



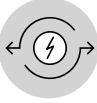
# India Transition Factbook 2026

Oct. 13, 2026

Bloomberg  
Philanthropies

BloombergNEF

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# About this report

India's size, rapid economic growth and rising energy demand place it at the center of global efforts toward lower-carbon energy sources. The country also has a major energy security imperative to reduce its reliance on imported oil and crude products. These dual goals – expanding clean energy and cutting fossil fuel imports – are today not only consistent but more economically viable than ever.

This Factbook, produced by BloombergNEF and commissioned by Bloomberg Philanthropies, profiles India's progress in expanding renewable energy deployment, increasing electric vehicle adoption, commissioning clean ammonia plants and taking other steps to green its economy. It also tracks the country's progress on decarbonization while examining new, rapidly growing sources of energy demand, including data centers.

Using BloombergNEF's long-term modeling, the report looks to 2035 and beyond to assess India's trajectory toward meeting its long-term energy and climate goals. The country can achieve major gains by leveraging the improved cost competitiveness of renewables, batteries and EVs. The Factbook also highlights lessons from India's experience for other countries and opportunities where further efforts could accelerate India's clean energy deployment while strengthening energy security.

**60%**

Projected share of non-fossil fuel capacity on India's power grid by 2028

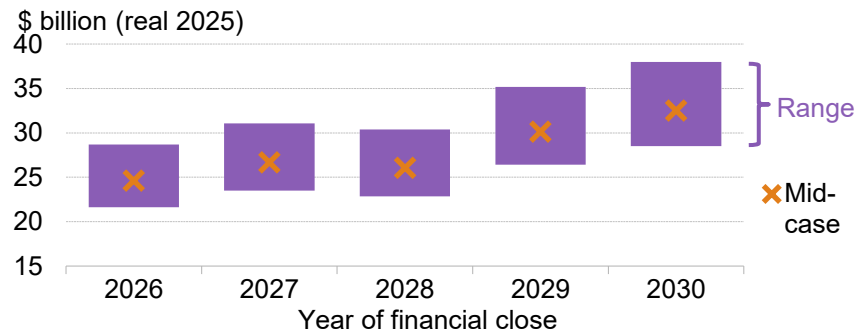
**\$123 billion-  
\$163 billion**

Projected investment needed for India's wind and solar build, 2026-2030

**11%**

Projected share of India's electricity generation consumed by data centers by 2050, from less than 1% in 2025

## Annual investment needs for wind and solar projects



Source: BloombergNEF. Note: Assumes capital expenditure of \$310-424 per kilowatt (direct current) for solar and \$799-952/kW for wind. Financial close is assumed to occur one year before commissioning. Projects forecast for 2027 are therefore shown as being financed in 2026.

# Key messages

- **India is a global leader in clean power adoption:** India was the second-largest market for annual solar and wind capacity additions in 2025, behind only China. India is poised to remain the second-largest solar market for the foreseeable future, supported by rising power demand and lower equipment prices.
- **India is the fifth-largest market for energy-transition investment:** Investors committed \$72 billion for India's energy transition in 2025, equivalent to about 1.7% of its gross domestic product (GDP). India's wind and solar sectors alone will have capital requirements of \$123 billion to \$163 billion in real 2025 dollars through 2030.
- **Renewables are starting to cut into coal's share of overall power generation:** Non-fossil fuel technologies have accounted for 80% of new power generation capacity added to India's grid over the last decade. These sources also supplied one-third of the country's electricity demand in the first seven months of 2026, though coal still provided the majority of power.
- **India is the world's fourth-largest market for grid investment:** The country plans to build enough transmission infrastructure by the first quarter of 2032 to connect 336 gigawatts of renewable capacity. The planned additions are equivalent to roughly twice the size of the UK's existing grid capacity.
- **India has achieved a key clean power capacity goal early:** The share of non-fossil fuel technologies installed on India's power grid as measured in capacity terms crossed 50% in 2025 – five years ahead of the target set in India's Nationally Determined Contribution in 2022. BNEF projects the share will exceed 60% in 2028, seven years ahead of the revised NDC.
- **Meeting India's 2035 emissions-intensity goal is achievable:** India's revised NDC targets a 47% reduction in the emissions intensity of GDP by 2035 from 2005 levels. That can be achieved under BNEF's base-case scenario for how the country's energy sector evolves.
- **The transition to lower-carbon energy sources can strengthen India's energy security by reducing its reliance on imports:** BNEF modeling of an economics-led shift even without the introduction of new supportive policies shows that India's energy imports could fall to 3.1% of GDP in 2035, from 5.3% in 2025, before declining further to 1.5% by mid-century.

# Key messages

- **India's hydrogen ambitions are bearing fruit:** Indian firms signed binding contracts in the first four months of 2026 to supply 0.3 million metric tons of clean hydrogen annually, including volumes exported as green ammonia, more than companies in any other country. That lifted India to third globally for cumulative contracted volumes. The country's growth has been supported by its ability to produce some of the world's cheapest green ammonia, helped by low-cost clean power, generous subsidies and competitive auctions. Low green ammonia prices have attracted overseas buyers and Indian firms have signed three major binding offtake agreements to export more than 1 million metric tons annually.
- **Electric vehicle sales are up but India is far from hitting most of its 2030 targets:** Lower total cost of ownership, greater model availability and a sustained policy push are helping boost Indian EV sales. The government has set targets for EVs to account for 80% of two- and three-wheeler sales, 70% of commercial vehicles and 30% of private cars by 2030. However, BNEF modeling suggests India will fall short of most of these goals, with three-wheelers the exception. Higher fuel costs stemming from the conflict in the Persian Gulf could improve the economics of EVs, but further measures will be needed if the country is to hit all of its 2030 targets.
- **Flexible power procurement can support greener data center growth:** Data center power demand could rise from 11 terawatt-hours in 2025 to 636 terawatt-hours by 2050, equivalent to about 11% of India's total electricity consumption by then. Much of this growth would initially be served by a coal-heavy grid, with coal currently supplying about 68% of India's electricity. This leaves data centers reliant on standard grid supply exposed to carbon-intensive electricity. Data centers can reduce this exposure by sourcing renewable power through third-party contracts, captive and group-captive projects, onsite solar and power exchanges.

# Short-term implications of the Iran conflict

The war in the Persian Gulf is strengthening the case for India's energy transition, but not uniformly. Higher fossil-fuel prices and supply disruptions are supporting EV adoption and encouraging greater electrification in industry and households. The crisis is also improving the economics of domestic alternatives such as compressed biogas, green hydrogen and ammonia. However, inflation, higher financing costs and concerns over reliable energy supply could slow investment. Domestically mined coal also remains an available resource.

- **The war has fueled inflation and raised the prospect of higher interest rates.** It has pushed up oil prices, disrupted supply chains and weakened the rupee. As of Oct. 5, bond traders were expecting the central bank's benchmark rate to close the year at 5.8%, up from 5.25% at the start of the month. That would raise borrowing costs for governments, companies and households, potentially weakening investment, spending and economic growth.
- **Electric two-wheeler and passenger car sales are rising.** EV demand among two-wheeler and mass-market car buyers has picked up since fuel prices increased in May. The electric share of two-wheeler sales rose to 10.7% in August from 6.7% in January. Passenger EV sales priced below 1 million rupees surpassed 32,320 units in the first eight months of the year, up 60% from the same period in 2025.

- **Higher prices are forcing businesses and households to seek alternatives to fossil fuels.** Physical shortages of liquefied natural gas (LNG) have pushed some Indian industries toward substitutes. Persistently high prices and limited availability could permanently reduce LNG demand in some industries, especially those that chose to invest in clean energy alternatives. Liquefied petroleum gas (LPG) supply disruptions have prompted some households to invest in electric appliances for cooking and heating.
- **Policy is supporting the adoption of newer fuels.** India's 2026 compressed biogas (CBG) policy boosts demand through assured purchases and blending requirements for vehicle fuel and pipe-gas supply. Locally produced green ammonia and clean hydrogen made using renewable electricity could provide a hedge against future global supply disruptions.

# Energy transition leadership



**Energy transition leadership**



Clean energy and climate targets



Clean power



Data centers



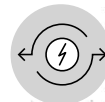
Electric vehicles



Green ammonia



Investment



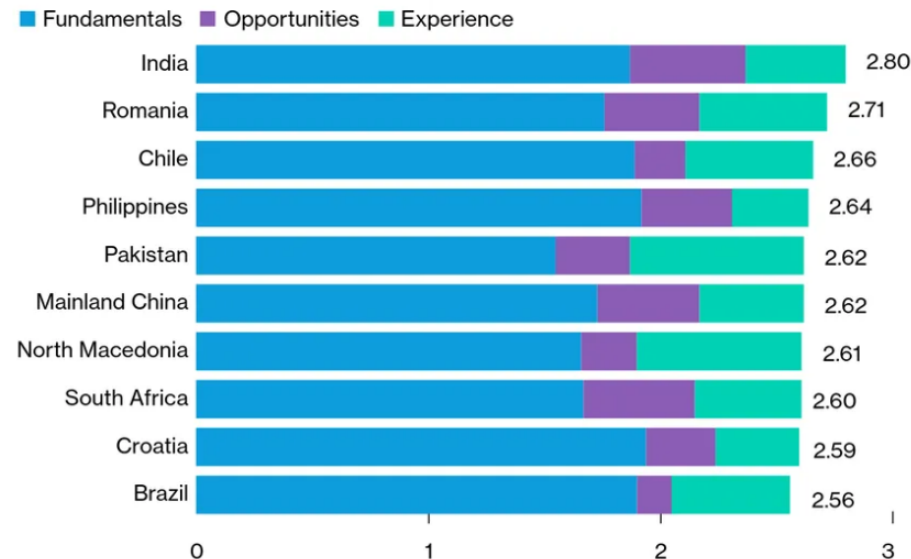
Long-term outlook



Learnings, challenges and opportunities

# India topped Climatescope ranking for third straight year in 2025

## Top 10 emerging markets in the power sector, by BNEF Climatescope score

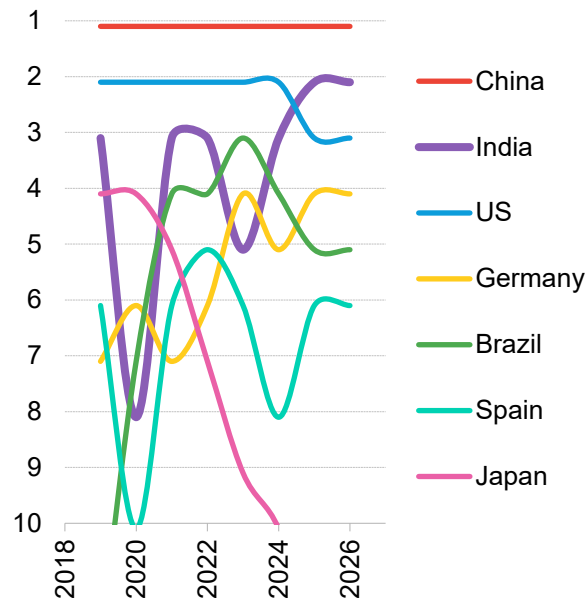


Source: BloombergNEF. Note: Maximum score is 5. Fundamentals, opportunities and experience are the parameters that add up to a market's overall score for clean power. Between them, they encompass more than 100 indicators, or individual data inputs collected by Climatescope researchers. For more, see Climatescope 2025 ([web](#) | [terminal](#)) published on Nov. 3, 2025.

- As one of the fastest-growing low-carbon economies among emerging markets, India was the first to top BloombergNEF's Climatescope rankings for three consecutive years.
- Over the past decade, India has played a pivotal role in global renewable energy growth, deploying nearly 300 gigawatts (GW) of clean power capacity.
- Rising clean energy investment reflects the market's stable policy environment favoring renewables deployment.
- To meet steadily rising power demand, the government has streamlined renewable auctions and expanded grid infrastructure to accelerate the deployment of solar, wind and storage technologies.

# India is the world's second-largest solar market for annual capacity additions

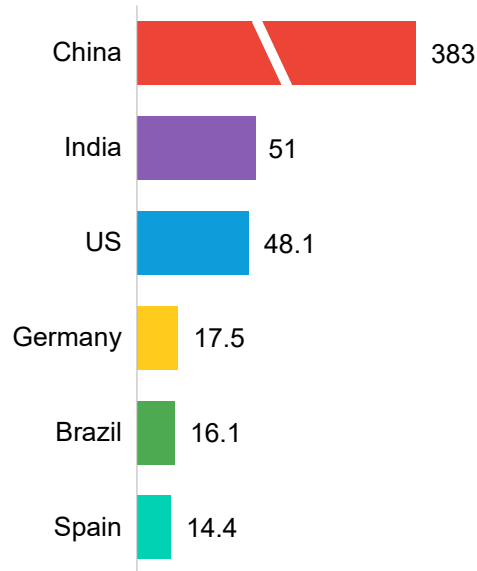
## Global ranking based on solar capacity commissioned by year



Source: BloombergNEF. Note: 2026 is a forecast.

## Top five markets by solar capacity commissioned in 2025

Gigawatts (direct current)

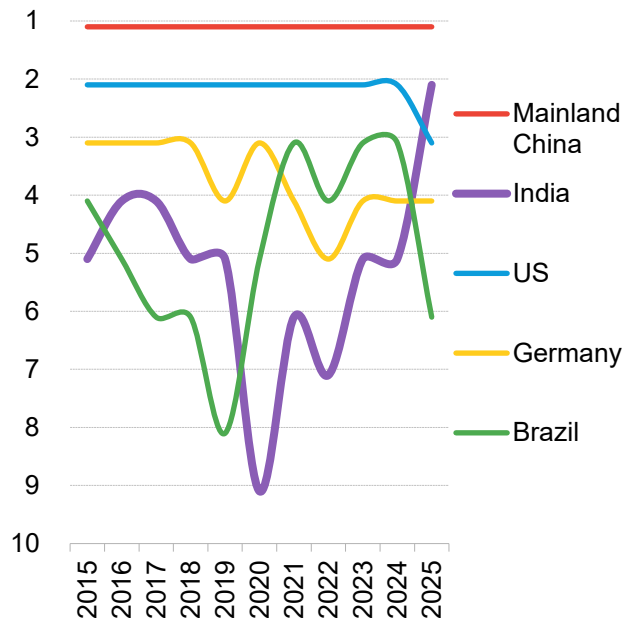


Source: BloombergNEF

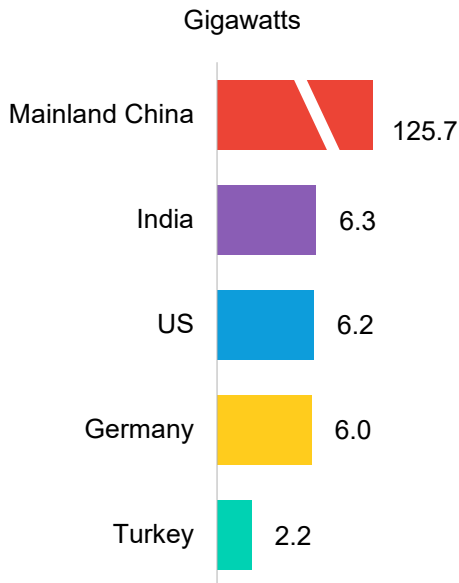
- India overtook the US to add the most solar capacity outside China in 2025 and has risen each year since 2023.
- India added 51GW (direct current) of solar capacity in 2025, 55% higher than the country's previous record in 2024. BNEF expects 52GW(DC) of additions this year.
- India appears likely to maintain its position as the second-largest market this year, based on BNEF forecasts.
- Rooftop solar has emerged as the top growth segment in India, driven largely by capital expenditure subsidies. The government is also subsidizing decentralized agro-photovoltaic (PV) projects, but this segment remains relatively small. Co-locating energy storage can improve project economics by shifting solar output to evening peak-demand hours.

# India was the biggest market outside China for wind build in 2025

## Global ranking based on wind capacity commissioned by year



## Top five markets by wind capacity commissioned in 2025

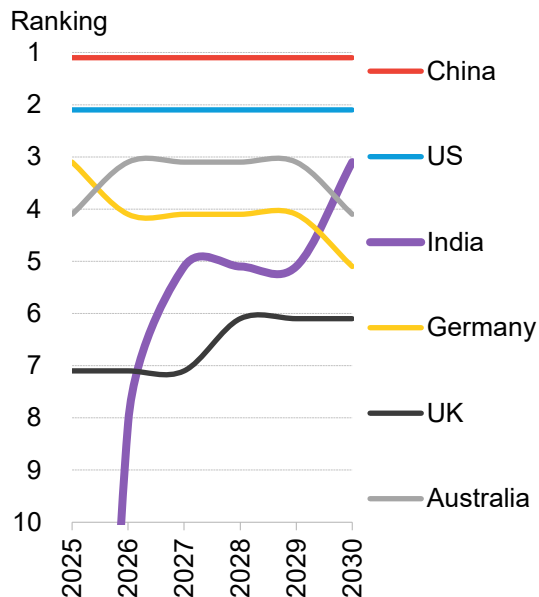


- India overtook the US and Germany to become the world's second-largest market for wind power deployment in 2025.
- Record additions of 6.3GW lifted India from the fifth-largest market in 2024.
- The 2025 build was nearly double the 2024 tally and about 50% above the previous record set in 2017. The surge included projects previously delayed by land acquisition and grid connection issues.
- The acceleration matters for India's increasingly solar-heavy power system. Rapid solar additions have pushed daytime power prices close to zero on several occasions. Wind can help diversify renewable generation beyond daylight hours. Such projects perform particularly well during the windier monsoon season.

