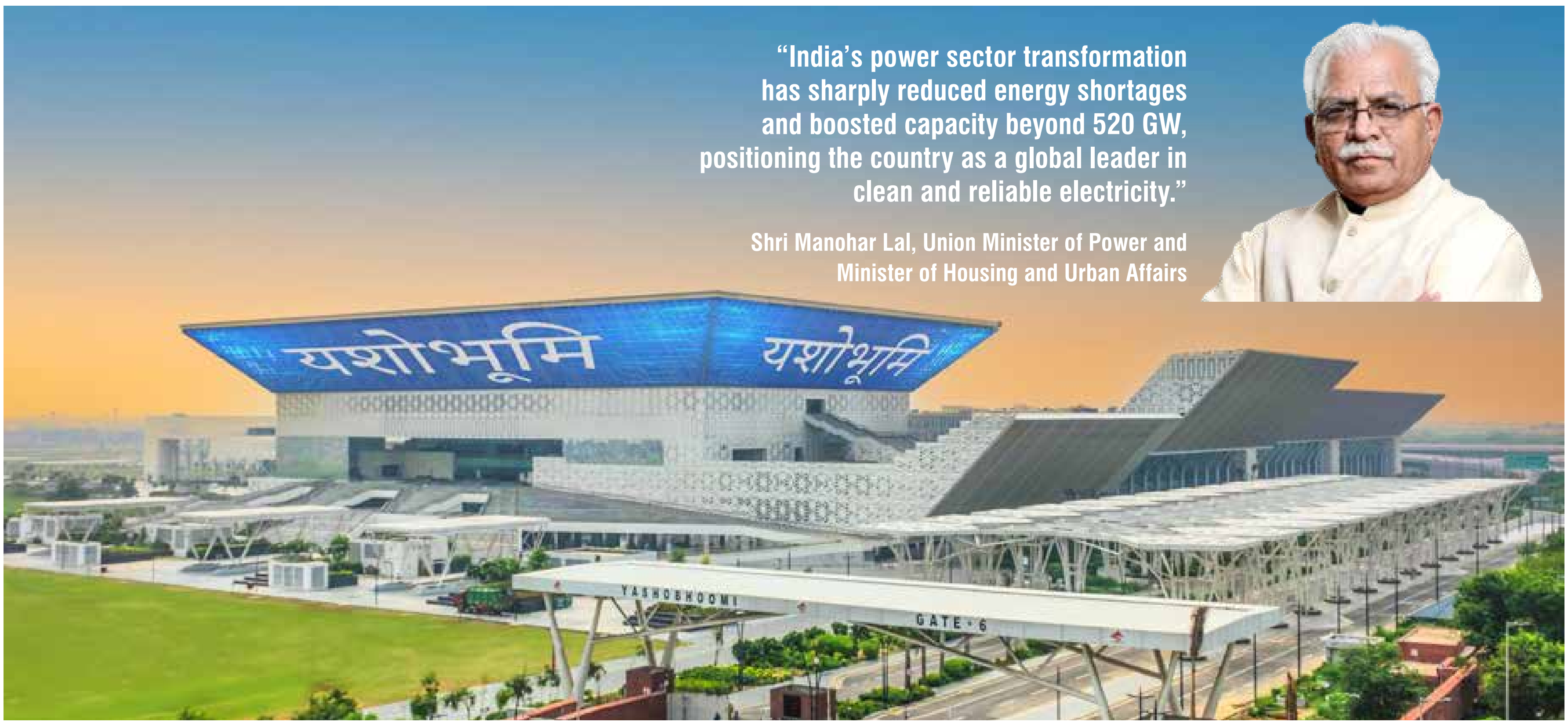
BHARAT ELECTRICITY SUMMIT 2026
POWERING A CLEAN FUTURE

UNDER THE PATRONAGE OF
GOVERNMENT OF INDIA
MINISTRY OF POWER
सत्यमेव जयते

19-22 March 2026 | Yashobhoomi, New Delhi, India

New Delhi, Thursday, March 19, 2026 DAILY NEWS #1



Bharat Electricity Summit 2026 Begins

Under the patronage of the Ministry of Power, Bharat Electricity Summit 2026 – a global conference-cum-exhibition for the power and electricity sector – is being held on March 19-22, 2026 at Yashobhoomi, New Delhi. Power Grid Corporation of India Limited, NTPC Limited, Power Finance Corporation Limited, REC Limited and NHPC Limited are the principal partners for the event.

