mechanisms. “The next level of development will come with important technologies like green hydrogen being promoted,” comments Chandrajit Banerjee, Director General, CII.

Meanwhile, segments such as biogas continue to account for only a small share of the overall energy picture, even as leading players have begun to explore and position themselves for its expansion. “Several challenges persist – for example, scaling up the sector requires significant capital and high initial operating costs. Securing affordable financing is essential, along with establishing reliable, year-round feedstock supply chains and viable markets for organic fertiliser,” says Gaurav Kedia, Chairman, Indian Biogas Association.

The recent clearance of the Sustained Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Bill, allowing private sector participation, is being viewed as a major push for a segment that has historically operated under strict restrictions. “At present, India’s installed nuclear power capacity is about 8.2-8.9 GW, contributing roughly 2-3 per cent of the country’s power mix. The government has already approved projects that will take this figure to 13 GW by 2029-30 and 22.5 GW by 2032. Looking further ahead, the Nuclear Energy Mission envisions 100 GW of nuclear capacity by 2047 – more than ten times today’s level,” comments Dr GM Gupta, Founder and Chairman, Global Engineers. Dr Gupta has designed and manufactured several types of pilot plants for the Bhabha Atomic Research Centre (BARC) and played a key role in manufacturing and installing the Fast Breeder Reactor at NPCIL Kalpakkam.

The biggest advantage of nuclear power projects is their long operational life of 40-60 years. However, how the new Bill translates into on-ground implementation, given the sector’s sensitive history, and the extent to which increased private participation materialises, will be closely watched in the years ahead.

### **The lineup and future scenario**

So, the equation for energy transition, as one analyst points out, appears fairly clear: while traditional resources will continue to be tapped, there will be an increasing inclination to push renewables to the forefront, alongside efforts to move peripheral elements into more prominent roles. In the near to medium term, incremental demand is expected to make the landscape more



action-packed. “We are expecting good GDP numbers, our manufacturing profile is improving, and the country is also becoming a hub for large-scale data centres – all these factors will ensure that energy demand continues to grow,” points out Ankit Jain, Vice President and Co Group Head, ICRA.

According to Chintan Shah, renewables will remain at the fulcrum of future activity, with the current lineup well positioned in the marketplace. “There are over 100 active players in the space. At the first stage, you have integrated players such as Tata and Adani covering the entire spectrum. Then there are players backed by financial investors, and now Indian corporate players like JSW, RPG, Sterlite, Apollo, and others have also entered the fray. Considering the potential, they have decided to board the bandwagon. In the future, they can make more aggressive moves and scale up through acquisitions,” he says.

There are also PSUs that have drawn up large capex plans to build strength in future energy segments. Thermal power giant NTPC is pursuing an ambitious renewable portfolio through its wholly owned subsidiary, NTPC Green. “NTPC currently operates over 85 GW of installed capacity, with 32 GW under construction, and has set a target to scale up to 149 GW, including 60 GW of renewable energy capacity, by 2032, and further to 244 GW by 2037. The roadmap envisages a capital expenditure of approximately ₹7 lakh crore, with expansion plans across energy storage systems, pumped storage projects, nuclear power, green hydrogen,



and chemicals,” a recent company media release stated.

ONGC is pursuing a green plan that entails achieving 10 GW of renewable energy capacity by 2030, comprising solar, wind, green hydrogen, and biofuels. IOC, as part of its future expansion strategy, is targeting a large-scale renewable portfolio, aiming to derive around a fourth of its revenue from alternative sources over the next 5 years. Private sector majors such as Adani, Reliance, and Tata Power have similarly aggressive plans for expanding their energy transition businesses. Among other initiatives, Reliance is targeting 3 million tonnes of hydrogen capacity by 2032. Tata Power has announced plans to spend 60 per cent of its ₹1.46 lakh crore planned capex to enhance its renewable capacity to 23 GW. Last September, the Adani Group announced a staggering \$60 billion war chest to ramp up its energy generation – including 50 GW of renewable capacity by 2030 – and transmission businesses. It is also India’s largest private-sector thermal power player, with plans to scale capacity to 41 GW by 2032.

Mid-tier and emerging players are equally bullish, seeking to push the envelope on the back of their growing capabilities. “In the near term, the company is targeting 3.5 GW of operating renewable capacity by FY 26, supported by a diversified pipeline of solar, wind, and hybrid projects. Looking ahead, Serentica plans to scale its portfolio to 17 GW by 2030,” says Hiranandani. “In generation, we are prioritising hybrid and storage-linked assets, participation in FDRE auctions, and selective exposure to market-linked opportunities. We continue to see strong opportunity in transmission, which remains essential for renewable integration, and in smart metering and digital solutions, which improve efficiency, transparency, and service quality,” adds Rajiv Ranjan Mishra of Apraava Energy, outlining the company’s near-term strategy.

For players in the fray, much of this confidence also stems from a more robust financial regime.

“India’s energy financing ecosystem today is far more diversified and mature than it was a decade ago. Government-led capital mobilisation has played a catalytic role. Domestic financial institutions continue to remain the backbone of energy funding,” points out Jyoti Prakash Gadia, Managing Director, Resurgent India.

On the immediate challenge front, however, there is broad agreement that transmission infrastructure development is not keeping pace with rising generation. Renewable contribution to the grid, therefore, remains in the range of 25-30 per cent. “I think the next 3 years will be critical, during which I expect greater emphasis on improving transmission,” Shah underlines.

As 2026 begins after a strong performance in the previous year that confirmed India’s energy transition is in fine fettle, some research agencies are projecting a possible slowdown in capacity addition. “Multiple indicators suggest India could face a glut in solar modules and renewable power supply in 2026. This is driven by aggressive domestic manufacturing expansion, ambitious renewable targets, and uneven demand absorption by the grid. If the pace of the previous year continues, supply could outstrip grid integration capacity. Transmission bottlenecks and curtailment risks mean renewable generation may exceed what the grid can absorb, creating a ‘power glut,’” points out Pankaj Sharma, Founder and Managing Director, K2Infragen.

This trend, however, is expected to play out more prominently in China, and many observers view it as a cyclical irritant. At the same time, a contrarian projection has emerged at the start of the new year. According to a forecast by BloombergNEF (BNEF), India is poised to overtake the US as the world’s second-largest solar market in 2026. For India, this could mean exchanging bronze for silver this year.

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