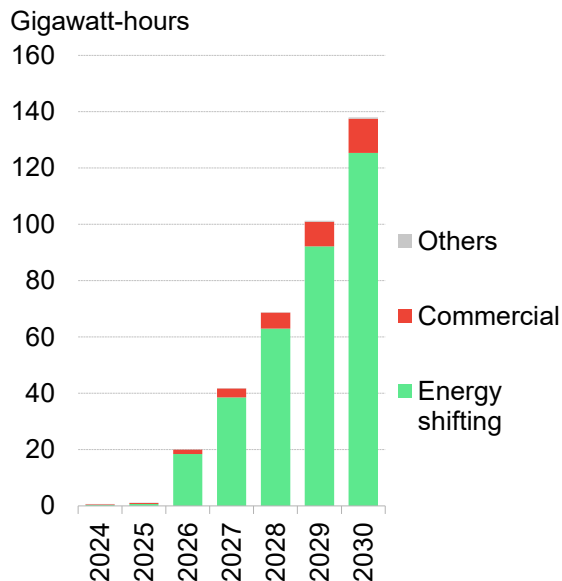
Source: BloombergNEF

# India will be third-largest energy storage market in 2030

## Cumulative capacity ranking based on storage capacity



## India's cumulative energy storage by application



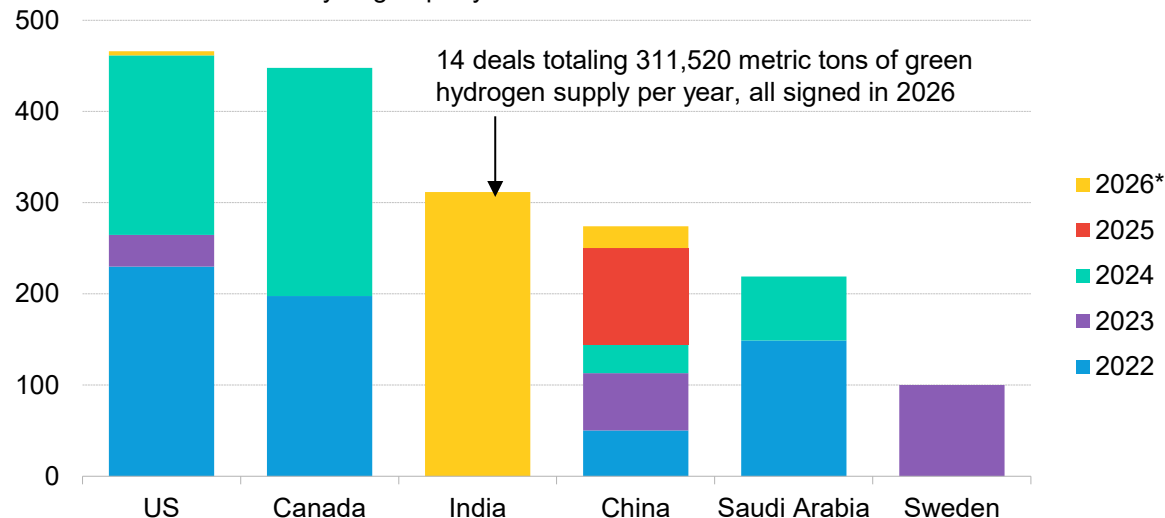
- BNEF projects India will become the world's third-largest market for energy storage projects by 2030 (excluding pumped hydro). Cumulative storage capacity is expected to reach 45GW/138 gigawatt-hours (GWh) by 2030.
- Standalone storage auctions are creating dedicated routes for projects supported by federal subsidies. Under the federal government's latest policy revision, viability gap funding – a subsidy that covers part of a project's upfront cost – provides assistance of 1.8 million rupees (\$18,700) per megawatt-hour. This covers roughly 15% to 20% of project capital expenditure.
- In addition, government-organized multi-technology renewable energy auctions increasingly require projects to provide firm-up electricity supply. This has encouraged power producers to pair renewables with storage when submitting bids to win contracts.

Source: BloombergNEF. Note: Ranking measured in gigawatt-hours and excludes pumped hydro projects.

# India signs largest volume of clean hydrogen supply contracts in 2026

## Cumulative binding offtake volumes signed by supplier country by year of deal announcement

Thousand metric tons of hydrogen per year



Source: BloombergNEF. Note: All of India's clean hydrogen supply is set to be produced through water electrolysis powered by renewable electricity. See Hydrogen Offtake Agreement Database (2.4) ([web](#) | [terminal](#)). \*Data as of April 30, 2026.

- India has gone from having no binding clean hydrogen offtake contracts in place in 2025 to ranking third globally by cumulative contracted volume in 2026. Through just the first four months of 2026, producers had signed no less than 14 binding contracts covering 311,520 metric tons of annual supply.
- India's push to create domestic demand helped establish some of the world's lowest electrolysis-based clean hydrogen (also referred to as green hydrogen) prices, which helped draw in overseas buyers (see pages 53 and 54). Contracted supply is now serving two distinct markets: domestic fertilizer production and exports.
- Fertilizer accounted for 11 of 14 deals and about 38% of contracted volumes. The remaining 193,600 tons of hydrogen a year are intended to be exported to buyers in Europe and Japan.

# Clean energy and climate targets



Energy  
transition  
leadership



**Clean energy  
and climate  
targets**



Clean  
power



Data  
centers



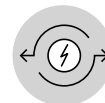
Electric  
vehicles



Green  
ammonia



Investment



Long-term  
outlook



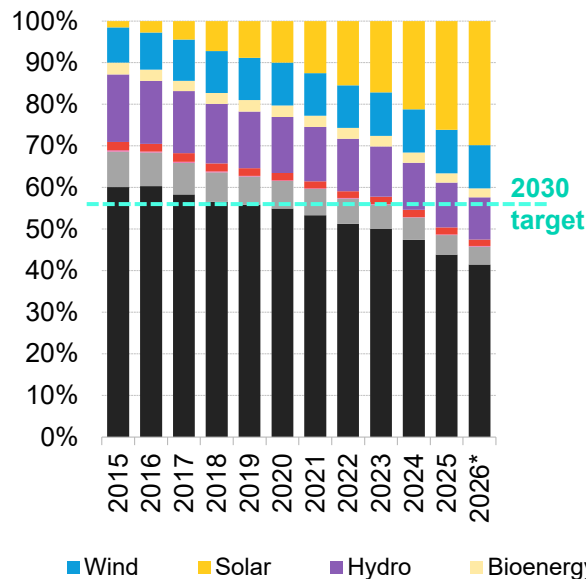
Learnings,  
challenges and  
opportunities

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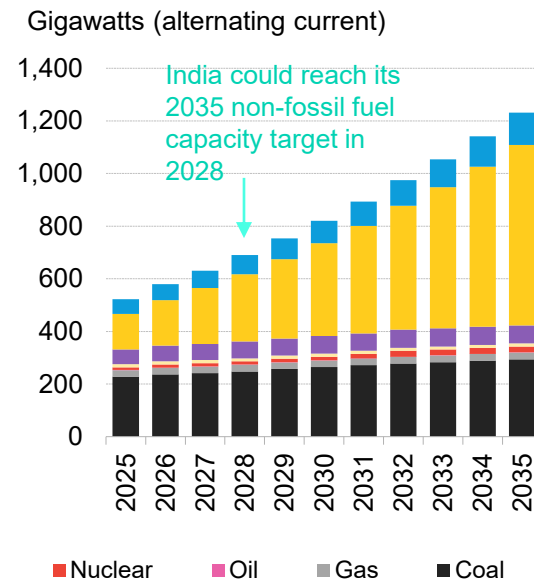
BloombergNEF

# India exceeds clean power capacity target early, with its next one in sight

## Technology/fuel's share of India's installed power generation capacity



## India's projected installed power generation capacity



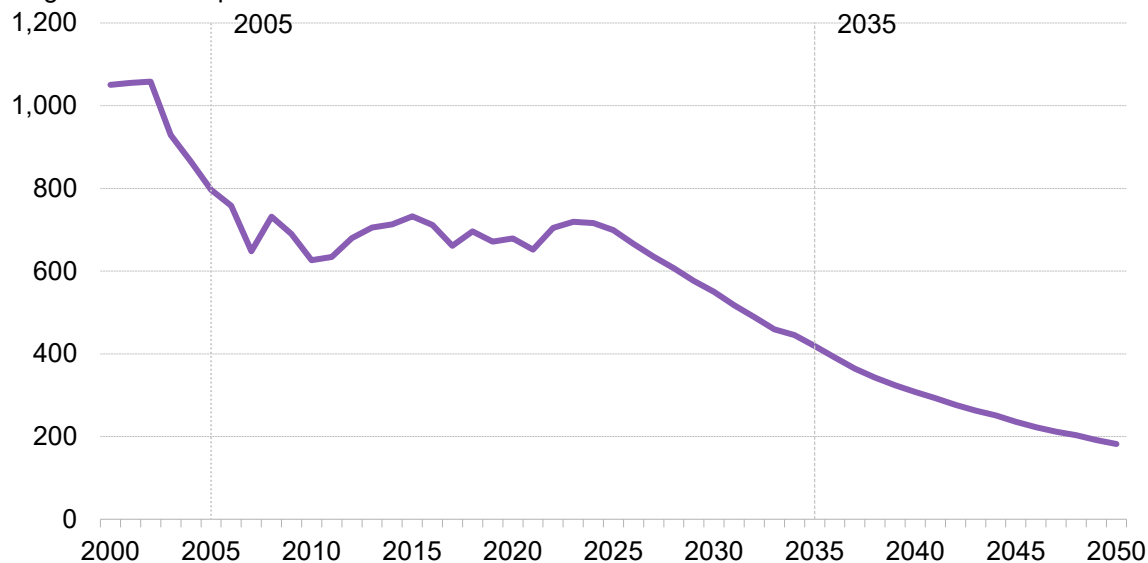
- In 2022, India's Nationally Determined Contribution (NDC) set a target for non-fossil fuel technologies to account for 50% of installed power generation capacity by 2030. The country crossed that threshold in 2025, five years ahead of schedule.
- The government then raised the bar when it updated its NDC in March 2026, targeting a 60% share of non-fossil fuel capacity by 2035.
- BNEF projects India could reach the new target as early as 2028 – seven years ahead of schedule. This estimate reflects BNEF's renewables forecast compared to conventional power capacity additions projected by the Central Electricity Authority.
- Non-fossil fuel technologies are likely to account for about three-quarters of India's power generation capacity by 2035.

Source: Central Electricity Authority, Ministry of New and Renewable Energy, BloombergNEF. Note: Values in the left-hand chart are in gigawatts (alternating current); Data through August 2026.

# India is tracking closely toward its 2035 emissions reduction target

## India's projected CO2 emissions intensity under BNEF Economic Transition Scenario

Kilograms of CO2 per \$ million of GDP



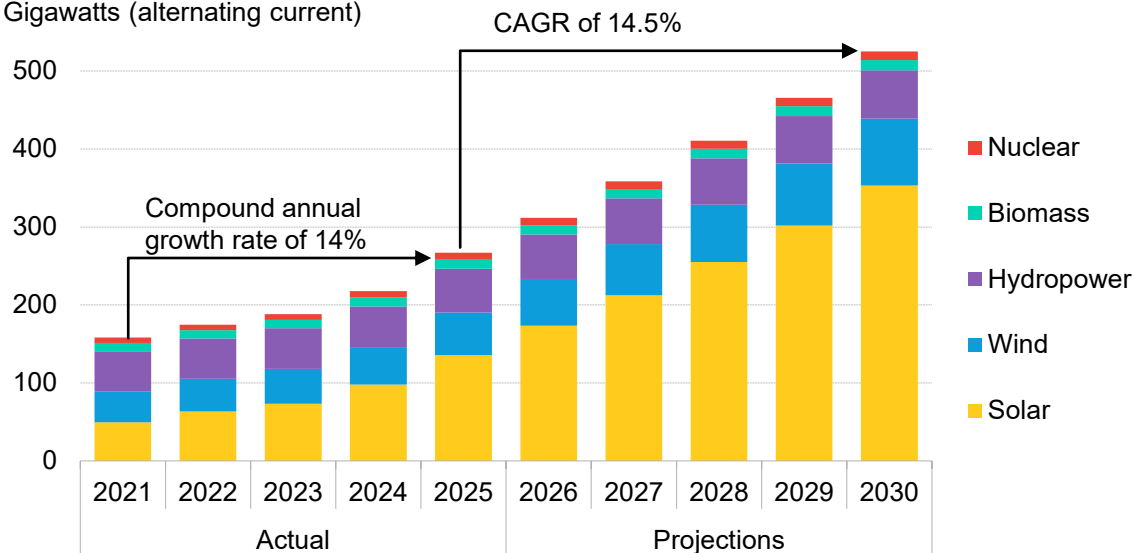
Source: BloombergNEF. Note: GDP is gross domestic product.

- India's revised NDC targets a 47% cut in the emissions intensity of its economy by 2035 from 2005 levels.
- BNEF produces long-term scenarios examining how the global energy landscape could evolve. Under the base-case Economic Transition Scenario (ETS), India's CO2 emissions intensity falls by 47% from its 2005 level by 2035. This puts the modeled trajectory broadly in line with the scale of reduction set out in the NDC.
- Unlike its clean power goals, which were reached well ahead of schedule, the emissions-intensity objective is unlikely to be achieved early. The narrow potential margin reflects the difficulty of curbing emissions across the broader economy. The industrial sector presents a particular challenge as many technologies needed for deep decarbonization remain immature or commercially uncompetitive.

# Solar surge puts India on track to meet its 2030 pledge made at Glasgow

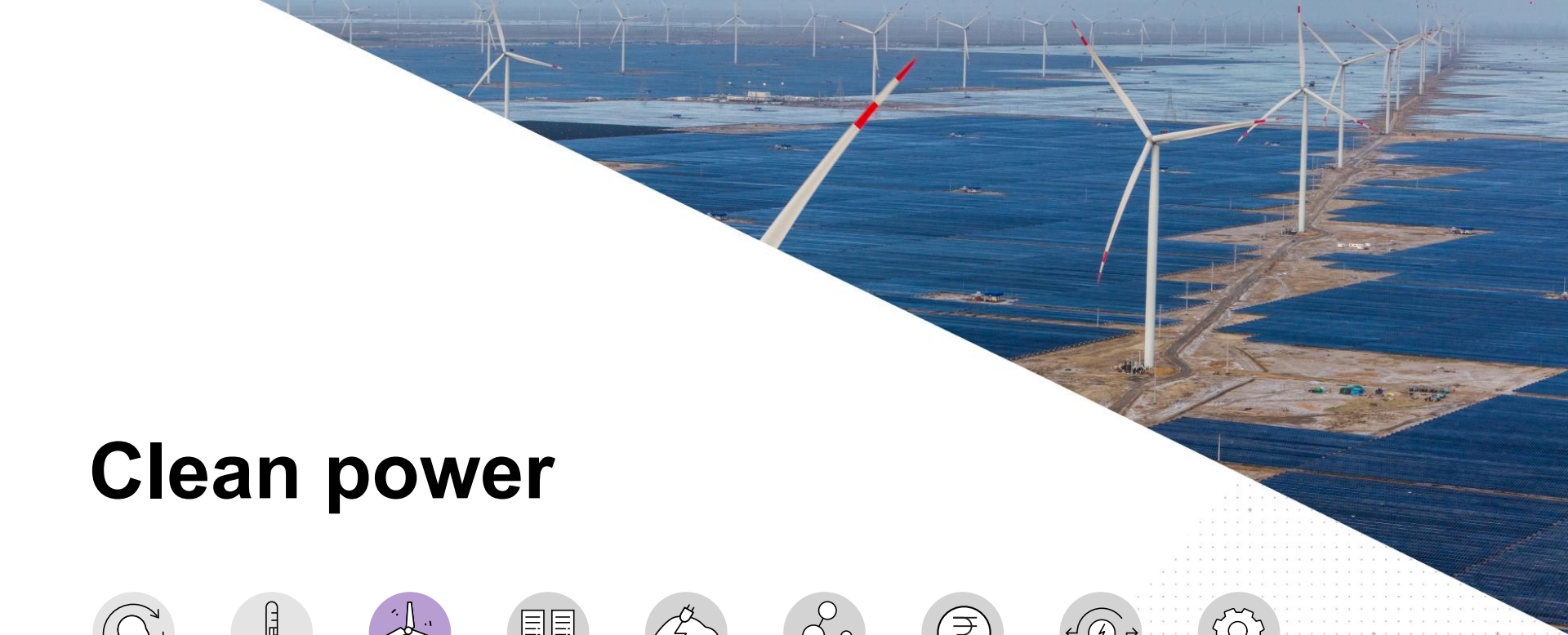
## India non-fossil fuel power generation capacity, historical and projected

Gigawatts (alternating current)



Source: Central Electricity Authority, Ministry of New and Renewable Energy, BloombergNEF. Note: Hydropower includes small and large hydro plants. Solar and wind projections are BNEF's mid-case forecasts. For other technologies, future additions are assumed to be the average annual build from 2022 to 2025.

- Indian Prime Minister Narendra Modi at the 2021 Glasgow climate summit announced the country would have 500GW of non-fossil fuel capacity online in 2030.
- India appears on track to meet this milestone, based on BNEF's forecasts for wind and solar commissioning and estimates for other technologies derived from historical annual additions.
- Solar power generating capacity is the largest contributor. It accounted for 31% of India's non-fossil fuel power capacity in 2021 (or 49GW), then 51% (136GW) in 2025 and is set to become 67% (353GW) by 2030.
- The government also targets 100GW of nuclear capacity online by 2047, while recent legislative amendments allowing private participation could support faster additions.



# Clean power



Energy  
transition  
leadership



Clean energy  
and climate  
targets



**Clean  
power**



Data  
centers



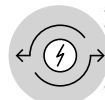
Electric  
vehicles



Green  
ammonia



Investment



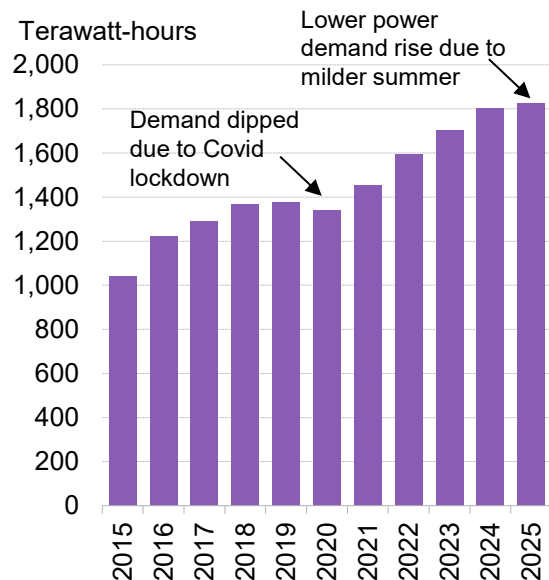
Long-term  
outlook



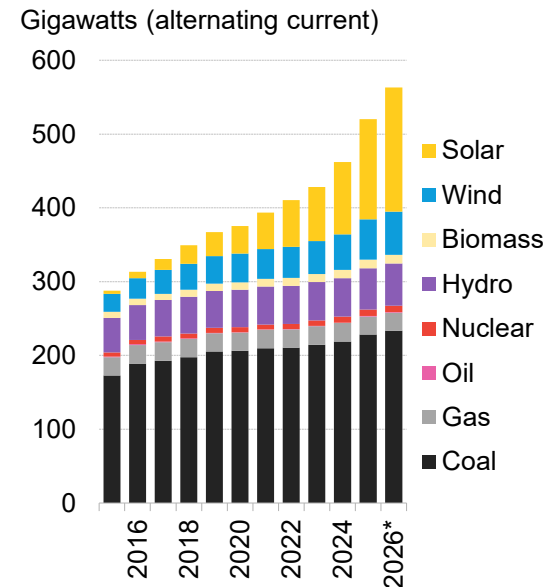
Learnings,  
challenges and  
opportunities

# Economic growth lifts India's power demand and clean power expands

## India electricity consumption



## India installed power generation capacity

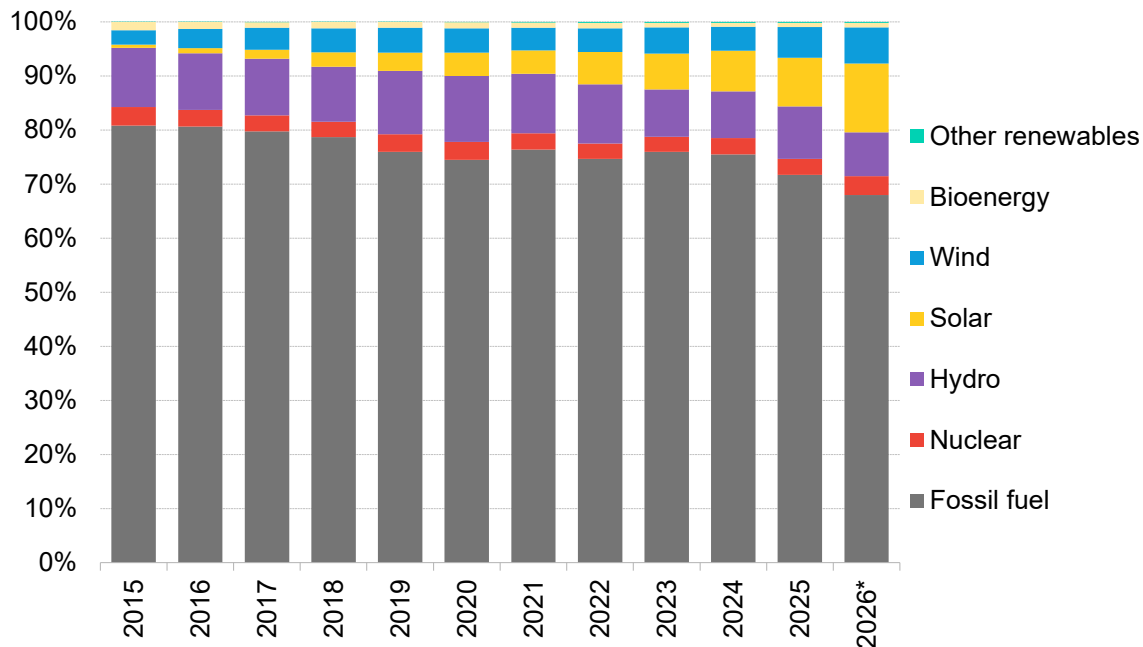


- India's economic growth, supported by ambitions to expand industrial and manufacturing activity, is driving electricity demand higher. Rising incomes are also increasing per-capita electricity consumption.
- India's overall electricity consumption grew by an average 6% a year from 2015 to 2025. Power demand in the first seven months of 2026 showed 6% growth compared to the same period a year earlier.
- India's power generation fleet has nearly doubled over the past decade, reaching 562GW in August 2026 from 288GW in December 2015. The expansion alone is comparable to Germany's entire existing power generation fleet.
- Non-fossil fuel technologies accounted for 80% of the fleet expansion over the decade. In this period the country also added 61GW of new coal-fired generation capacity.