The theme of the four-day event, "Electrifying Growth. Empowering Sustainability. Connecting Globally", reflects its focus on showcasing India's leadership in the global energy transition while addressing emerging challenges and opportunities. The summit will bring together domestic and international stakeholders from government, industry and academia to deliberate on the future of electricity and sustainable energy systems, facilitate cross-sector dialogue and strengthen global cooperation through strategic partnerships. In this context, it will serve as a key platform to showcase cutting-edge technologies and global investment opportunities, enabling policymakers, industry leaders, innovators and investors to shape the next chapter of India's energy growth.

The summit comes at a crucial juncture when India's power sector is witnessing strong growth, marked by record renewable capacity additions, evolving market mechanisms and rapid digital transformation. During 2025–26 (up to January 31, 2026), the country added 52,537 MW of generation capacity, the highest-ever in a single year. Renewables accounted for the bulk of this expansion, contributing 39,657 MW, including 34,955 MW of solar and 4,613 MW of wind capacity, underscoring the accelerating pace of the energy transition.

The transmission segment has also recorded significant progress. As of January 2026, the national grid comprised over 500,000 ckt km of transmission lines (220 kV and above), with 1,407 GVA of transformation capacity. In parallel, distribution utilities reported a collective profit after tax of Rs 27.01 billion in 2024-25, marking a notable improvement in sectoral performance.

The Strategic Conference at the summit will focus on nine core themes, representing the key pillars of future power systems. These are energy leadership, supply chain evolution, ease-of-doing business, clean energy transition, advanced technologies, inclusive access, workforce development, and financing. These themes provide a comprehensive framework to guide policymakers and industry leaders in building resilient, efficient and inclusive electricity systems.

Bringing together global policymakers, industry leaders, regulators, investors, technology providers and solution innovators, the summit will drive dialogue across the entire electricity value chain – from generation and transmission to distribution, storage and smart consumption. By fostering innovation, strengthening partnerships and showcasing India's scale and leadership, the event is set to play a pivotal role in shaping a robust, future-ready energy ecosystem with global impact. ■

Industry Speak

What excites you the most about the power sector today?

India stands at an inflection point on its energy journey, with scale, speed and integration driving a structural transition. Platforms like the Bharat Electricity Summit play a key role in aligning stakeholders to accelerate coordinated action.

As the energy ecosystem becomes more integrated across renewables, conventional power, transmission, distribution, storage and digital intelligence, ensuring reliability, affordability and sustainability remains critical. Geopolitical uncertainties further highlight the need for resilience, energy security and greater focus on self-reliance and indigenisation.

At Tata Power, we are enabling this shift by scaling clean energy, strengthening grid infrastructure and advancing customer-centric, technology-led solutions, including domestic manufacturing. Our focus remains on building a resilient and sustainable power system to support India's long-term energy and economic aspirations.

Dr Praveer Sinha, CEO and Managing Director, Tata Power Company Limited

India's renewable energy is no longer a promise; it is a reality that we are building and scaling every day. What is truly energising is to witness how renewables are moving from the margin to the mainstream, powering communities, businesses and the aspirations of millions of Indians today.

With the country achieving 50 per cent of its installed power capacity from non-fossil fuels five years ahead of the target, the scale of this transformation is unprecedented. India's journey to a low-carbon future is closer than ever.

J.P. Chalasani, Member, Group Executive Council, Suzlon Group

What excites me most about the power sector is its unique ability to shape the future of economies, societies and individual lives. When I began my career, electrical and electronics engineering was an emerging field that offered the opportunity to contribute to nation-building by democratising access to power (electricity). Bringing electricity to the remotest corners of the country was deeply fulfilling.

What has kept me engaged is the sector's constant evolution. From the transition to digital grids and advanced automation to the early adoption of intelligent standards, the industry has continuously reinvented itself.

Today, the most exciting aspect is the energy transition. The power sector sits at the heart of the global push towards sustainability, and the decisions we make now will define how responsibly and efficiently the world powers its future. Being a part of that transformation is both a responsibility and a privilege.

N. Venu, Managing Director and CEO India & South Asia, Hitachi Energy

The most exciting aspect of the Indian power sector today is the unprecedented scale and pace of transformation under way. India is simultaneously expanding generation capacity, accelerating renewable energy adoption and strengthening transmission infrastructure to support a rapidly electrifying economy. Ambitious renewable energy and green hydrogen initiatives, combined with significant investments in grid expansion, digitalisation and energy storage, are reshaping how electricity is generated, transmitted and consumed. Rising demand from data centres, advanced manufacturing, electric mobility and rapid urbanisation further reinforce the sector's long-term growth trajectory. What makes this moment particularly compelling is India's unique opportunity to build a future-ready, resilient and sustainable power system while powering one of the world's fastest-growing economies. This convergence of scale, innovation and strong policy momentum positions the Indian power sector among the most dynamic globally.

Sandeep Zanzaria, CEO and Managing Director, GE Vernova T&D India

India's power sector is evolving rapidly as the country strengthens its transmission infrastructure to support rising electricity demand and the integration of large-scale renewable energy.

To support India's rapid energy shift and renewable integration, Toshiba Transmission & Distribution Systems (India) has expanded its Rudraram facility and introduced 765 kV GIS, surge arrester production lines and advanced CRGO cutting facilities. An additional capacity of 12,000 MVA for power transformers will also be operational by this year.

We are partnering with PowerGrid to indigenously develop EHV mobile GIS (m-GIS) solutions for up to 400 kV. In a series of firsts, we have already delivered India's first indigenously developed 220 kV m-GIS to PowerGrid and will deliver the 132 kV m-GIS in the coming weeks, followed by the 400 kV variant later this year. We are gearing up to support India's upcoming UHVAC scheme with plans underway to expand our manufacturing capabilities through further investments.

As India's grid becomes larger, smarter and more resilient, we see tremendous opportunity to develop and manufacture advanced transmission technologies in India, supporting both the nation's enery transition and the "Make in India" vision.

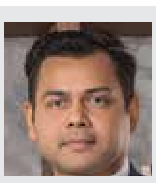
Hiroshi Furuta, Chairman & Managing Director, Toshiba Transmission & Distribution Systems (India) Private Limited

The global power sector is undergoing one of the most significant transformations in its history. The rapid expansion of renewable energy and data centres, the growing electrification of transportation, and the emergence of more resilient and smarter grids are reshaping how electricity is generated, transmitted and consumed.

What excites me most is the growing importance of transmission infrastructure worldwide. As countries accelerate renewable capacity, building strong, efficient and resilient transmission networks becomes critical to move clean energy from where it is generated to where it is needed. This transition opens immense opportunities for innovation in conductors, grid technologies and system efficiency. For APAR Industries Limited, which works closely with utilities and grid developers, it is an inspiring time to contribute to building the backbone of the future energy system – not only through greenfield projects but also through uprating and upgrading existing transmission networks with lower losses, higher capacities and within the same space.

Looking forward to engaging with industry leaders at the upcoming CEO Conclave at Bharat Electricity Summit 2026 this week.

Manish Agrawal, CEO, Conductors and Telecom Businesses, APAR Industries Limited, and Managing Director, APAR T&D Projects Private Limited



What excites me most about the power sector today is the strong alignment between policy intent, infrastructure demand and execution momentum. There is unprecedented clarity from governments on expanding transmission networks, integrating renewable energy and strengthening grid reliability. This is translating into large, time-bound expansion programmes, especially in emerging markets like India, as well as across the world.

At the same time, the global energy transition is fundamentally reshaping the sector – renewables, electrification and decentralised energy systems are driving significant investments in transmission and distribution infrastructure. This creates a long-term, structurally strong demand environment.