Source: Central Electricity Authority, BloombergNEF. Note: \*Data through August 2026.

# Clean power is cutting coal's dominance of India's electricity generation

## Technology/fuel's share in India's electricity output



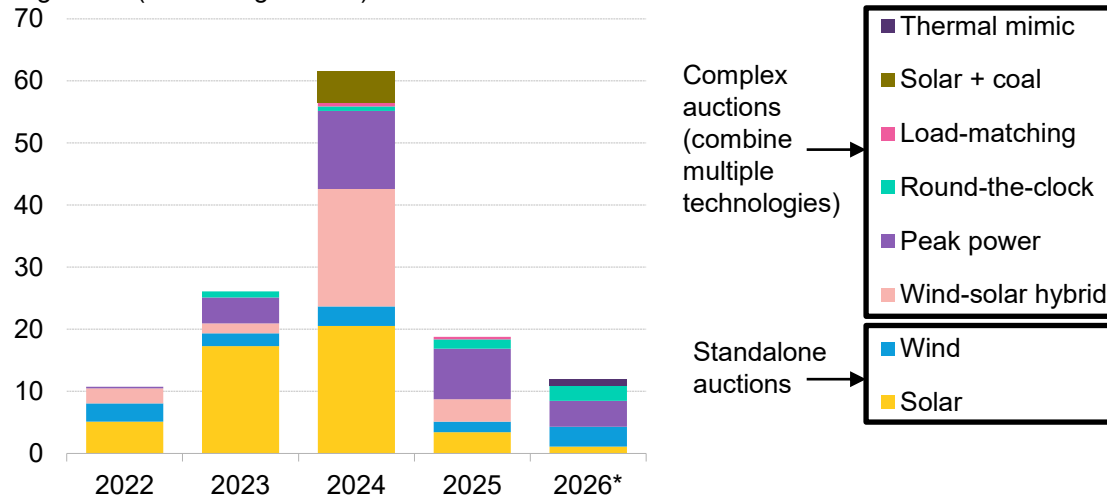
Source: Central Electricity Authority, BloombergNEF. Note: \*Data through July 2026.

- The share of non-fossil fuels in India's overall electricity generation reached 28% in 2025, up from 19% in 2015. This was driven by the rapid additions of renewable energy projects.
- In 2025, non-fossil fuel technologies supplied 517 terawatt-hours (TWh) of electricity to India's grid, the highest on record. It was also the first year apart from 2020 when coal-fired generation declined both in absolute terms and as a share of the generation mix from a year earlier. This largely reflected weaker overall electricity demand amid cooler weather, while renewables benefited from priority dispatch.
- Non-fossil fuel technologies accounted for a third of India's electricity generation in the first seven months of 2026. The fossil fuel share, dominated by coal, fell to 68%, dropping below 70% for the first time.

# India's clean power auctions shift toward firm, dispatchable output

## India annual renewable energy auction volumes

Gigawatts (alternating current)

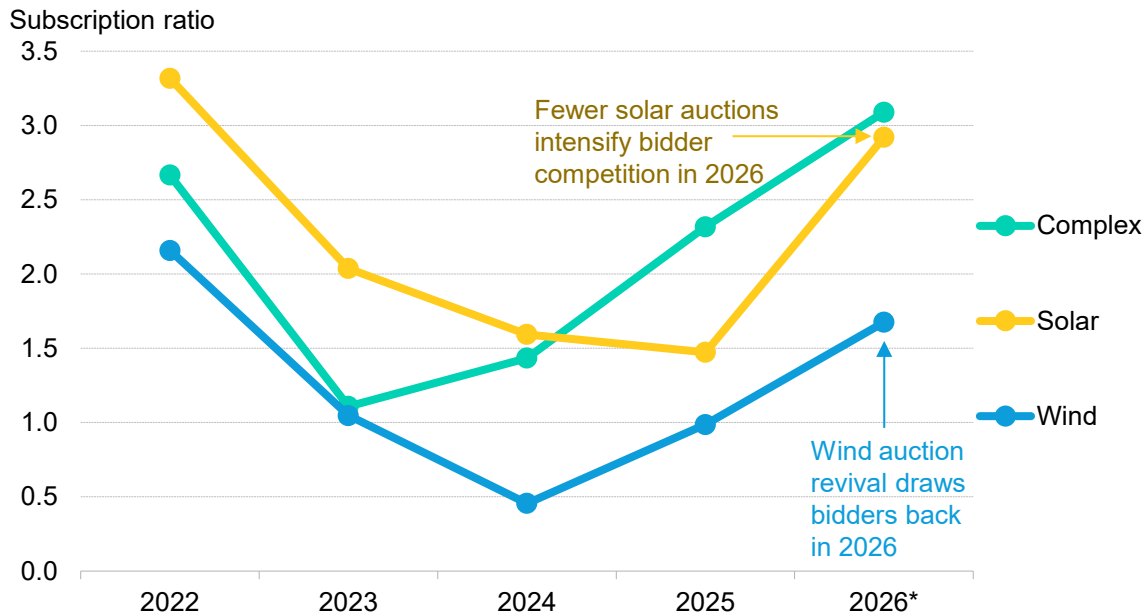


Source: BloombergNEF. Note: Thermal mimic refers to SECI's 1GW FDRE-RTC V tender, which requires renewable projects to maintain minimum power supply across different time blocks, making their output profile more similar to dispatchable thermal generation. \*Data through August 2026.

- Complex projects now dominate India's clean power auctions, as procurement shifts from standalone solar and wind toward projects combining renewable technologies and storage to deliver firmer, more dispatchable power.
- The evolution has extended to a first-of-a-kind "thermal-mimic" auction completed in August 2026. That auction required renewable projects to deliver power with characteristics closer to that of coal-fired generation in terms of hours when they generate.
- Auction volumes have nevertheless fallen from their 2024 peak as auctioning agencies struggle to secure offtake agreements with power distribution companies. While that could slow renewables build, a surge in power demand this year is likely to prompt India's power distribution companies (discoms) to accelerate contract signings.

# India's renewable energy auctions are highly competitive and over-subscribed

## Annual subscription ratio in renewable energy auctions, by auction type



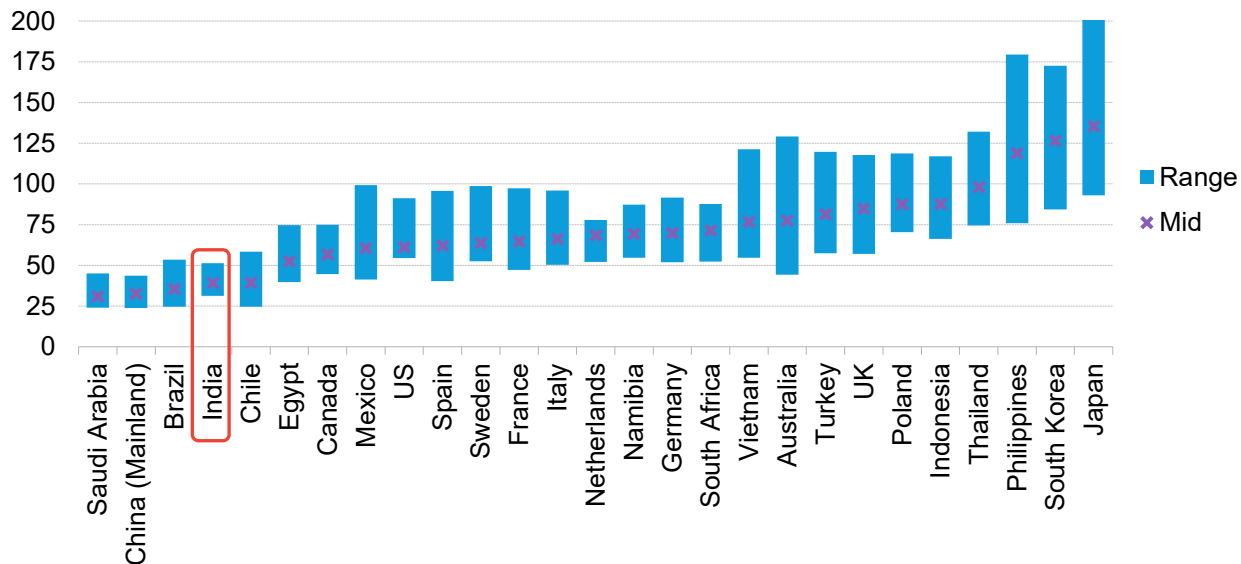
Source: BloombergNEF. Note: Subscription ratio is the ratio of bid volume to capacity on offer. \*Data through August 2026.

- Indian government-organized reverse auctions invite developers to compete to deliver power to the grid at the lowest cost. These auctions have attracted strong bidder interest across solar, wind and complex projects.
- High subscription ratios show that developers are bidding to build more capacity than is on offer. Strong competition can put downward pressure on tariffs.
- Developers of complex projects must compete to optimize technology configurations, project locations and costs to meet increasingly sophisticated power-delivery requirements.

# India's wind power is among the most cost-competitive globally

## Levelized cost of electricity (LCOE) for onshore wind in selected markets, 2H 2025

\$ per megawatt-hour



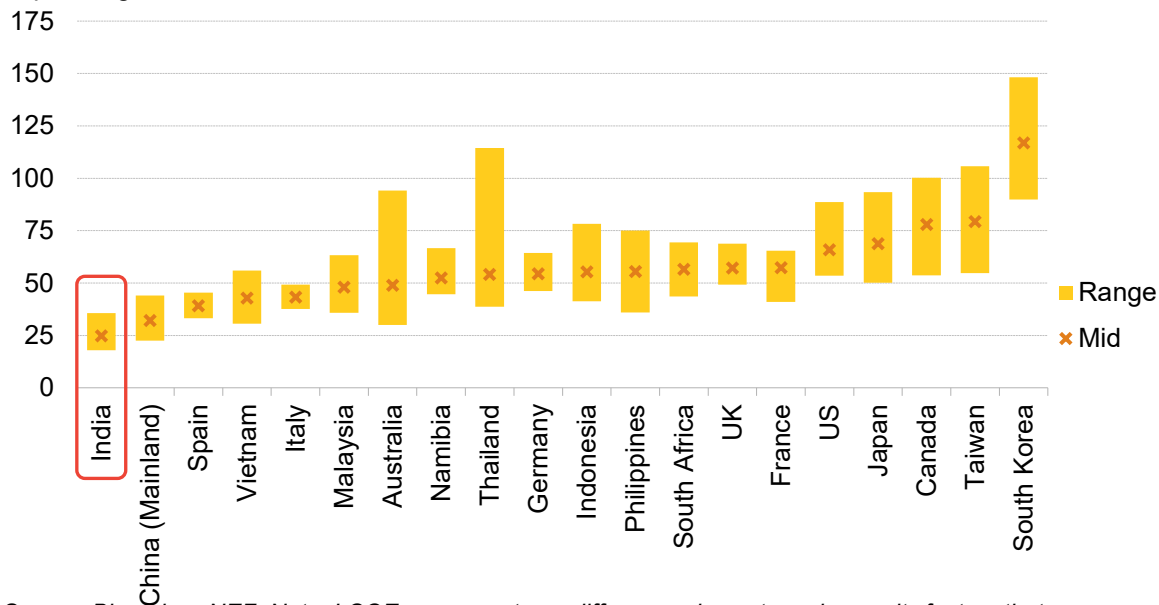
Source: BloombergNEF. Note: LCOE range captures differences in costs and capacity factors that are typically observed within each market.

- The levelized cost of electricity (LCOE) is the long-term offtake price a project developer needs to recoup costs and meet the minimum rate of return for its investment.
- India had the fourth-lowest LCOE for wind, based on BNEF's estimate for new projects financed in the second half of 2025. The increasing adoption of larger turbines (at least 5 megawatts) could be the key driver for future reductions.
- The inputs for LCOE calculations are capital expenditure, operating expenditure, capacity factors and financing rates gathered from industry interviews, company filings and price indices.

# India has the world's lowest-cost utility-scale solar power

## Levelized cost of electricity for utility-scale solar in selected markets, 2H 2025

\$ per megawatt-hour



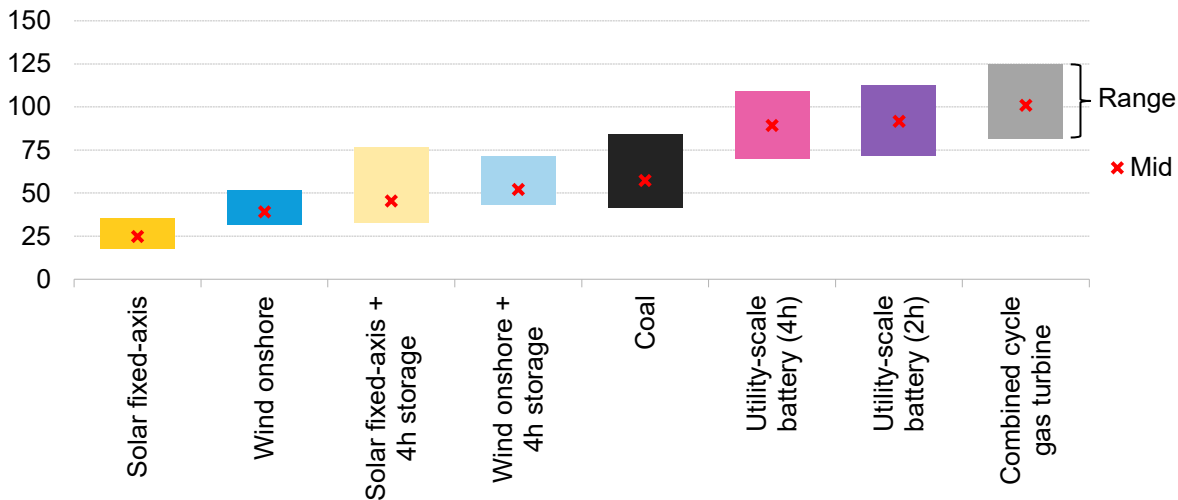
Source: BloombergNEF. Note: LCOE range captures differences in costs and capacity factors that are typically observed within each market.

- India has the lowest LCOE in the world for its utility-scale solar projects. Most of these projects are in the states of Rajasthan and Gujarat, which have clear, sunny weather for most of the year. The government has developed numerous solar parks in those states, offering developers large tracts of flat, contiguous land.
- Power generated can be supplied to any other part of the country because the government has enabled non-discriminatory access to the national power transmission grid. Grid fees were fully waived until June 2025 and gradually rise in four equal increments thereafter.
- Most renewable projects built in India have 25-year fixed price power purchase agreements with government-owned entities. The certainty of cash flows has helped cut the cost of capital by attracting many investors. This, in turn, has contributed to lower LCOEs.

# Wind and solar paired with storage in India can be cheaper than new coal power

## Levelized cost of electricity in India, 2H 2025

\$ per megawatt-hour

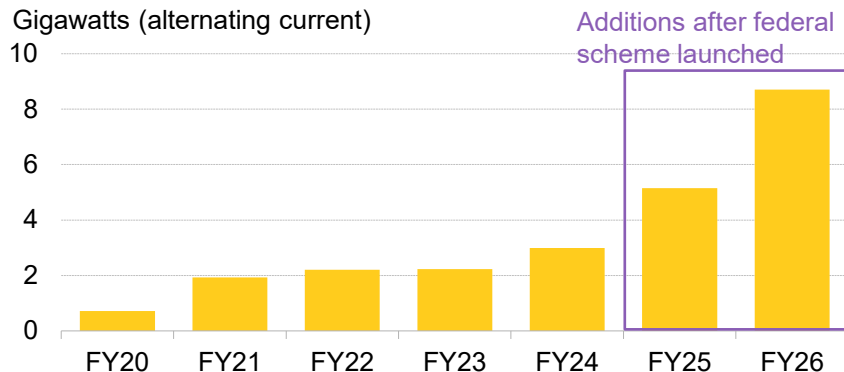


Source: BloombergNEF. Note: The LCOE range for solar- and wind-plus-storage systems is calculated based on different capacity factors and size of battery is assumed to be 25% to 100% of capacity of the generation component. The LCOE for utility-scale batteries assumes charging at 60% of the average wholesale electricity price. For more granular insights and reasons, see Energy Storage Systems Cost Survey 2025 ([web](#) | [terminal](#)).

- Standalone solar and wind have been the cheapest source of new bulk power generation in India since 2018 based on BNEF's LCOE estimates.
- The LCOE for Indian solar and wind projects paired with 4-hour battery storage fell below that of coal in BNEF's mid-case scenario for the first time in the second half of 2025.
- The key reason for this shift has been battery prices. BNEF forecasts that the turnkey costs for a 4-hour energy storage system could fall to \$48 per kilowatt-hour in China by 2030 from \$62/kWh in 2025. In Europe, these fall to \$125/kWh from \$172/kWh. These global battery-cost declines are likely to put downward pressure on costs in India as well.
- LCOEs for storage-paired systems could also decline as developers gain experience from the first projects being built in India.

# Residential solar has grown swiftly, reaching 61% of the national goal

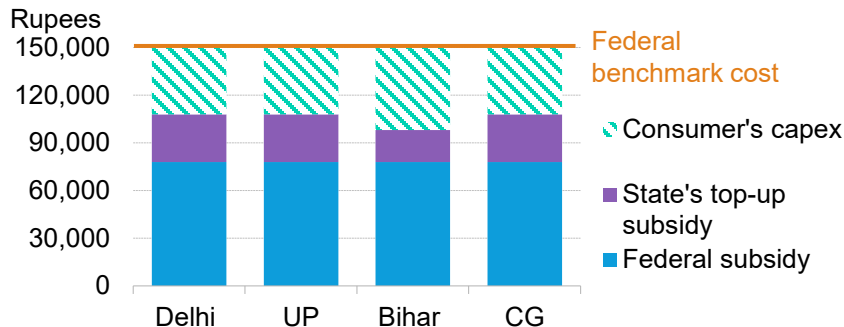
## Annual additions of rooftop solar systems in India



Source: BloombergNEF, Ministry of New and Renewable Energy. Note: FY20 is the financial year from April 2019 to March 2020 and so on. Chart shows all rooftop installations, not just residential sector.