From our perspective at Skipper, this is particularly exciting as it aligns with our own ambitious growth plans. Our ongoing capex initiatives aim to scale capacity to around 600,000 mt, positioning us to become the largest transmission tower and pole manufacturer globally by 2029. Being part of this transformation phase is both a strategic opportunity and a source of immense professional energy.

Devesh Bansal, Executive Director, Skipper Limited

Industry Speak

What excites you the most about the power sector today?

What excites me most about the power sector today is the rapid expansion of the infrastructure needed to support the energy transition. As countries, including India, accelerate renewable energy deployment and grid expansion, demand is growing for reliable and efficient structural solutions. Products such as monopoles, transmission line towers, solar module mounting structures, crash barriers, ERW pipes, high masts and poles are playing a critical role in enabling this transformation.

The shift towards compact and faster-to-install solutions such as monopoles is particularly encouraging, especially in urban and space-constrained environments. At the same time, the massive growth in solar capacity is creating new opportunities for robust and cost-effective solar mounting structures. Expanding transmission networks and modern lighting infrastructure are also driving demand for advanced tower and high-mast solutions.

Overall, it is exciting to see how engineering innovation in structural products directly supports the development of resilient power networks and the growth of renewable energy infrastructure.

Prakash Agrawal, Director, R.R. Ispat

What excites me most about the power sector today is India's unprecedented momentum towards a sustainable, self-reliant energy future. The rapid integration of renewables, coupled with advancements in grid modernisation, energy storage and smart infrastructure, is transforming how we generate, transmit and consume electricity. As a leader in wires and cables, I am particularly thrilled by the surging demand for high-quality, innovative solutions like fire-retardant, solar and low-emission cables that enable safer, greener electrification at scale, making them future-ready. Now, it is high time for us to follow global standards, which are focused on safety, liability and longevity. With policies driving "Viksit Bharat" and global collaboration at events like the Bharat Electricity Summit 2026, we are not just powering homes and industries, we are building a resilient, inclusive energy ecosystem that will define the next era of growth. The possibilities are electrifying!

Shreegopal Kabra, Chief Mentor and Co-promoter, RR Global

The convergence of renewables, electrification and digital technologies is reshaping power systems to be smarter, more resilient and more sustainable – or simply, we need intelligent energy.

In India, this transition is especially powerful – modernising grids while supporting growth, energy access and decarbonisation. Being able to drive real impact at this intersection of technology, sustainability and nation-building is truly energising.

Udai Singh, Managing Director and CEO, Schneider Electric Infrastructure Limited

Today, the power sector in India presents endless and limitless opportunities. The sector is full of energy and excitement. The Government of India is pushing for clean energy, with a stronger focus on decarbonisation, and we are systematically moving towards a cleaner, more digitalised, sustainable and electrified future.

What excites me most is the renewed government attention on the health of the power sector, covering generation to distribution, with a focus on the quality of power; growing global attention on India; the shift of energy-intensive applications like data centres to Indian shores; increased investments by technology leaders, creating opportunities for youth employment; and India's positioning at the forefront of the renewable capacity expansion and demand growth, unlike previous decades.

The demand for the electrification of all aspects of life is expected to grow, creating demand for grid modernisation, resilience and flexibility. This, in turn, is increasing demand for a wide range of electrical equipment across the power sector. Daily news on capacity expansions in line with government policies such as "Make in India" is encouraging.

Nagesh Tilwani, Managing Director, Hyosung T&D India Private Limited

What excites me most about the power sector today is not just the scale of growth, but its growing strategic importance in a changing geopolitical environment.

Rajesh Kumar Singh, CEO, Jyoti Structures Limited

The power sector is truly an exciting sector to be in today. We are witnessing a historic epoch in the making. The triple whammy of decarbonisation, artificial intelligence and global energy insecurity is leading to a paradigm where electricity is becoming the default source of energy. This creates unprecedented opportunities for growth in the sector.

At the other end, digitalisation is not just a market but also a critical need for this sector. As a result, we are seeing the convergence of electrical engineering with electronics and information technology at a pace never seen before.