- India in 2024 launched a federal subsidy scheme (PM Surya Ghar Muft Bijli Yojana) under which households can receive up to 78,000 rupees (\$812) to support deployment. This is about half the upfront cost of a 3-kilowatt system.
- The scheme has spurred record additions, with more than 8GW (alternating current) rooftop solar added in the year ending March 2026.

## Subsidies and consumer spending for 3-kilowatt residential rooftop system in selected states

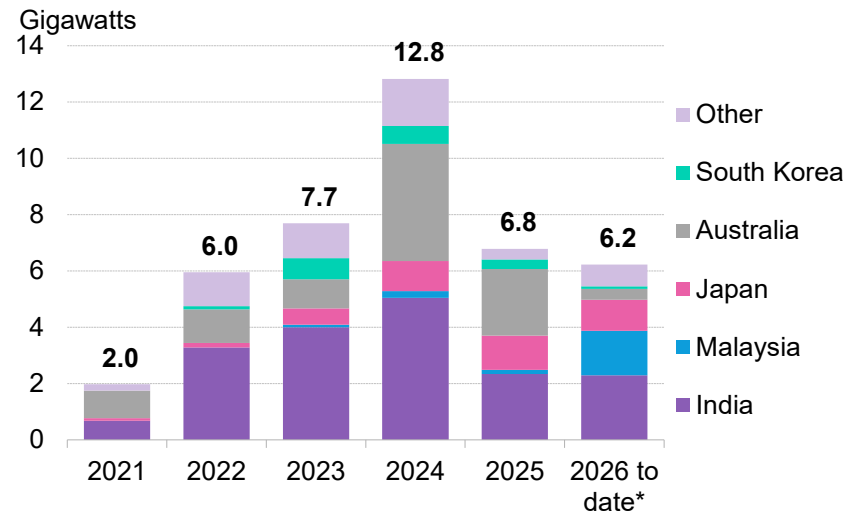


Source: BloombergNEF, Ministry of New and Renewable Energy. Note: UP is Uttar Pradesh and CG is Chhattisgarh. Projects get the benefit of net metering.

- The scheme targets 10 million households by March 2027, had reached 61% of that target by Oct. 5, 2026.
- Many states are offering additional subsidies to boost residential rooftop installations, further shortening customer payback periods. Local distribution grids will also need to be strengthened to manage increasing two-way power flows as households become both electricity generators and consumers.

# India is Asia Pacific's largest corporate clean power procurement market

## New APAC corporate PPAs signed per year



Source: Company announcements, news reports, BloombergNEF. Note: Chart shows only offsite corporate power purchase agreements (PPAs) that are publicly disclosed or submitted directly to BNEF by market participants and meet a set of minimum requirements. Only includes PPAs with contract durations of more than one year. Figures are subject to change as more information becomes available. \*Data were taken from BNEF's Corporate PPA database on Sept. 14, 2026.

- Corporations operating in India had signed approximately 2.3GW of clean power purchase deals in 2026 through September, making India the largest market in the Asia-Pacific region in this calendar year.
- Deals signed over the past few years have been dominated by companies in the large industrial sector that want to meet their decarbonization goals. These include steelmakers, miners, metal producers and oil refiners.
- Large consumers in the country can procure power in several ways, including direct power purchase agreements (PPAs) with independent power producers (IPPs), installing onsite solar systems, green tariffs and purchasing renewable energy certificates (see more on the [page 26](#)).
- The “group captive” model is the preferred structure for direct PPAs between consumers and IPPs. Under such arrangements, a consumer or group of consumers invests at least 26% equity in a power plant and consumes at least 51% of the total energy generated annually. Customers are exempted from paying the “cross subsidy surcharge” that the distribution utility levies on consumers who purchase power from third-party power generators. This can result in substantial savings and has contributed to the popularity of the mechanism.

# Economics support greater use of renewables by corporates in India

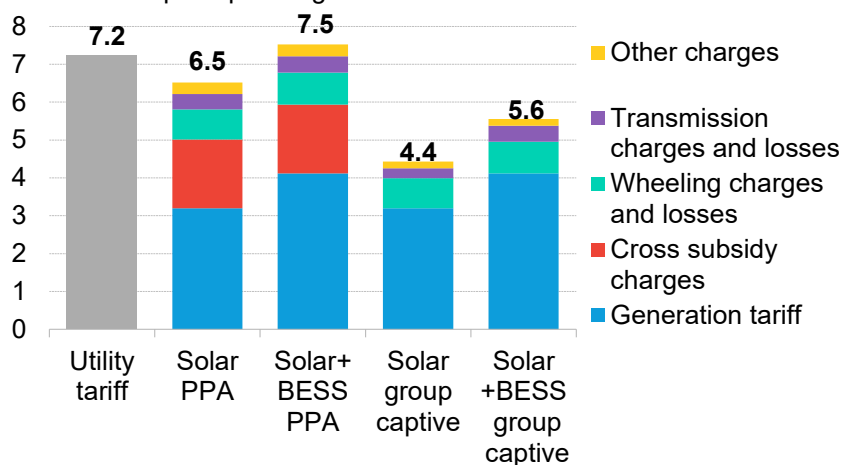
## Corporate renewable energy procurement options in India

| Procurement model                                                                          | Types of contract                                                                                                       |
|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Onsite power plants</b><br>(power plants located within the premises of the offtaker)   | <ul style="list-style-type: none"> <li>Captive power plant</li> <li>Bilateral power purchase agreement (PPA)</li> </ul> |
| <b>Offsite power plants</b><br>(power plants located outside the premises of the offtaker) | <ul style="list-style-type: none"> <li>Bilateral PPA</li> <li>Group captive PPA</li> </ul>                              |
| <b>Renewable energy attributes</b>                                                         | <ul style="list-style-type: none"> <li>Domestic RECs</li> <li>International RECs</li> <li>Virtual PPA</li> </ul>        |
| <b>Green tariff</b>                                                                        | <ul style="list-style-type: none"> <li>Contract with power distribution company</li> </ul>                              |

Source: BloombergNEF. Note: REC is renewable energy certificate.

## Landed cost of third-party clean power purchased for industrial category customers

Thousand rupees per megawatt-hour

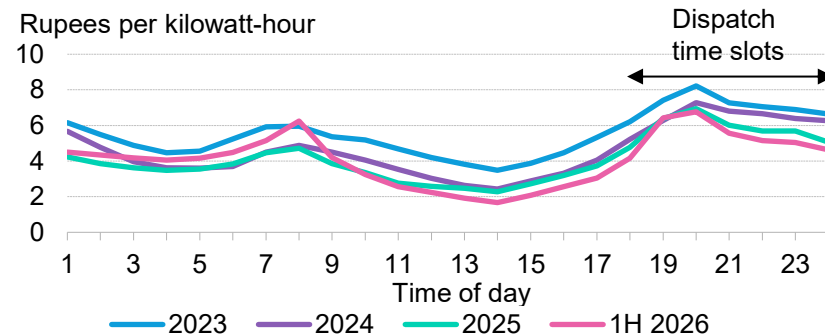


Source: State Electricity Regulatory Commissions, state energy development agencies, BloombergNEF. Note: Includes electricity duty and fuel surcharges where applicable. Assumes a flat consumption load. Tariffs are averages across three states (Andhra Pradesh, Maharashtra and Tamil Nadu) for the latest financial year. Values correspond to the fiscal year ending March 31, 2027.

# The power market is evolving rapidly with new trading instruments

- About 90% of the power in India is bought and sold via long-term bilateral offtake contracts. However, power markets are growing increasingly sophisticated, and this is giving investors the ability to buy and sell clean power in more flexible ways.
- Traded volumes are likely to increase as complex renewable energy projects (combining multiple technologies) are oversized and have a component of merchant exposure. The introduction of virtual power purchase agreements (VPPAs, which split green attributes from physical power) and contracts for difference (CfDs) could also increase liquidity on the exchanges.
- India launched electricity futures contracts in July 2024. The monthly, cash-settled contracts are traded in lots of 50MWh.
- All trades on India's power exchanges are for physical delivery, meaning market participants cannot use them to hedge against price volatility. Futures allow power generators to lock in their margins and buyers to manage their exposure to power prices.
- More types of tradable products can enable sophisticated hedging strategies in the future, such as electricity options (derivatives that give the holder the right but not the obligation to buy or sell futures) and weather derivatives (payouts based on a weather index).

## Average hourly day-ahead market prices



Source: BloombergNEF, Indian Energy Exchange.

- The Solar Energy Corp. of India (SECI) has issued a tender for India's first CfD pilot. The 500MW of renewables must sell power for two hours in the evening, when wholesale market prices are typically high.
- CfDs could help address distribution companies' reluctance to sign long-term offtake contracts for auctioned renewable energy projects. They could also increase liquidity in the wholesale market while giving project owners greater revenue certainty.

# Regulations move renewable operations closer to dispatchable power sources

- Power producers and large buyers, primarily power distribution companies (discoms), must regularly submit generation and demand forecasts in 15-minute time blocks. India's **deviation settlement mechanism** (DSM) helps maintain grid stability by penalizing grid users whose actual generation or consumption deviates from the agreed schedules.
- The Central Electricity Regulatory Commission is tightening DSM rules for renewables to ensure grid stability as the share of intermittent generation rises. In 2025, wind and solar accounted for 16% of India's electricity generation and their share could rise to 41% by 2035 under BNEF's economics-led scenario.
- India's shift toward renewables paired with battery storage has so far been driven mainly by buyers seeking firmer, more dispatchable clean power. Revised DSM rules due to come into force in 2029 will apply deviation requirements to new renewable projects that are as stringent as those for coal-fired power projects. This is likely to make standalone solar and wind projects less attractive for IPPs. Together, these demand- and supply-side forces could make energy storage a standard component of all new renewable projects.

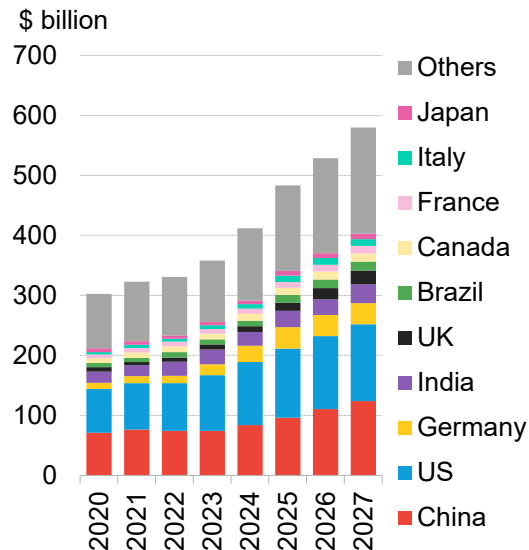
## Challenges and possible responses to new deviation settlement rules implemented in April 2026

| Technology                                  | Main challenge                                                                                                         | Areas for new investments by project developers                           |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Standalone solar, wind or wind-solar hybrid | Measured deviations will increase as the reference point shifts to scheduled generation rather than available capacity | Granular weather data and artificial intelligence-based forecasting tools |
| Standalone energy storage                   | Deviation penalties depend on grid frequency, which is beyond project operators' control                               | Battery management systems                                                |
| Renewables paired with storage              | Penalties depend on which technologies are injecting to or withdrawing from the grid                                   | Separate forecasts for each technology within a project                   |

Source: BloombergNEF, Central Electricity Regulatory Commission.

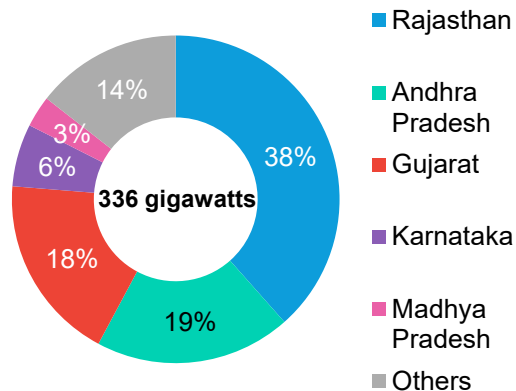
# India is the fourth-largest spender on grids globally, second in Asia Pacific

## Global grid investment by country



Source: BloombergNEF. Note: Data as of Dec. 1, 2025. Investments include transmission and distribution segments.

## Share of evacuation potential for new clean power projects by state under India's grid expansion plan

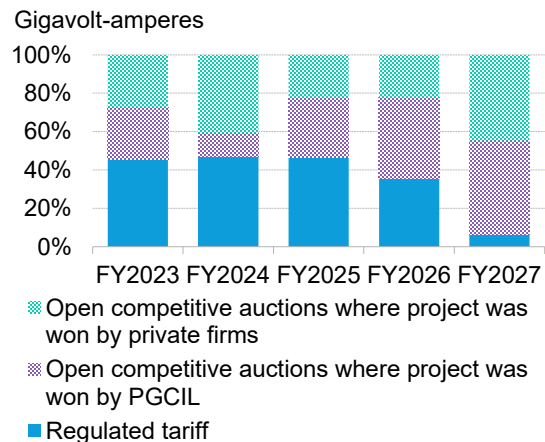


Source: Central Electricity Authority, Central Transmission Utility, India Investment Grid, Central Electricity Regulatory Commission, Power Grid Corp., PFC, REC, BloombergNEF. Note: Data as of Oct. 31, 2025. The 336GW total is based on BNEF calculations.

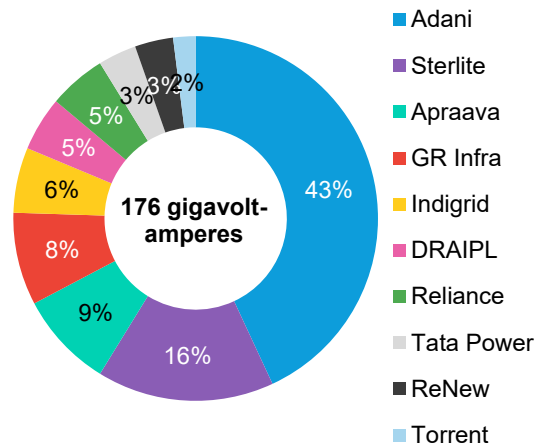
- India was the world's fourth-largest market for transmission grid investment in 2025 and is expected to remain a major spender through 2027.
- BNEF estimates that India's 2024 interstate transmission expansion plan to 1Q 2032 will provide grid connection capacity for 336GW of renewable power-generating capacity.
- The Central Transmission Utility of India (CTUIL) updates the buildout through annual rolling plans, providing greater visibility on where new transmission infrastructure is required and helping align grid development with the renewable project pipeline.
- The federal government approved 1.86 trillion rupees (\$19.6 billion) for the third tranche of the Green Energy Corridor program in September. About three-quarters of funding will expand intra-state transmission networks, enabling the grid to accommodate 135GW of renewable projects through March 2033. The remainder will fund battery energy storage projects.

# India wants more private firms to support a faster grid expansion

## Share of substation capacity addition by expected commissioning year and award mechanism

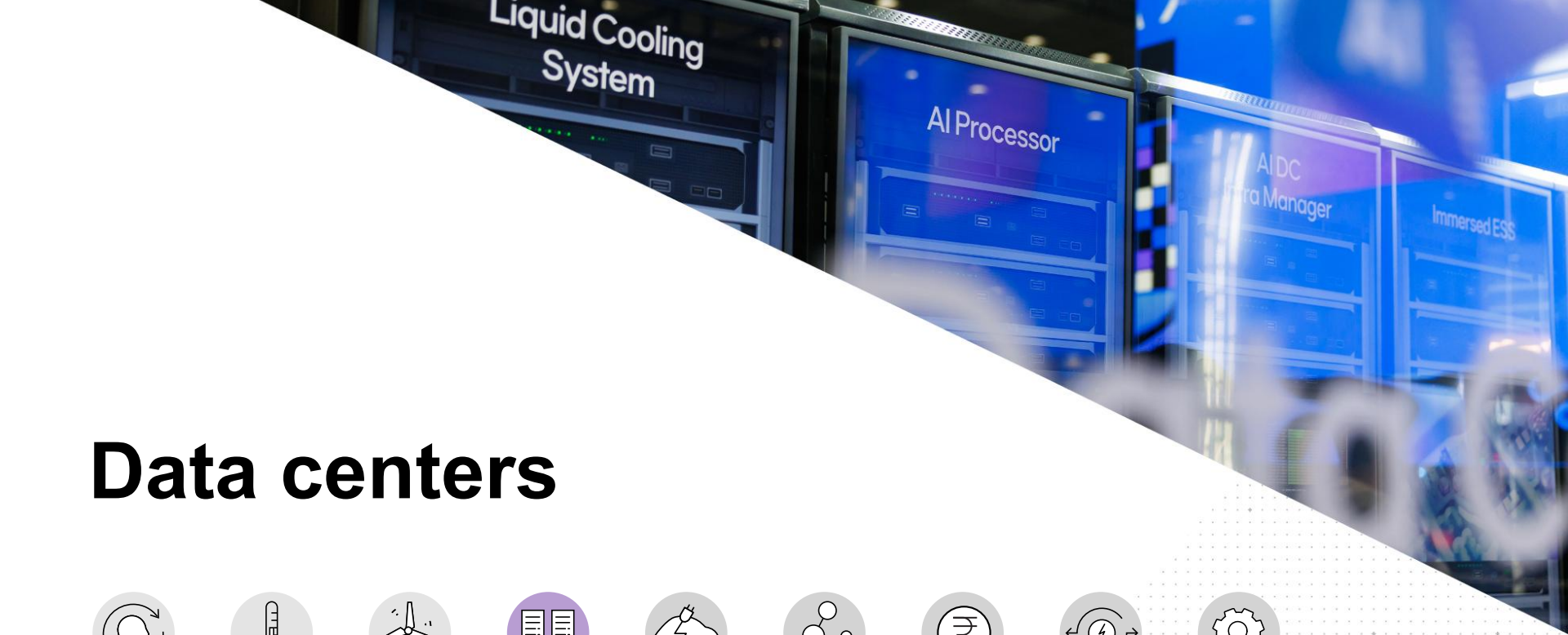


## Substation capacity additions listed under the grid expansion plan won by private developers



- India is awarding a growing share of transmission projects through auctions, opening grid buildout to private developers.
- Private companies secured nearly half of the federal transmission projects identified under the 2024 grid expansion plan for commissioning in the fiscal year ending March 2027.
- BNEF data compiled through March 2026 show that private developers were awarded projects totaling 176 gigavolt-amperes of substation capacity, which includes 23,589 circuit kilometers under the federal grid expansion plan.
- Renewable energy project developers are also building transmission projects, giving them greater strategic control over grid access and potentially helping connect their power plants to the grid more quickly.

Source: Central Electricity Authority, Central Transmission Utility of India, BloombergNEF. Note: FY2023 refers to the financial year running from April 2022 through March 2023. Regulated tariff refers to the cost-plus tariff mechanism. Auctions refer to tariff-based competitive bidding. PGCIL refers to Power Grid Corp. India. Data are based on public disclosures accessed through March 31, 2026. DRAIPL refers to Dineshchandra R. Agrawal Infracon.



# Data centers



Energy  
transition  
leadership



Clean energy  
and climate  
targets



Clean  
power



**Data  
centers**



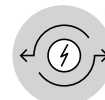
Electric  
vehicles



Green  
ammonia



Investment



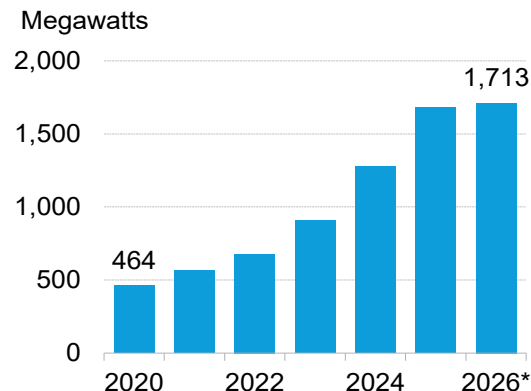
Long-term  
outlook



Learnings,  
challenges and  
opportunities

# India IT capacity quadruples as growth spreads beyond Maharashtra hub

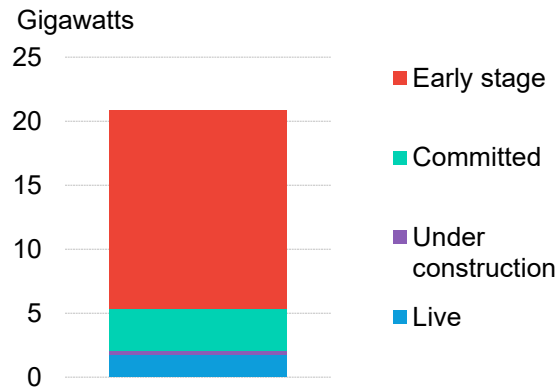
## India's cumulative live IT capacity



Source: BloombergNEF, DC Byte. Note: \*Data as of June 2026.

- India's live IT capacity has quadrupled in six years to about 1.7GW but stands at only roughly 1 watt per capita, leaving substantial room for growth. Maharashtra hosts 56% of this capacity, supported by its subsea cable infrastructure and concentration of corporate demand.

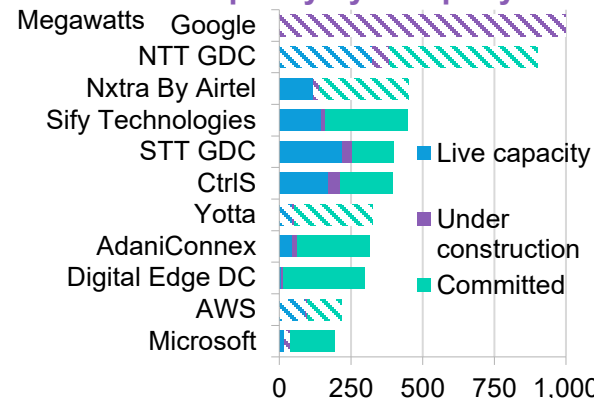
## India's pipeline IT capacity



Source: BloombergNEF, DC Byte. Note: \*Data as of June 2026.

- India has 350MW of data centers under construction, with another 3.3GW committed and 15.5GW in earlier development. Hyperscalers and AI are driving growth, with about one-third of the pipeline in Maharashtra. Other states are also beginning to attract projects.

## India's IT capacity by company

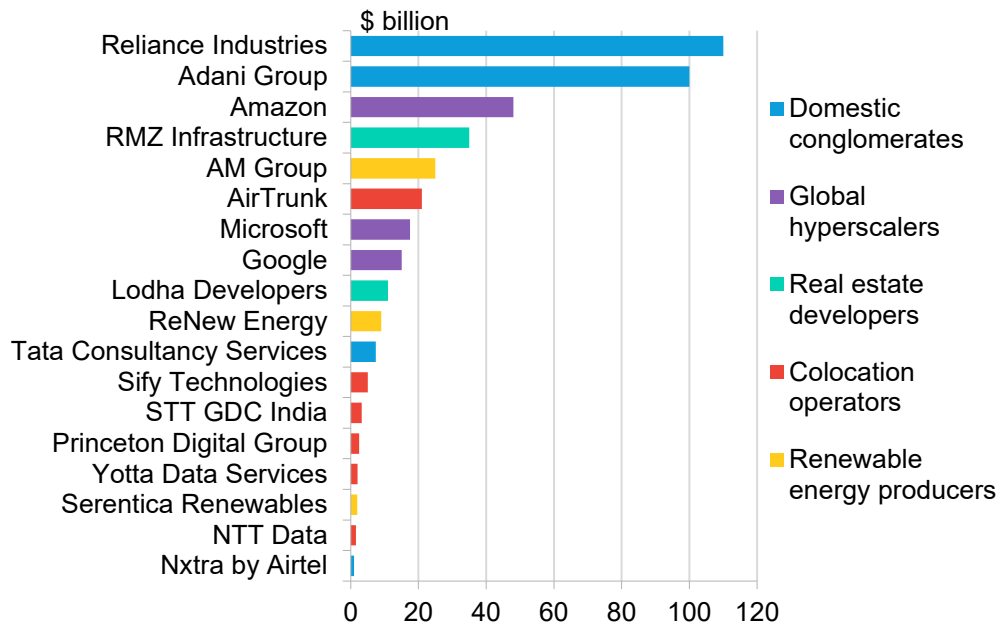


Source: BloombergNEF, DC Byte. Note: Dashed bars represent foreign companies; solid bars represent domestic companies. Data as of April 2026.

- Foreign operators NTT GDC and STT GDC lead live capacity in India, supported by early market entry and global customers. Google and NTT also have large projects in the pipeline, while Indian operators such as CtrlS, Sify and Yotta are expanding to serve hyperscale and AI demand.

# Investment announcements signal a new hyperscale AI era in India

Data center investment commitments in India by major domestic and foreign companies

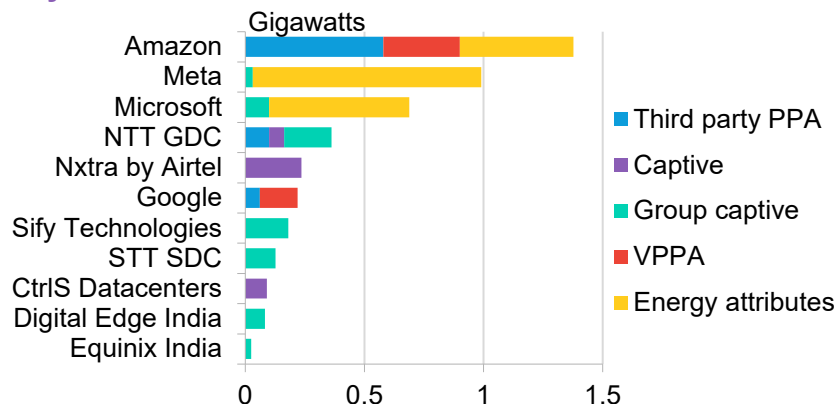


Source: BloombergNEF. Note: Data as of August 2026. STT GDC is STT Global Data Centers.

- India's data center pipeline is increasingly dominated by large hyperscale artificial intelligence (AI) projects, a departure from the colocation facilities that make up most of the existing market.
- Colocation data centers provide shared infrastructure, including space, power, cooling and connectivity to multiple customers. Colocation accounted for 88% of India's cumulative data center market as of 1H 2026, while hyperscale AI data centers made up 95% of new capital investment announcements tracked by BNEF.
- Companies are announcing gigawatt-scale projects backed by billions of dollars in new investment. Google is developing a 1GW AI data center in Visakhapatnam, while Tata Consultancy Services has announced a project of the same size in Hyderabad. Indian conglomerates Adani Group and Reliance Industries have also announced a combined \$210 billion of investment in hyperscale AI campuses.

# Renewables cut power costs and help meet corporate clean-energy targets

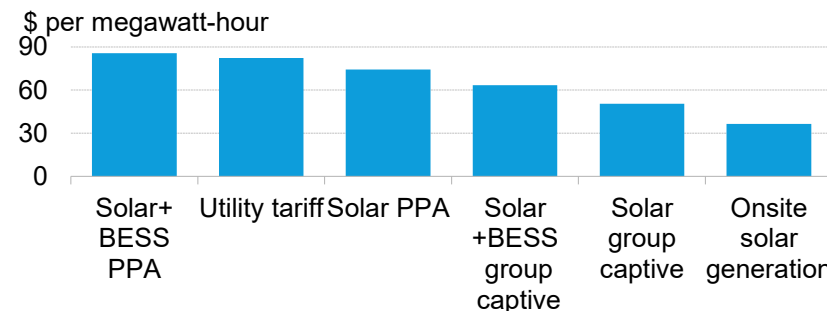
Clean power procured by data centers in India, as of July 2026



Source: BloombergNEF. Note: VPPA refers to virtual power purchase agreement.

- Data-center operators in India can use several clean-power procurement routes depending on the project's size, location and risks. Some hyperscalers favor virtual power purchase agreements (VPPAs) and renewable energy certificates, which indirectly support development of new renewable projects without changing the electricity physically supplied to facilities.

Average landed cost of different power procurement methods



Source: BloombergNEF. Note: Landed costs are calculated using the average across Maharashtra, Andhra Pradesh and Tamil Nadu. BESS is battery energy storage system. PPA is power purchase agreement.

- Companies can buy renewable electricity directly from generators through PPAs. Solar generation costs in India are low at about \$36/MWh, but utility network charges raise the landed cost. Colocation operators often use onsite captive or offsite group-captive projects, where they own or jointly the generating assets, to reduce these charges. Compared with utility tariffs, data centers can save about \$32/MWh with group-captive solar and \$19/MWh with group-captive solar-plus-storage projects.

# State policies cut data-center build costs and support renewable adoption

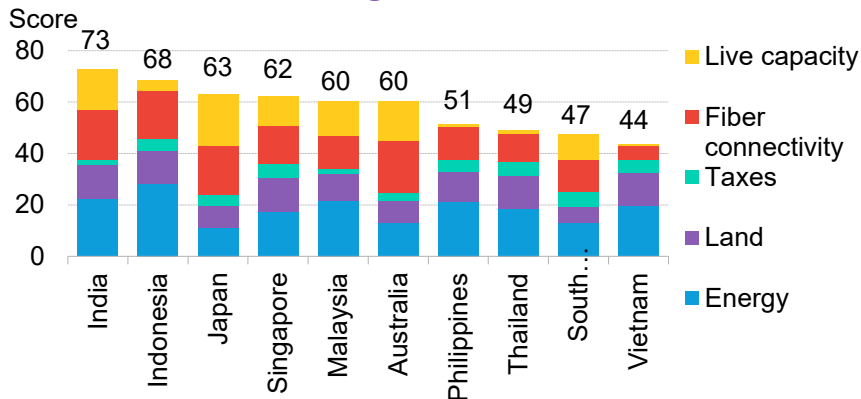


Source: BloombergNEF. Note: Capital subsidies apply to eligible fixed capital investments, excluding land and chips. Green cells indicate that an incentive is available in the state, red cells indicate that it is unavailable, and yellow cells indicate that it is conditional. RE refers to renewable energy.

- States are using data center policies, capacity targets and incentives to attract investment, while increasingly linking support to renewable energy use.
- Policies in Karnataka and Uttar Pradesh also promote efficiency measures such as power usage effectiveness (PUE) and water usage effectiveness (WUE), alongside sustainable data center parks. Maharashtra has raised its 2030 target for green data-center parks to 20 from three. Karnataka and Uttar Pradesh offer further incentives to data centers meeting minimum renewable-energy consumption thresholds, including higher capital subsidies, lower interest rates on term loans and green-power tariff reimbursements.
- The federal government also provides a tax holiday through 2047 for eligible foreign companies that use India-based data centers to provide cloud services globally. This could further accelerate domestic data-center development serving overseas customers.

# India leads selected Asia-Pacific markets in data center development as power demand rises

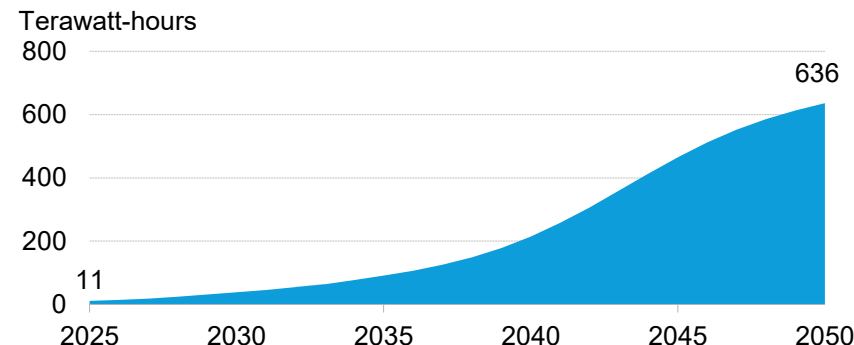
## BNEF's data center siting score



Source: BloombergNEF

- India is one of the fastest-growing data center markets in Asia Pacific. A large domestic digital economy, an expanding fiber network, competitive power costs and supportive state policies underpin its position.
- India offers an average industrial power tariff of \$89/MWh, which is reduced further by state level incentives such as electricity tax exemption. India's power-generation capacity has also expanded at a compound annual growth rate of 7.1% since 2021.

## India's data center power demand under BNEF's Economic Transition Scenario

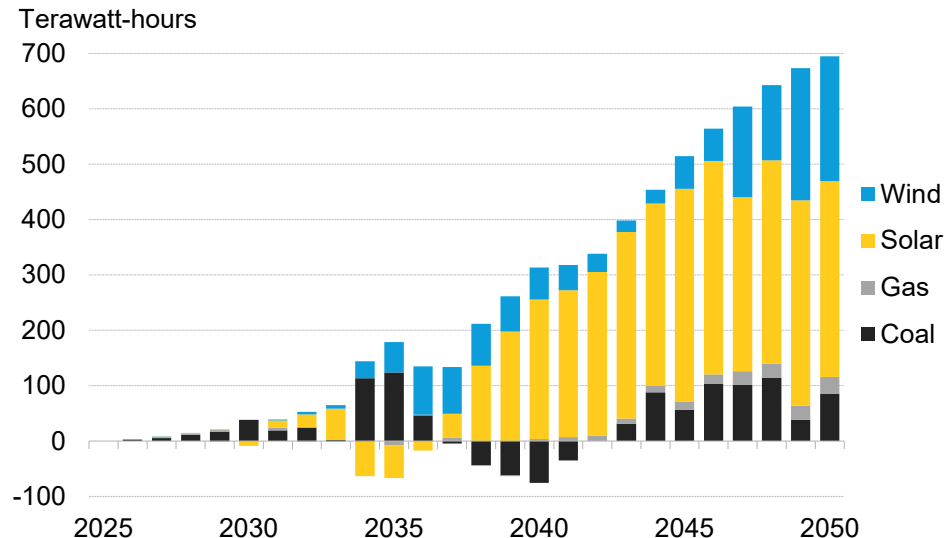


Source: BloombergNEF

- Clear zoning laws and single-window portals reduce land-acquisition hurdles. Land-permitting timelines can also be shorter when sites are acquired through state government agencies. Incentives such as land subsidies, land-conversion fee exemptions, building-fee rebates also help developers.
- Under BNEF's ETS in *New Energy Outlook 2026* ([web](#) | [terminal](#)), India's data center power demand rises to 636TWh by 2050, equivalent to 11% of total electricity consumption, from 11TWh in 2025.

# Coal meets near-term data center demand before clean power gains ground

## Incremental generation for data-center electricity demand under BNEF's Economic Transition Scenario



- Coal supplied 68% of India's electricity in the first seven months of 2026, leaving grid-connected data centers exposed to high-emissions-intensity power.
- Existing coal plants are relatively cheap to operate and can provide round-the-clock electricity, allowing them to meet much of the additional near-term demand in the ETS.
- Under the ETS, solar generation rises sharply from 2037, while wind also makes a material contribution and the share of coal in incremental generation declines. Batteries support this transition by shifting low-cost daytime solar generation into non-solar hours.
- In 2041, the levelized cost of electricity of a new solar-plus-storage project falls below the marginal running cost of an existing coal plant. This further strengthens the economics of clean, firm power relative to coal.

Source: BloombergNEF. Note: Data are from New Energy Outlook 2026. The Economic Transition Scenario is BNEF's assessment of how the energy economy could evolve due to cost-based technology change to 2050. It combines near-term market activity, the uptake of new consumer-facing energy products, least-cost system modeling and trend-based analysis to describe the deployment of commercially available technologies. The chart shows technologies producing more than 0.1 terawatt-hours.

# Electric vehicles



Energy  
transition  
leadership



Clean energy  
and climate  
targets



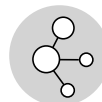
Clean  
power



Data  
centers



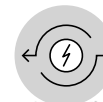
**Electric  
vehicles**



Green  
ammonia



Investment



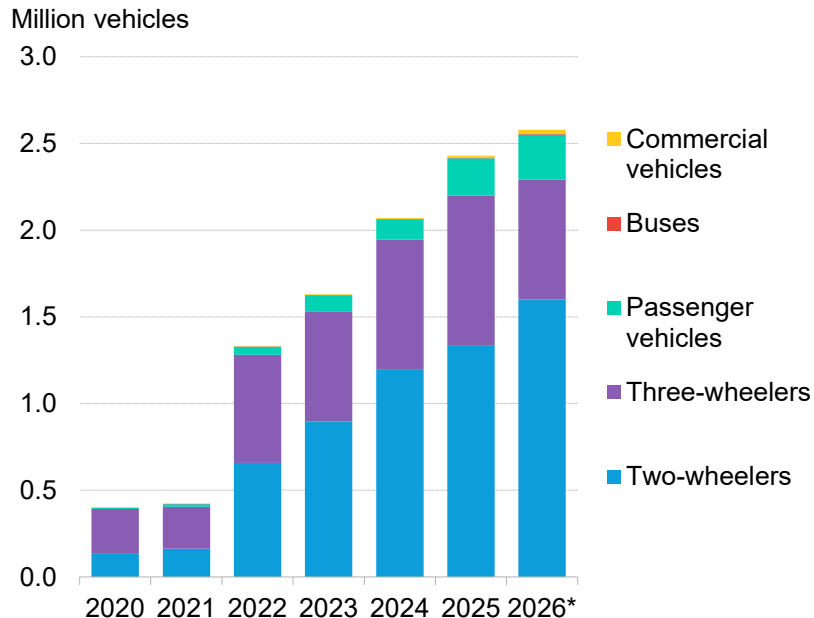
Long-term  
outlook



Learnings,  
challenges and  
opportunities

# Policy support and expanding model choice drive EV sales

## India electric vehicle sales by segment



Source: Ministry of Road Transport and Highways, JATO Dynamics  
BloombergNEF. Note: \*Data for 2026 as of Oct. 7.

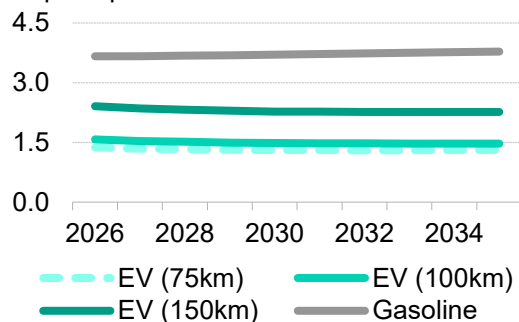
- **Two- and three-wheelers** lead transportation electrification in India. Lower operating costs, greater model availability and upfront purchase subsidies have helped boost sales in both segments.
- **Passenger EV** sales are growing as automakers expand model options in the high-volume compact sport utility vehicle segment. Demand is concentrated among urban commuters.
- Policy support, including subsidies and payment-security mechanisms, has boosted sales of **electric buses** for use in government-owned fleets. Purchases are typically made through centralized tenders, where the federal agency Convergence Energy Services Ltd. aggregates demand across multiple states.
- **Commercial vehicles** have been the slowest segment to electrify, although adoption is growing in the sub-3.5-metric-ton segment as companies seek to decarbonize last-mile and intra-city delivery fleets.
- In 2025, EV sales across passenger vehicles, commercial vehicles, buses, and two- and three-wheelers displaced 89,000 barrels per day of oil demand in India, including fossil-fuel and bio-derived gasoline, diesel and liquefied petroleum gas. This is equivalent to about 4% of oil demand that year.