These factors combine to create an ecosystem where grassroots innovation gets the opportunity to thrive, for new business models to emerge and for emerging players to be able to thrive alongside larger peers.

Vinamra Agarwal, Joint Managing Director and CEO, Technical Associates Transformers Limited

What excites me most about the power sector today is that utilities are finally in the spotlight of global transformation. Energy and water are no longer background services. They are becoming central to how economies grow, how cities function, and how societies transition towards sustainability.

What is accelerating this shift is the rise of vertical artificial intelligence (AI) and connected platforms. Instead of fragmented systems, utilities are now able to bring together customer, workforce and grid intelligence into a single, cohesive layer. This is changing how decisions are made, operations are managed, and experiences are delivered.

Platforms like SEW.AI are enabling this shift by unifying these layers through AI-native, connected intelligence built specifically for utilities. This is not just digitalisation. It is a redefinition of the utility operating model. Utilities now have the opportunity to lead from the front, not just power the future, but shape it.

Deepak Garg, Chairman, Co-CEO and Founder, SEW.AI

Energy Pathways

NITI Aayog report assesses power scenarios towards Viksit Bharat and net zero

As part of the thrust towards India's 2070 net zero target, NITI Aayog has released a series of reports on scenarios towards Viksit Bharat and net zero for various sectors, including power. The report on sectoral insights for the power sector identifies the policy, technological and infrastructure measures required to meet the net zero objective, while maintaining grid reliability, system adequacy and affordability.

Prepared with inputs from an interministerial working group, the study applies a scenario-based modelling framework to assess alternative energy transition pathways up to 2070. It evaluates two scenarios – the current policy scenario (CPS), which extends existing policy trends, and the ambitious net zero scenario (NZS), which aligns with India's 2070 net zero target. Based on this analysis, the report examines the evolving roles of renewable energy, energy storage, nuclear power, coal-based generation and transmission infrastructure in supporting this transition. Here are the key takeaways from "Scenarios Towards Viksit Bharat and Net Zero – Sectoral Insights: Power"…

Scenario-based modelling

To assess long-term transition pathways, NITI Aayog developed an integrated energy–economy framework that projects sectoral activity and translates it into energy demand and total electricity requirements. The projected electricity demand is then used to estimate capacity expansion, generation mix and emission outcomes under two scenarios. The CPS assumes the continuation of existing policies and historical trends, resulting in the gradual uptake of low-carbon technologies. In contrast, the NZS assumes stronger policy support, faster electrification, higher energy efficiency and large-scale deployment of clean energy solutions. The key modelling results are outlined below.

- Electrification-led demand surge: Under both scenarios, rapid electrification across end-use sectors drives the transition. The share of electricity in the final energy consumption is projected to rise from about 21 per cent in 2025 to nearly 40 per cent under CPS and 60 per cent under NZS by 2070. This increase is supported by electric mobility, industrial electrification, green hydrogen production and rising cooling demand. As a result, the per capita electricity consumption rises significantly, reaching around 4,800 kWh under CPS and 6,400 kWh under NZS by 2050, and further increasing to approximately 7,400 kWh and 10,000 kWh, respectively, by 2070.
- Capacity expansion and generation mix: To meet the rising demand, the total installed capacity is projected to increase from 535 GW in 2024-25 to about 4,650 GW-4,750 GW under CPS and 6,800 GW-7,350 GW under NZS by 2070. Across both pathways, a strong shift towards variable renewable energy (VRE) is anticipated, with the combined share of solar and wind capacity rising from 26 per cent in 2023-24 to around 88 per cent under CPS and 91 per cent under NZS. In parallel, battery energy storage systems (BESSs) are projected to scale up from less than 50 GW in 2030 to about 1,300 GW-1,400 GW under CPS and 2,500 GW-3,000 GW under NZS by 2070. Pumped storage capacity is also expected to reach roughly 110 GW under CPS and 150 GW-165 GW under NZS by 2070. Coal is projected to continue to play a role in the near to medium term, particularly for grid stability. It is projected to peak earlier under NZS as long-duration storage and clean alternatives become more competitive. Nuclear capacity is projected to reach 87 GW-135 GW by 2070 under CPS. Under NZS, the 100 GW nuclear mission target is expected to be achieved by 2047, with capacity rising further to around 295 GW-320 GW by 2070. Additionally, natural gas will play a limited long-term role in both scenarios, with most existing plants likely to be phased out by 2050.