# Lower lifetime ownership costs favor EVs in several segments

## Total cost of ownership of battery electric vehicles vs. internal combustion engine by segment

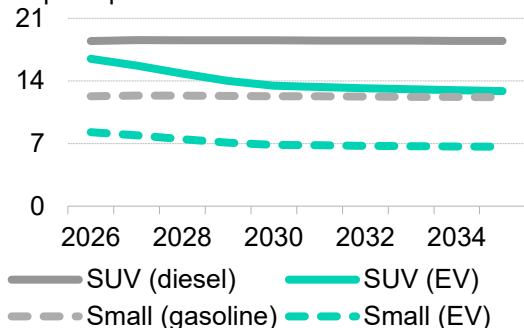
### Two-wheelers

Rupees per kilometer



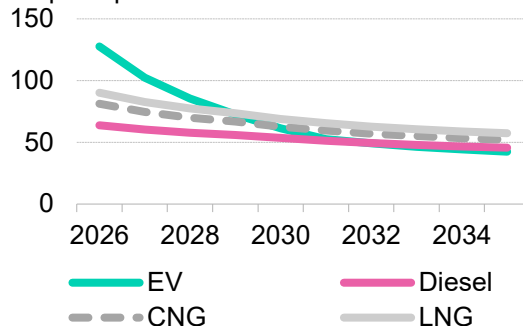
### Passenger vehicles

Rupees per kilometer



### Heavy commercial vehicles

Rupees per kilometer



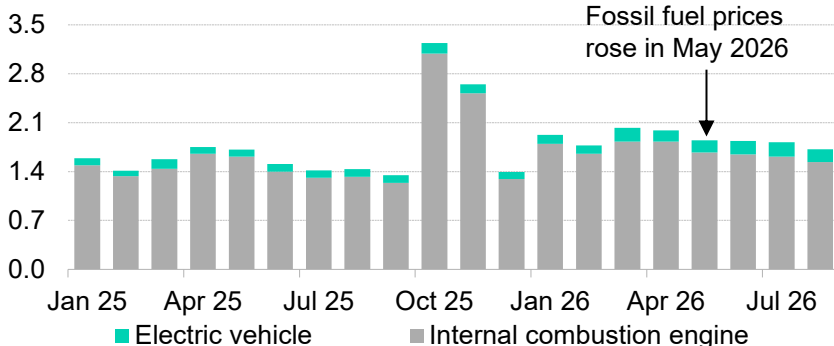
Source: BloombergNEF. Note: Assumes a vehicle life of 10 years for two-wheelers and passenger vehicles and five years for commercial vehicles. Vehicles on long-haul cycles cover more than 100,000 miles. CNG is compressed natural gas. LNG is liquefied natural gas. SUVs are sport utility vehicles.

- EVs already have lower total ownership costs (TCOs) than comparable internal combustion engine vehicles in the two-wheeler and passenger vehicle segments, assuming annual mileage of 9,125 kilometers and 12,775 kilometers respectively. Electric trucks on long-haul duty cycles are not expected to reach cost parity with diesel variants until after 2030 because of the large batteries needed to provide sufficient range.
- Despite favorable TCOs across most vehicle segments, EVs still face barriers to uptake, including concerns around resale value, charger availability and limited access to affordable finance (see [page 63](#) for more on focused interventions to boost adoption).

# Electric two-wheeler adoption has picked up due to the Iran war

## India two-wheeler sales

Million vehicles

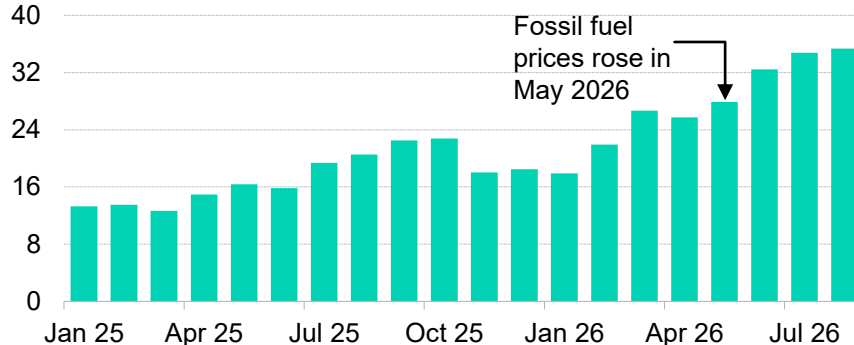


Source: Ministry of Road Transport and Highways, BloombergNEF.

- The Iran war has renewed focus on reducing dependence on imported oil. Electric two-wheeler adoption accelerated after India's state-run oil retailers, which control most of the market, raised fuel prices beginning in May. Although retail fuel pricing in the country is deregulated, the government can still influence retail prices indirectly through these companies and fuel taxes.
- Customers bought more than 1.3 million electric two-wheelers in the first eight months of 2026 – 1.6 times the volume in the same period of

## India passenger electric vehicle sales

Thousand vehicles



Source: JATO Dynamics, automaker websites, BloombergNEF.

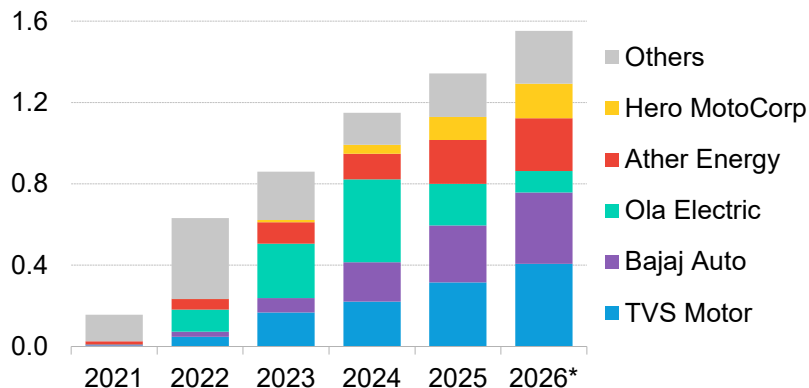
2025. The EV share of total two-wheeler sales grew to 10.7% in August 2026 from 6.7% in January.

Passenger EV uptake has also risen steadily in 2026. Uncertainty over future fossil fuel prices has bolstered demand for mass-market EVs priced at up to 1.5 million rupees (\$15,600). A wider model lineup has also helped sales.

# Domestic automakers dominate India's EV market

## India electric two-wheeler sales by manufacturer

Million vehicles

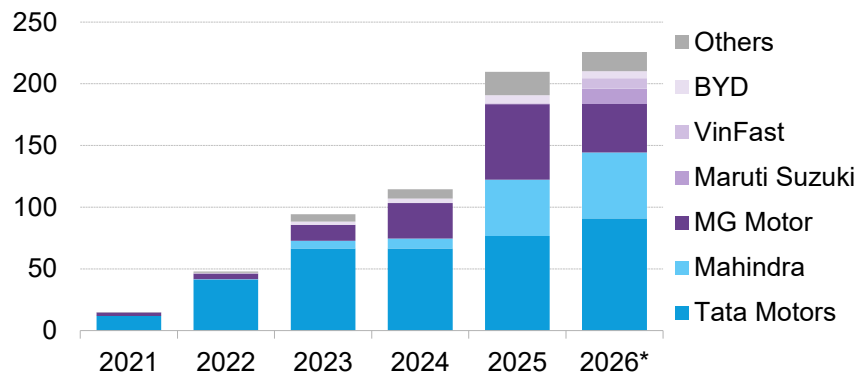


Source: Ministry of Road Transport and Highways, BloombergNEF. Note: \*Data for 2026 through September.

- India's homegrown automakers have taken the lead in EV sales, with the electric two-wheeler market supplied almost entirely by domestic players. Honda Motorcycle & Scooter India and Suzuki Motorcycle India, both major gasoline two-wheeler sellers in the country, have made little progress in EVs. Domestic players Tata Motors and Mahindra & Mahindra lead the passenger vehicle segment.

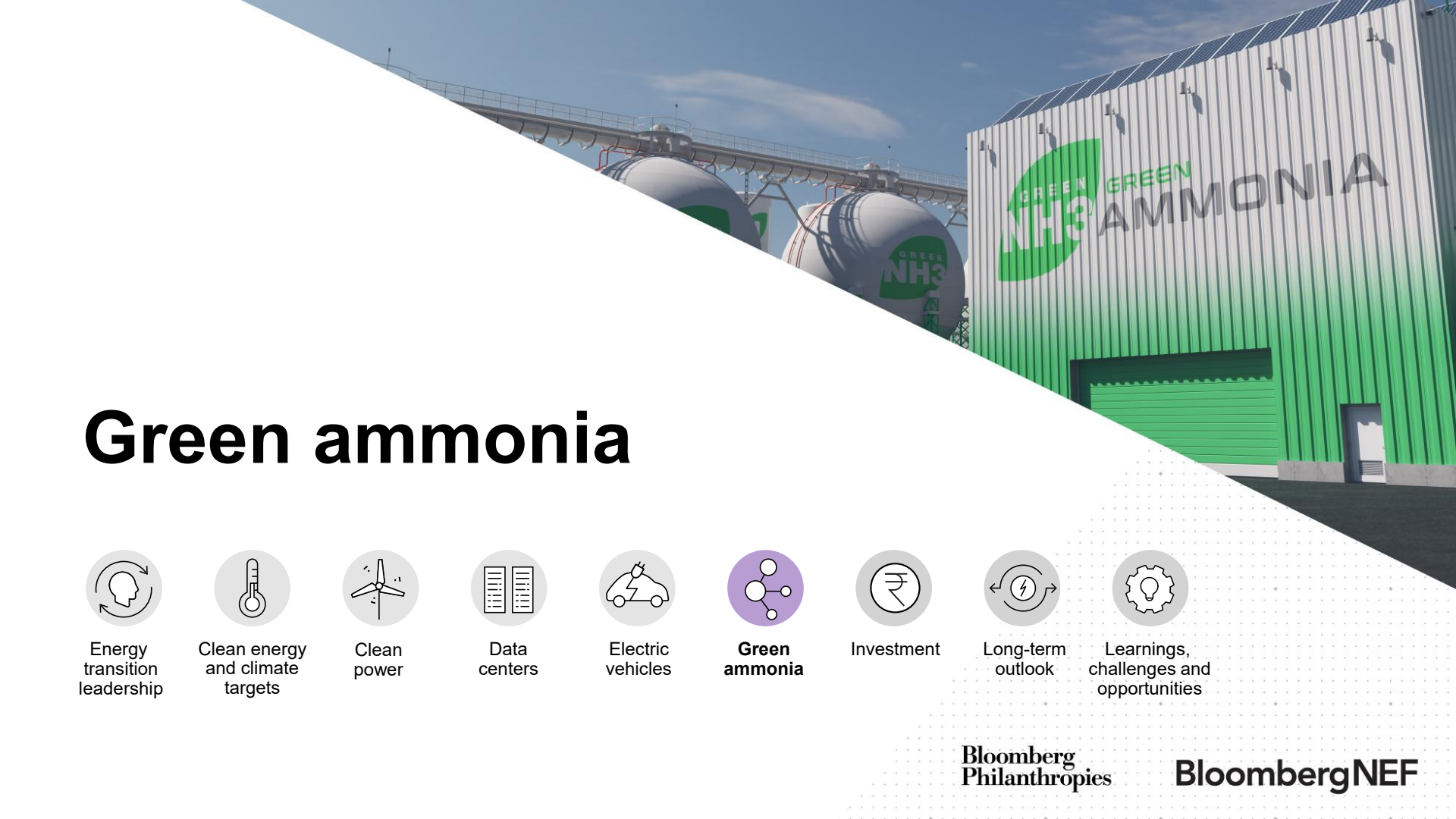
## India passenger EV sales by manufacturer

Thousand vehicles



Source: JATO Dynamics, BloombergNEF. Note: \*Data for 2026 through August.

- Manufacturers face different barriers to wider EV adoption across vehicle segments. Two-wheeler makers have yet to offer price-competitive electric models that can compete with comparable gasoline bikes on performance. Meanwhile, compressed natural gas cars are gaining popularity due to their lower operating costs, making them the biggest competitors to passenger EVs.



# Green ammonia



Energy  
transition  
leadership



Clean energy  
and climate  
targets



Clean  
power



Data  
centers



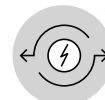
Electric  
vehicles



**Green  
ammonia**



Investment



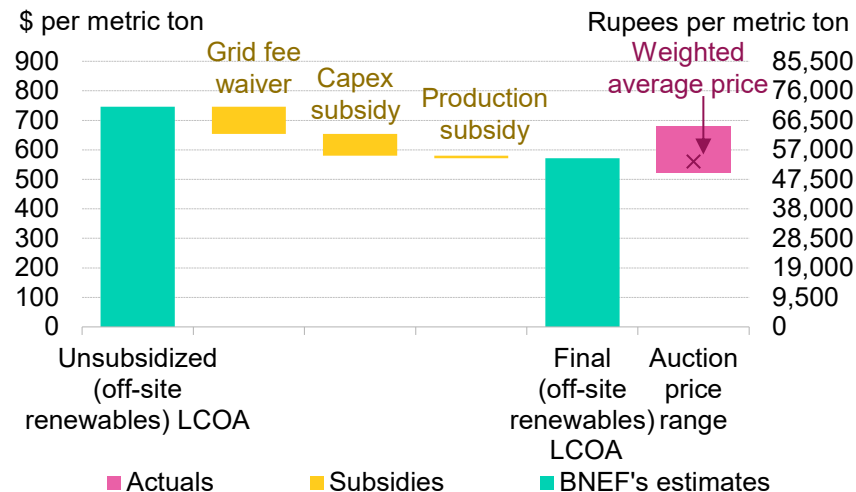
Long-term  
outlook



Learnings,  
challenges and  
opportunities

# India can produce some of the cheapest green ammonia globally

## How bidders achieved record-low green ammonia prices in a Solar Energy Corp. of India auction



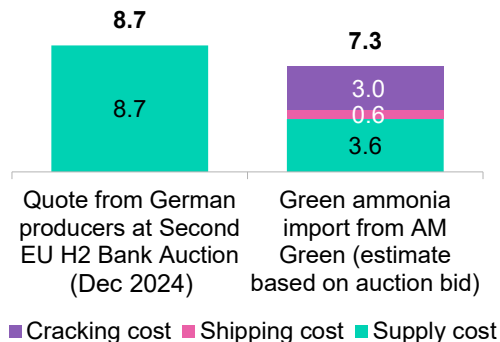
Source: Solar Energy Corp. of India, BloombergNEF. Note: Assumes an exchange rate of \$1 = 95 rupees. LCOA is levelized cost of ammonia. Interstate transmission charges are waived for green hydrogen projects. Developers receive a 30% capital expenditure subsidy in some states, such as Odisha. The calculation does not account for transmission losses.

- India's success in building low-cost renewable power is supporting its ambition to produce some of the world's most competitively priced green hydrogen and ammonia. A large interconnected grid, generous subsidies, the ability to stack incentives and competitive auctions have all helped Indian companies lower production costs.
- Electricity accounts for a significant share of green ammonia production costs. Access to low-cost clean power enables electrolyzers to operate at capacity factors above 60%, helping India produce green ammonia at about 71,000 rupees (\$750) per ton.
- Green hydrogen projects commissioned before the end of 2030 receive a 25-year waiver on federal grid transmission fees. This can reduce green ammonia costs by about \$92 per ton.
- India's federal grid allows green hydrogen producers to procure renewable electricity through power purchase agreements from projects at distant locations. This enables solar, wind and storage assets to be built where generation is optimal, with electricity transmitted to the consumption site.
- State incentives can reduce costs further. Some states, including Odisha, offer capital expenditure subsidies of up to 30%, which can reduce green ammonia costs by another \$74 per ton. Federal production-linked subsidies have a relatively small impact.

# Quest for low-cost green ammonia brings global buyers to India

## Green ammonia pricing estimates based on auction bids

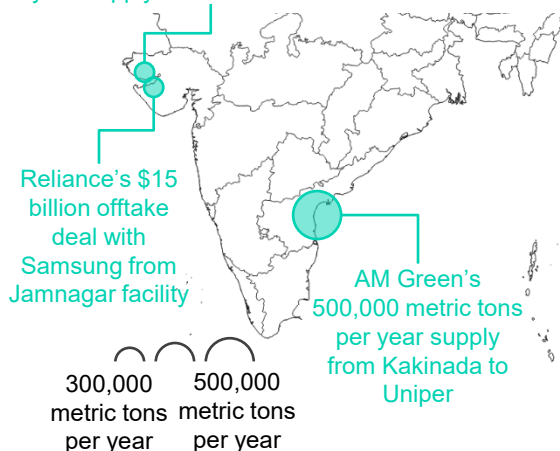
\$ per kilogram of H<sub>2</sub> equivalent



Source: European Commission, Solar Energy Corp. of India, BloombergNEF. Note: The AM Green estimate is based on its SECI 2025 green ammonia auction submission of 55,480 rupees per metric ton of green ammonia. Shipping costs for Indian green ammonia exports are assumed at \$110 per metric ton.

## Announced binding green-ammonia export agreements from India

L&T's 300,000 metric tons per year supply from Kandla to Itochu



Source: BloombergNEF, public disclosures. Note: Binding offtake agreements refer to those that have been publicly disclosed. Supply destination is based on the offtaker's headquarters location.

- India's low-cost clean ammonia is translating into firm demand from global buyers.
- Indian firms signed three major binding offtake agreements through April 2026, representing more than 1 million metric tons of annual green ammonia exports.
- The largest is Uniper's January 2026 agreement with AM Green for 500,000 metric tons a year of green ammonia from the latter's Kakinada facility. BNEF estimates that procuring clean ammonia from India could be cheaper for Uniper than sourcing ammonia produced domestically in Germany.
- Long-term bilateral contracts with Indian firms could offer buyers an advantage beyond cost by securing clean ammonia at fixed prices for extended periods, limiting their exposure to price volatility and potential supply disruptions.

# Investment



Energy  
transition  
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Clean energy  
and climate  
targets



Clean  
power



Data  
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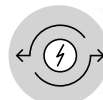
Electric  
vehicles



Green  
ammonia



**Investment**



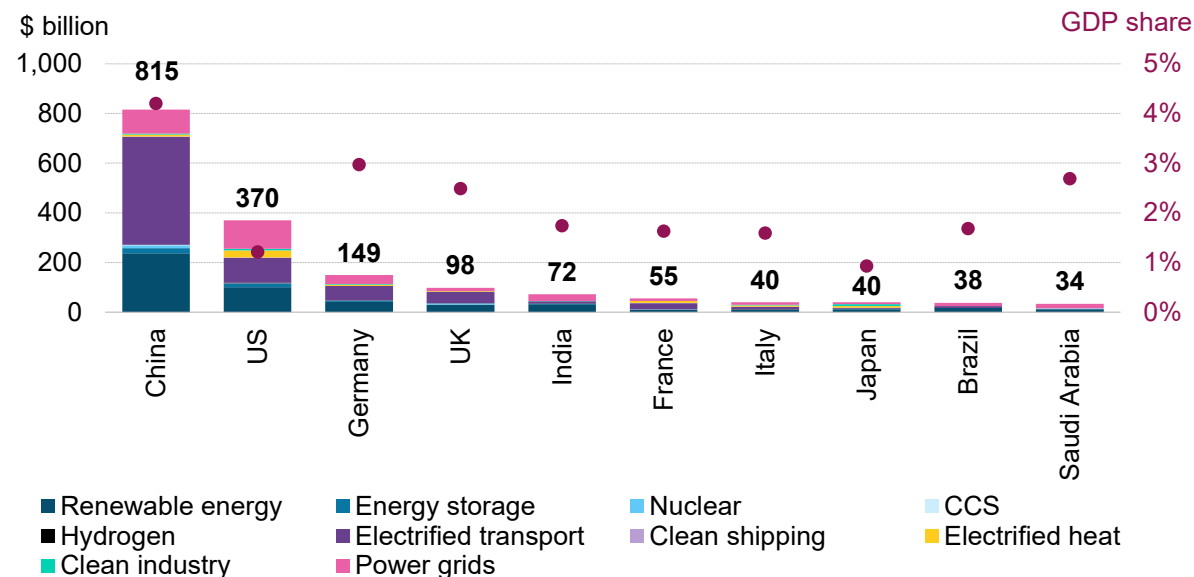
Long-term  
outlook



Learnings,  
challenges and  
opportunities

# India is the world's fifth-largest market for energy transition investment

## Energy transition investment and GDP share in 2025, top 10 economies



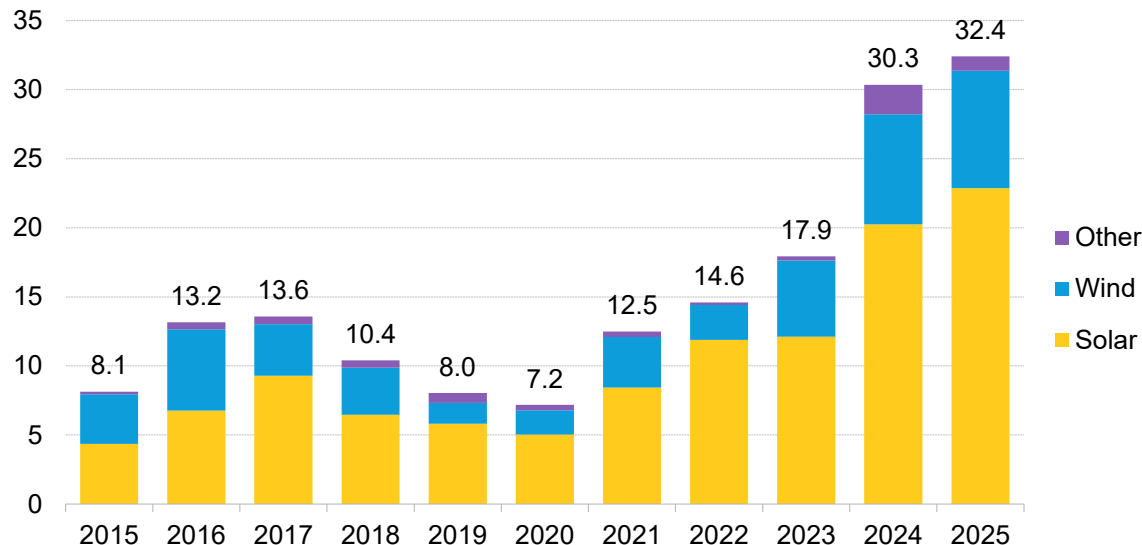
- India rose one spot to fifth globally for absolute energy transition investment attracted in 2025, according to BNEF's annual tally. Energy transition investment deployed reached \$72 billion, up 15% from 2024. That lifted India above France in the global ranking.
- Energy transition investment denotes real-economy investment commitments and spending to deploy clean technologies such as renewable energy, EVs, heat pumps, hydrogen and carbon capture. It also includes investment in the grid to enable greater electrification of transport and industry.
- Energy transition investment deployed in India in 2025 was equivalent to about 1.7% of the country's gross domestic product (GDP), on par with major economies such as France, Italy and Brazil.

Source: BloombergNEF. Note: GDP is gross domestic product. CCS is carbon capture and storage.

# Renewable energy investment continues to set new records

## India renewable energy investment

\$ billion

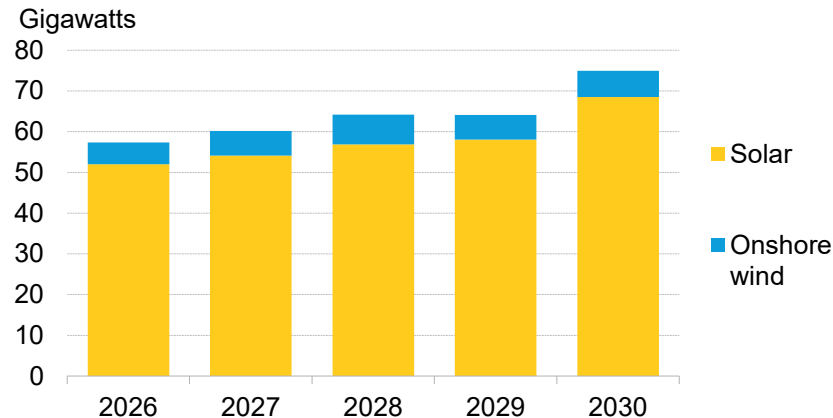


Source: BloombergNEF. Note: Includes new asset finance for renewables and investment in small-scale solar. Solar includes solar thermal, utility-scale photovoltaic (PV) projects and small-scale solar. Other includes biomass, waste-to-energy and small hydro.

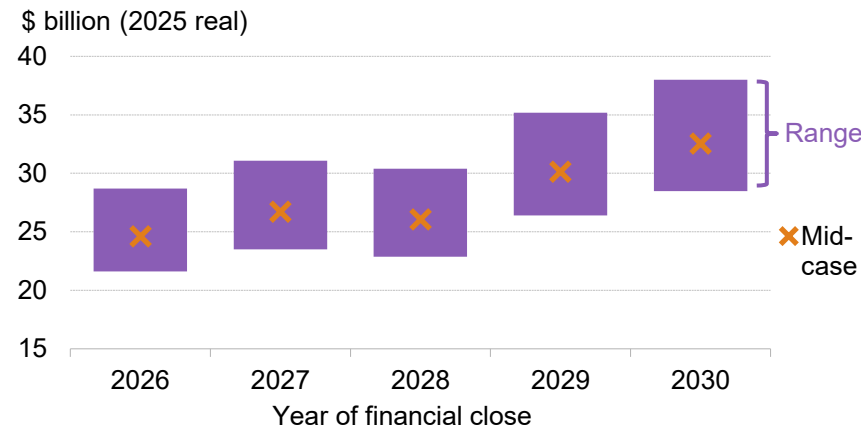
- India is the world's fourth-largest market for investment in new renewable energy projects, behind China, the US and Germany.
- Annual renewable energy investment in India reached \$32.4 billion in 2025, up from a low of \$7.2 billion in 2020 and rising every year since. The figure captures new debt and equity commitments for building renewable energy capacity. Solar is the largest segment, accounting for about two-thirds of the total.
- Renewable energy investment in 2026 is likely to remain near 2025 levels, with \$15.4 billion committed in 1H 2026, according to data tracked by BloombergNEF.
- India's renewable energy sector attracted \$10.8 billion of cumulative foreign direct investment in the three years through March 2026, according to government data.

# India's wind and solar build will require \$123 billion to \$163 billion through 2030

## BNEF wind and solar build forecast



## Annual investment needs for wind and solar projects



Source: BloombergNEF. Note: The left-hand chart shows solar capacity in gigawatts (direct current). The right-hand chart assumes capital expenditure of \$310-424 per kilowatt (DC) for solar and \$799-952/kW for wind. Financial close is assumed to occur one year before commissioning. Projects forecast for 2027 are therefore shown as being financed in 2026.

- From 2026 to 2030, BNEF's bottom-up forecasts show that India will add 52-69GW(DC) of solar and 5.4-7.4GW of wind every year. The economic attractiveness of these technologies, supportive government policies and decarbonization targets are driving investment.
- Such a build rate would mean that India's wind and solar sectors require \$123 billion to \$163 billion in real 2025 dollars of new-build project finance from 2026 to 2030. This assumes current capex levels remain unchanged and projects are financed one year before commissioning.

# Long-term outlook

The view to 2050



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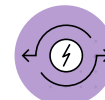
Electric  
vehicles



Green  
ammonia



Investment



**Long-term  
outlook**



Learnings,  
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# Energy and climate scenarios for the transition to a low-carbon economy

This report builds on the results of the *New Energy Outlook 2026*, BNEF's latest energy and climate scenarios. The *New Energy Outlook* models the power, transport, industry and buildings sectors to 2050 using bottom-up subsector models for 20 markets and regions. It covers 16 subsectors and more than 75 decarbonization technologies.

The core scenario used in BNEF's research is our Economic Transition Scenario (ETS). This lays out how commercially available technologies could be deployed based on the underlying economic fundamentals of the energy transition, in the absence of new policy regimes. It employs a combination of near-term market analysis, least-cost modeling, and consumer uptake and trend-based analysis. The Net Zero Scenario (NZS) describes a tough but achievable stretch that reaches net-zero emissions and keeps the temperature increase by mid-century well below 2C, via an orderly transition using current technologies.

## Economic Transition Scenario (ETS)

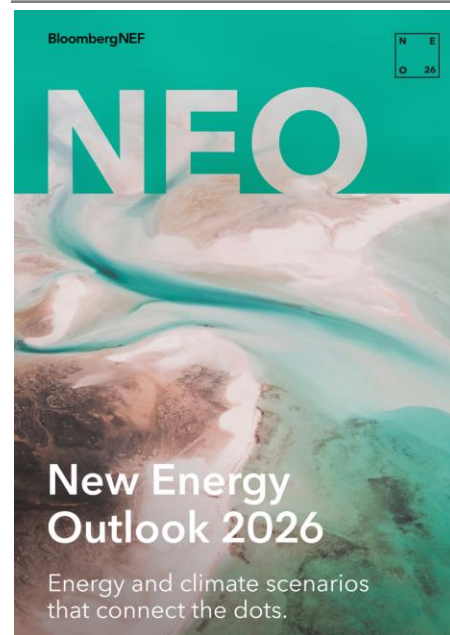
- Exploratory **base case** that describes how the power, industry, transport and buildings sectors might evolve as a result of cost-based technology changes.
- Consistent with a **2.4C** warming by 2100 outcome.
- Assumes no further policy support for the energy transition beyond existing measures.
- The low-carbon transition is largely limited to the power and transport sectors.

- Uses bottom-up subsector models at hourly and yearly granularity.
- Leverages proprietary data and the expertise of 200 analysts.
- Detailed data on country- and sector-level data inputs and results.

## Net Zero Scenario (NZS)

- Normative **climate scenario** that describes a tough but achievable stretch to get on track for net-zero emissions by 2050 by meeting sectoral carbon budgets.
- Consistent with a peak temperature outcome of **1.81C** in 2049 and **1.73C** warming by 2100.
- Limited reliance on net-negative emissions post-2050.
- Fully decarbonizes power, transport, industry and buildings by 2050.

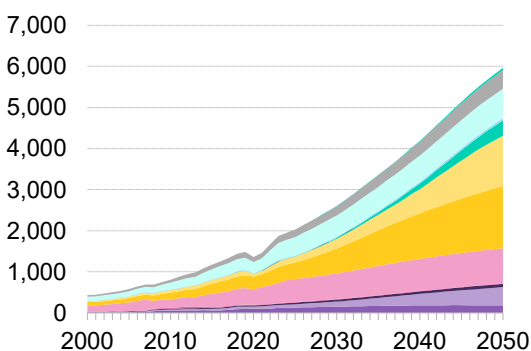
## New Energy Outlook 2026



# Buildings, air conditioning, data centers, other sectors triple power demand by 2050

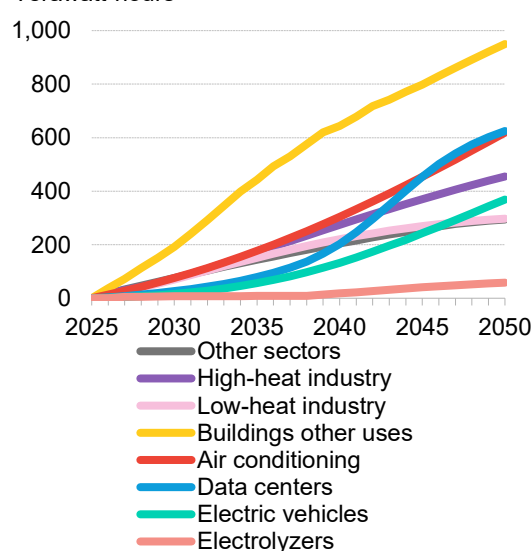
## India electricity consumption by sector BNEF's Economic Transition Scenario (ETS)

Terawatt-hours



## Net change in electricity demand 2025-2050 (ETS)

Terawatt-hours

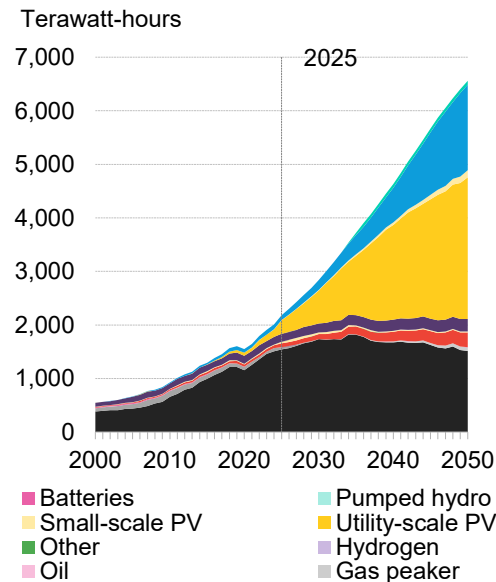


- India's electricity demand triples to about 6,000 terawatt-hours (TWh) by 2050 under BNEF's base-case Economic Transition Scenario (ETS), which uses least-cost system modeling to meet energy demand.
- Economic growth and rising incomes spur higher energy use. A warming climate accelerates air-conditioner adoption. Electricity used for cooling method increases by about 619TWh by mid-century, accounting for 14% of India's total power demand in 2050.
- Data centers become another major source of demand, accounting for 11% of India's electricity consumption by 2050.
- Demand from EVs accelerates in the 2030s as sales in mass-market segments rise. By 2050, EVs account for 7% of India's electricity demand.

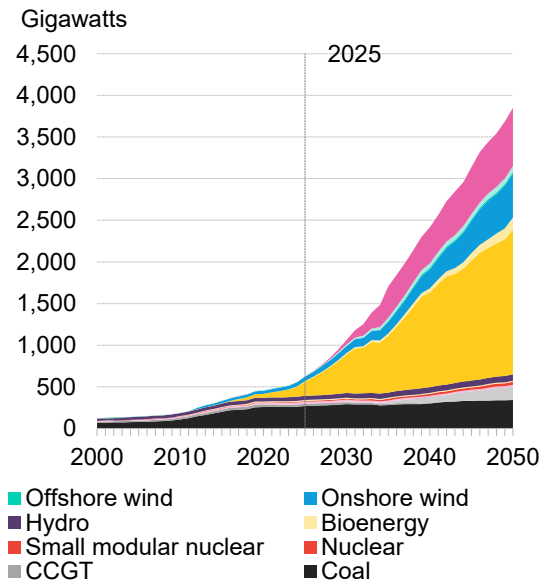
Source: BloombergNEF. Note: Excludes the energy industry's own use and losses.

# Solar and wind reshape India's power system by 2050

## Power generation by technology/fuel (ETS)



## Installed capacity by technology (ETS)

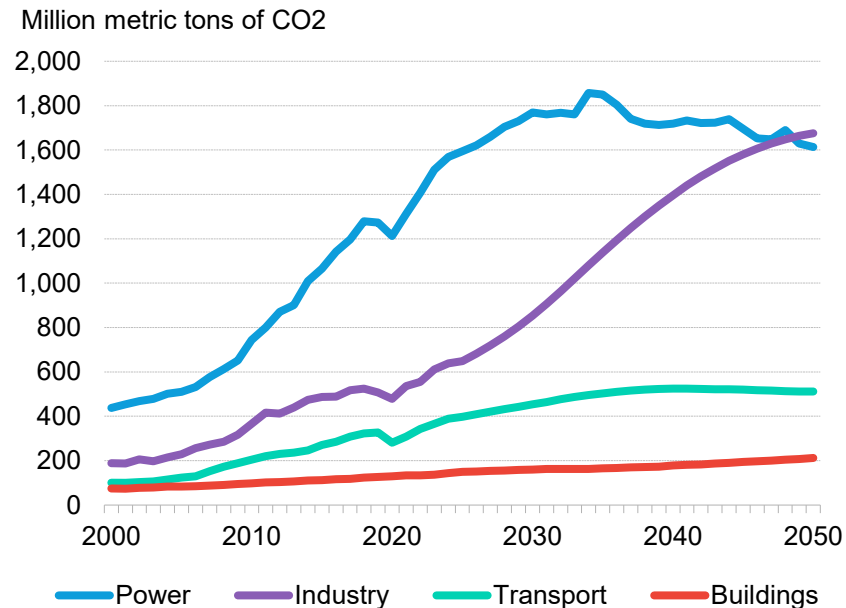


- Under BNEF's ETS, solar and wind together overtake coal in electricity generation by 2035.
- Solar and wind generate 64% of India's electricity in 2050, up from about a fifth in 2025. Coal's share falls sharply, from 71% today to 23% by mid-century.
- India's installed power generation capacity expands sixfold to about 3.9 terawatts (TW) by 2050. Solar capacity jumps 10-fold to 1.9TW, while coal remains broadly flat, with net additions of 71GW taking the fleet to 341GW.
- The growing share of variable renewables increases the need for grid flexibility and balancing. India adds about 700GW of batteries and another 65GW of pumped hydro capacity by 2050 to support intermittent power generation.

Source: BloombergNEF. Note: PV refers to solar photovoltaic. CCS refers to carbon capture and storage. CCGT refers to combined-cycle gas turbine.

# Mature cleantech alternatives in power, transport help emissions peak before 2050

## India direct CO<sub>2</sub> emissions by macro sector (ETS)

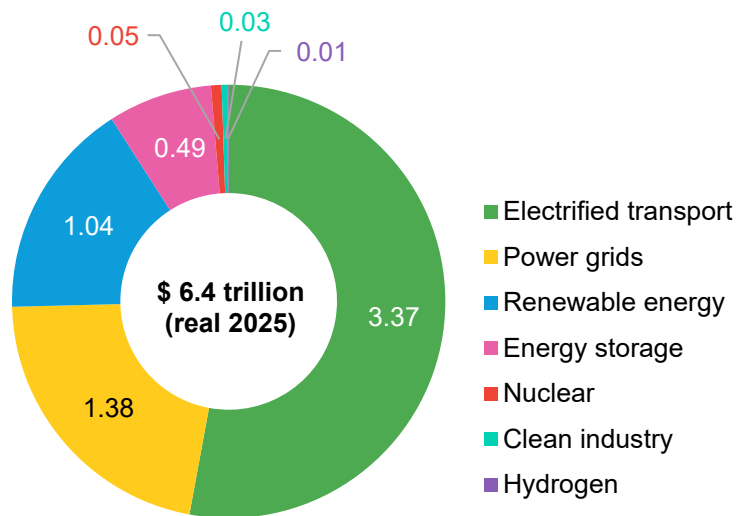


Source: BloombergNEF. Note: Excludes non-energy use.

- India's overall energy-related emissions peak in 2044 under the ETS, but the trajectory varies considerably by sector, reflecting differences in the availability and commercial maturity of clean technologies.
- The power sector, which accounted for 54% of India's emissions in 2025, is the first to peak in 2034. Non-fossil fuel technologies start to dominate electricity generation thereafter as coal's share falls below 50%.
- Transport emissions peak in 2040 as EV adoption accelerates. Oil consumption peaks that year as well.
- The industrial sector accounts for nearly a quarter of India's emissions in 2050. The lack of mature and commercially viable deep decarbonization technologies means industrial emissions continue to rise through mid-century.
- Emissions from buildings, the smallest contributor among India's macro sectors, also rise through 2050.

# EVs, grids and renewables dominate India energy transition spending

## Cumulative investment in India's energy transition by sector, 2026-2050



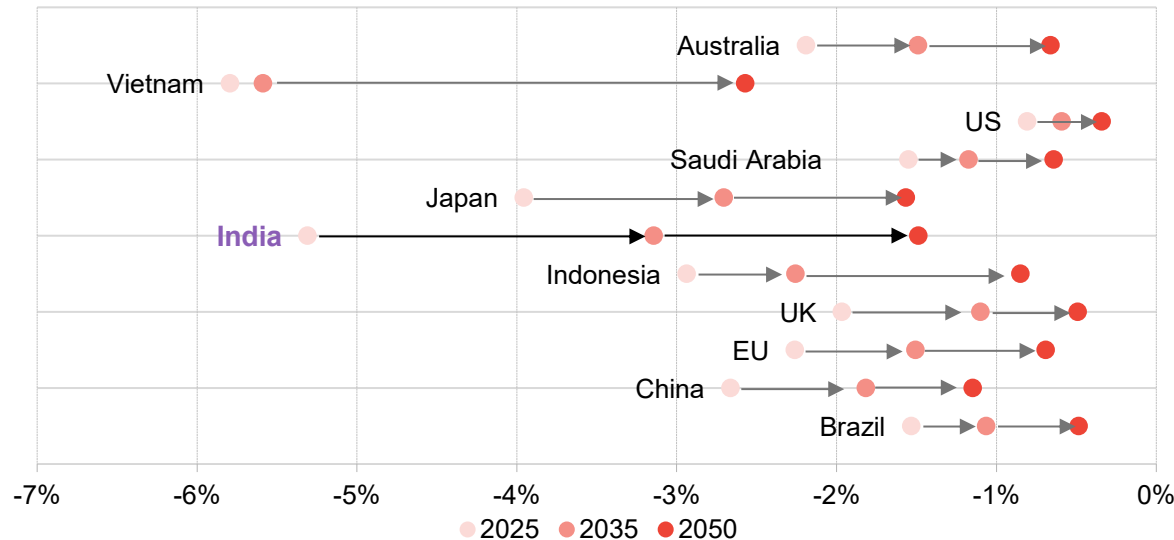
- Under BNEF's ETS, \$11.9 trillion in real 2025 dollars is invested in India's energy system from 2026 to 2050. About \$6.4 trillion of this goes to energy-transition technologies.
- Electrified transport accounts for the largest share, with \$3.4 trillion through 2050. EV sales make up \$3.3 trillion, with the remainder going toward charging infrastructure. Annual EV sales overtake those of internal combustion engine vehicles in 2040 in the scenario.
- Power grids are another major investment area as India expands and upgrades its electricity network to accommodate growing demand and electrification. Spending on new connections and grid assets, as well as reinforcement of the existing network, averages \$53 billion annually through 2050.
- Renewables and energy storage require a further \$1.5 trillion of investment through 2050. Solar and wind account for about \$0.5 trillion each. Renewable assets receive an average \$40 billion a year through 2050, while energy storage draws another \$19 billion annually.

Source: BloombergNEF

# Decarbonization sharply cuts India's exposure to energy imports

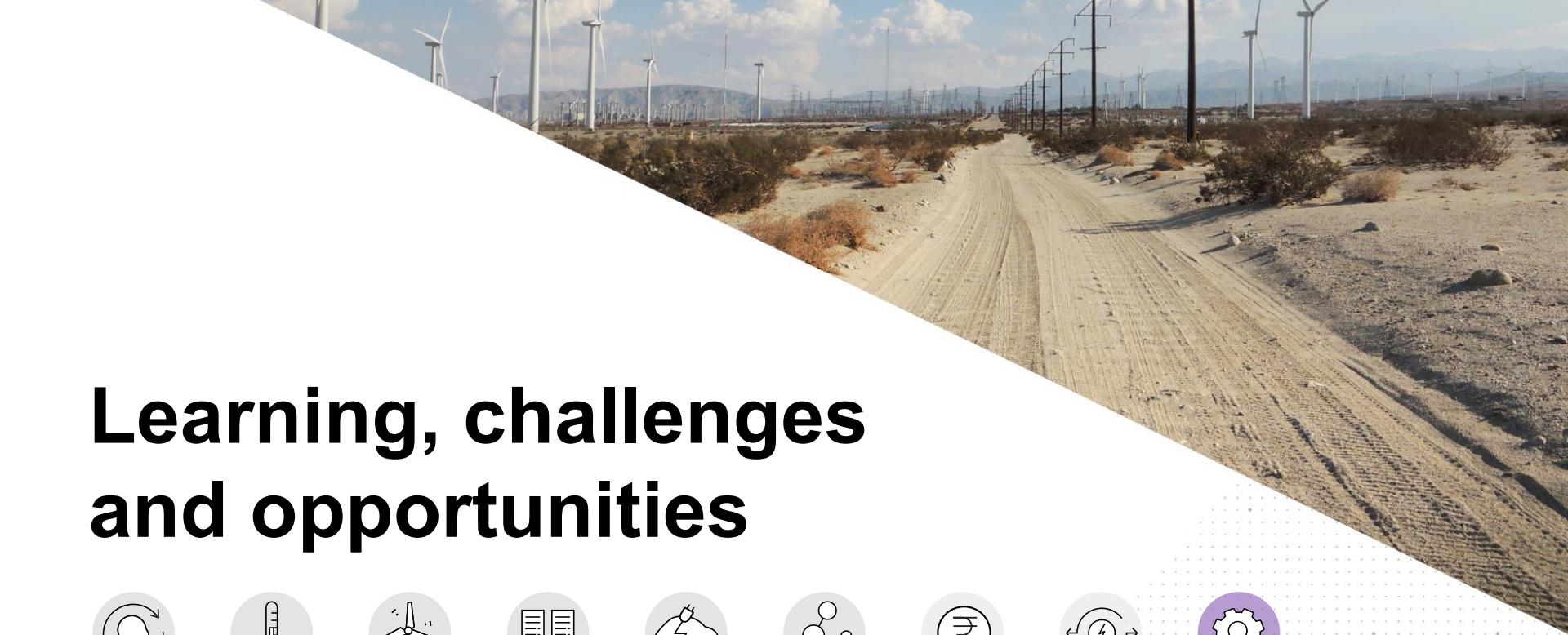
## Energy commodity import dependence under the ETS

Energy imports as share of GDP (\$, real 2025)



Source: BloombergNEF Trade Transition Scenario Tool, Sinoimex Global Trade Flow (GTF), Global Change Analysis Model (GCAM).

- Decarbonizing the economy can strengthen India's energy security. Under BNEF's ETS, the shift to cleaner technologies steadily reduces India's reliance on imported energy.
- Energy imports could fall to 3.1% of GDP in 2035, from 5.3% in 2025, before declining further to 1.5% by mid-century.
- Much of the improvement comes from transport electrification, as EVs reduce demand for imported crude oil products.
- Expanding low-cost solar and wind also reduces reliance on imported coal.
- Deeper industrial decarbonization offers India further scope to cut fossil fuel imports and strengthen energy independence.



# Learning, challenges and opportunities



Energy  
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power



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# Four trends will define India's energy and mobility transitions through 2030

India has successfully expanded its renewable energy capacity, met some of its clean power goals and kickstarted the development of newer sectors, such as green ammonia. However, challenges remain, including heavy reliance on coal-fired power generation and imported fossil fuels. Four trends will shape the next five years of the transition, bringing new challenges, risks and opportunities explored later in this section.

- **Renewables are entering their next phase.** India has successfully added large volumes of standalone wind and solar capacity. However, the rising share of intermittent generation is bringing into focus the need for faster transmission buildout, more flexible generation resources and electricity market reforms that send clearer price signals to drive new investment.
- **Electric mobility requires targeted policy intervention to continue scaling.** The Iran war has renewed focus on moving away from imported crude oil products, and sales of electric two-wheelers and passenger vehicles have risen after fuel price hikes. Different customer and vehicle segments will require different policy tools to accelerate EV adoption, ranging from mandates and tax benefits to infrastructure rollout and concessional finance.

- **Improving energy security is consistent with the transition to clean energy.** The energy transition can reinforce energy security by reducing dependence on imported energy. Energy imports fall to 3.1% of GDP in 2035, from 5.3% in 2025 under BloombergNEF's economics-led Economic Transition Scenario. Policies are creating new investment opportunities to reduce energy imports. These include support for compressed biogas and green ammonia.
- **Cutting emissions is challenging but presents opportunities.** Coal supplies about three-quarters of India's electricity, despite strong renewable energy build. Electricity demand continues to rise as incomes grow, a warming climate accelerates air-conditioner adoption, and EVs and data centers add to power use. Industry is particularly difficult to decarbonize because activity is expanding while many technologies needed for deep decarbonization remain immature or commercially uncompetitive.

# Learnings from India's energy transition policies

| Sector                                                                           | Supportive actions by India                                                                                                                                                                                                                                                                                                                  | Benefits                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                  | <ul style="list-style-type: none"> <li>Federal bulk-procurement tenders for municipal e-buses</li> </ul>                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>Automakers gain visibility on order pipelines, while bulk tenders can improve price discovery and lower bids</li> </ul>                                                                                                                                                                        |
|  | <ul style="list-style-type: none"> <li>Payment-security mechanism to reduce revenue-realization risk</li> <li>Gross-cost contracts with payments based on kilometers traveled</li> </ul>                                                                                                                                                     | <ul style="list-style-type: none"> <li>Government guarantee ensures timely payment to fleet operators</li> <li>Reduces upfront capex investment by financially strained transport utilities</li> </ul>                                                                                                                                |
|  | <ul style="list-style-type: none"> <li>Subsidies and lower taxes, followed by tighter emission standards</li> </ul>                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>Improves affordability by narrowing the price premium over gasoline vehicles</li> </ul>                                                                                                                                                                                                        |
|  | <ul style="list-style-type: none"> <li>Regulatory reforms enabling multiple corporate clean power procurement options, including different contract types and durations</li> <li>Reductions or exemptions on some utility charges for power procured from third parties</li> </ul>                                                           | <ul style="list-style-type: none"> <li>Offers customers multiple pathways more flexibility in how they procure clean power</li> <li>Improves the economics of clean power procurement</li> </ul>                                                                                                                                      |
|  | <ul style="list-style-type: none"> <li>Subsidies to accelerate uptake of distributed renewables</li> </ul>                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>Helps consumers overcome high upfront costs and reduce monthly electricity bills</li> </ul>                                                                                                                                                                                                    |
|  | <ul style="list-style-type: none"> <li>Regular updates to short- and long-term grid expansion plans, aligning transmission development with renewable energy targets</li> <li>Higher penalties for forecasting errors by renewable energy and storage projects</li> </ul>                                                                    | <ul style="list-style-type: none"> <li>Regular grid studies and transparent reporting can identify network constraints earlier, helping reduce connection delays and giving developers more clarity on investment planning and project locations</li> <li>Improves scheduling discipline and helps maintain grid stability</li> </ul> |
|  | <ul style="list-style-type: none"> <li>Evolved auction designs that value when power is delivered, rather than only the lowest electricity cost, while maintaining competition</li> <li>Provide initial subsidies for new project designs, then transition to subsidy-free contracts exposed to wholesale market price volatility</li> </ul> | <ul style="list-style-type: none"> <li>Firm and dispatchable auctions match offtakers' needs as rising renewable penetration creates periods of excess generation; they can also reduce reliance on higher-cost short-term power purchases</li> <li>The phased progression strengthens investor experience and confidence</li> </ul>  |

# How other countries are preparing for a renewables-heavy grid

- As clean energy costs have fallen, wind and solar adoption has risen rapidly in many nations around the globe. Further cost declines are likely to sustain this trend. Integrating these variable resources effectively is one of the biggest challenges facing power systems operators today.
- Approaches being pursued globally can be broadly grouped into **technological solutions**, **power market reforms** or **mechanisms that value flexibility**. This and the next page highlight examples of each from countries with different power system designs, network structures and demand-growth trajectories. These practices could potentially be adapted to support India's transition to a grid with much higher clean power uptake.

## Promoting new technologies



**Long-duration energy storage** technologies, such as pumped hydro, molten salt and compressed air storage, can help ensure uninterrupted supply during extended periods of low generation.



Lowering the **minimum operating load of coal power plants** to 25% can help reduce renewable curtailment



Building **high-voltage direct current transmission** can efficiently move power from renewable-rich areas



**Pairing batteries** on site with intermittent renewables can reduce short-term fluctuations in power fed to the grid



Deploying **synchronous condensers** can provide frequency stability, system strength and voltage control



Using **grid-forming inverters** can support renewable buildout in areas with weak grids

# How other countries are preparing for a renewables-heavy grid

## Power market reforms



**Short scheduling and dispatch intervals** (five minutes) reduce forecast errors, allow the grid operator to respond faster to variation in renewables output and can reduce curtailment of variable renewable generators



**Shorter gate closure** – the time between submitting power output schedule to actual generation – allows wind and solar plants to reduce deviations, balancing costs and potential curtailment



**Capacity markets** can improve long-term resource adequacy by trading and remunerating capacity, while helping ensure that lowest-cost technologies are selected



**Negative power prices** can help integrate renewables by signaling oversupply, encouraging flexible demand and supporting storage deployment

## Market mechanisms that value flexibility



**Procurement of ancillary services** through competitive auctions sends transparent price signals that encourage investment in fast-response generation technologies



**A stability market** competitively procures grid services, such as inertia, helping maintain grid stability cost-effectively



**Demand response programs** compensate consumers for reducing electricity use, lowering peak demand and avoiding power from expensive sources

# Potential focus areas as India accommodates more renewables

## Supply and demand-side flexibility

- Energy storage systems can make renewable generation more dispatchable and reduce short-term variability. India could **incentivize storage deployment** in different configurations (standalone and co-located with renewables) and technologies (batteries, pumped hydro and other long-duration solutions).
- Energy storage also has multiple use cases, including energy shifting, frequency regulation, grid support services and grid investment deferral. Regulatory reforms that **open additional revenue streams for storage** could enable revenue stacking, support new business models and attract investment.
- Developing an **ancillary services market** with transparent price discovery and broad participation could **create price-signals for demand and supply flexibility**.
- Government investment in open-source, **high-frequency and granular weather forecasts** in renewable-rich areas can improve accuracy of forecasting clean power generation.

## Power networks and operations

- **Expanding transmission infrastructure** help renewables-rich regions serve large demand centers more effectively.
- Investment in state-of-the-art **hardware, software and operating practices** can reduce technical losses, improve real-time system response, maintain system frequency, reduce curtailment and strengthen cybersecurity.
- **Increasing inter-regional transfer capacity** can exploit differences in the timing of renewable generation and peak demand, allowing surplus power to flow where it is needed most.
- **Strengthening the distribution grid is essential** to support rapid growth in distributed solar, including residential rooftop and agri-PV, while handling two-way power flows and minimizing curtailment.
- **Adopting market-based economic dispatch and centralized scheduling** could reduce economic curtailment of renewables and support the development of a truly pan-India grid.

Source: BloombergNEF

# Focused interventions could boost near-term EV adoption in India

## Key enablers for accelerating EV adoption in India by 2030

| Intervention type | Details                                                | Two-wheelers |            | Passenger vehicles |            | Commercial vehicles |     |     |
|-------------------|--------------------------------------------------------|--------------|------------|--------------------|------------|---------------------|-----|-----|
|                   |                                                        | Personal     | Commercial | Personal           | Commercial | LCV                 | MCV | HCV |
| Policy            | Mandatory electrification of government-owned vehicles | N.A.         |            | N.A.               |            |                     |     |     |
|                   | Phased electrification mandates                        |              |            |                    |            |                     |     |     |
|                   | Accelerated depreciation benefits                      |              |            |                    |            |                     |     |     |
|                   | Reduced tolls                                          |              |            |                    |            |                     |     |     |
|                   | Parking fee waivers                                    |              |            |                    |            |                     |     |     |
| Infrastructure    | Expansion of public charging infrastructure            |              |            |                    |            |                     |     |     |
| Vehicles          | Greater model availability                             |              |            |                    |            |                     |     |     |
| Finance           | Concessional vehicle finance                           |              |            |                    |            |                     |     |     |
|                   | Upfront purchase subsidies                             |              |            |                    |            |                     |     |     |

### Key:

Intervention can be implemented without exceptions by vehicle subsegment or buyer type

Intervention can be implemented but with exceptions

Intervention is not recommended because it is either unnecessary or difficult to implement in practice

Source: BloombergNEF. Note: Vehicles used for commercial purpose include those that are owned, operated or leased by public sector companies. LCV, MCV and HCV refer to light, medium and heavy commercial vehicles, respectively. N.A. means not applicable.

# Short-term policy opportunities to accelerate India's energy transformation

- India has steadily added electric buses to municipal fleets, supported by **bulk procurement tenders and payment guarantees**. These can continue to support deployment while upfront procurement costs of remain high.
- Renewables paired with four-hour storage are now cheaper than new coal power plants on a levelized cost of electricity basis. **Incentives that lower battery costs** could accelerate energy storage deployment. This could create a virtuous cycle in which large demand drives cost optimization and enhances industry learnings.
- Ancillary services strengthen the case for investing in standalone storage systems and **market reforms that enable revenue stacking** for energy storage could support a higher share of renewable electricity and reduce grid emissions intensity.
- India's non-fossil fuel capacity is on track to meet the ambitious goal of 500GW by 2030. To integrate all this capacity onto the grid that ensures minimal curtailment, the country requires an **accelerated buildout of the transmission grid** to move power from renewable-rich areas to demand centers.
- **Aggregating green hydrogen demand** across industries, including smaller consumers, and procuring supply through auctions could create sufficient scale for investment in electrolysis-based production, help smaller buyers access clean hydrogen and give producers greater visibility on future demand to support investment.
- **Strengthening battery mineral and metal supply chains** through international partnerships, alongside support for domestic research and deployment of battery technologies that rely on more readily available local resources, can improve India's energy security.
- **Better coordination between federal and state governments** on power sector reforms, together with more consistent and predictable policies on power purchase agreements, tariff adoption, renewable purchase mandates and data disclosures, could strengthen investor confidence in the Indian market.

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