In terms of generation, electricity output increases substantially in both scenarios. By 2070, renewables are projected to account for more than 80 per cent of the total generation. The share of nuclear power rises to 13-14 per cent under NZS and 5-8 per cent under CPS, while coal's contribution declines significantly. However, plant load factors during the intermediate period remain around 62-65 per cent, reflecting continued utilisation for grid stability.

- Grid emission factor: These structural changes in the generation mix are to reduce carbon intensity significantly. The grid emission factor, estimated at 0.71 kg CO2 per kWh in 2025, declines to about 0.328 kg CO2 per kWh by 2050 under CPS. Under NZS, the emission intensity falls by a sharp 65 per cent over the same period, driven by accelerated renewables deployment, storage integration and phased coal retirements.
- Resource footprint: The projected capacity expansion has land and water implications. Based on assumed land requirements per MW and the projected capacity mix, land use is expected to increase steadily under both scenarios, reaching around 7.5 per cent of the national wasteland under CPS and 11 per cent under NZS by 2070. Water demand is projected to rise initially, before moderating as thermal generation declines. However, higher nuclear capacity and green hydrogen production under NZS may result in slightly higher water use compared to CPS.
- Investment requirement: Meeting the projected electricity demand requires substantial investment in generation, storage and transmission and distribution (T&D) infrastructure. The total investment is estimated at approximately $8.79 trillion under CPS, with 69 per cent allocated to capacity expansion (generation and storage) and 31 per cent to T&D. Under NZS, investment requirements increase to about $14.23 trillion, with 74 per cent directed towards capacity addition (generation and storage) and 26 per cent towards transmission, reflecting faster renewable deployment, large-scale storage integration, extensive electrification and grid modernisation.

Challenges and opportunities

As India advances towards a clean energy transition, the power sector faces interconnected technical, financial, regulatory and institutional challenges across the entire value chain.

In the near to medium term, coal will remain essential for maintaining system stability. However, coal plants based on ultra-supercritical and advanced ultra-supercritical coal plants entail high upfront capital costs. Over time, there is also a risk of assets becoming stranded, if newly built coal plants become underutilised before the end of their economic life. The growth of variable renewable energy also intensifies the need for supply-demand balancing. Today, coal and hydro plants largely provide this flexibility, but as coal's share declines, scalable energy storage solutions such as pumped hydro and BESSs will become increasingly critical. Currently, these storage solutions exist far below the scale required for reliable grid operation.

T&D infrastructure is another key enabler of renewable integration. Existing systems can accommodate only limited renewable growth, beyond which substantial upgrades are needed. A major opportunity here is distributed generation such as rooftop solar, which reduces land constraints, lowers transmission losses and enables consumers to generate power closer to where it is consumed. Initiatives such as the green energy corridor scheme are also strengthening interstate and intra-state transmission lines to evacuate renewable energy. However, distribution upgrades such as smart meters and advanced monitoring remain slower due to high aggregate technical and commercial losses, which continue to strain discom finances and limit investment in modernisation.

Domestic manufacturing capacity also lags behind projected demand, with solar cells, modules, wind components, electrolysers and batteries insufficiently supplied. Research and development spending also remains modest, especially in the private sector, creating dependence on imported technologies for advanced storage, AI-enabled grids and green hydrogen. To promote local manufacturing, the government has rolled out measures such as the production-linked incentive scheme. The government also notified the Battery Waste Management Rules, 2022, to promote the recycling of solar panels and batteries. Recycling enterprises are also emerging, with several firms establishing facilities to recover materials such as silver, copper and silicon from end-of-life

Snapshot of the power sector by 2050 and 2070 under the two scenarios

Indicator	2023-24	CPS		NZS	
		2050	2070	2050	2070
Per capita electricity consumption (kWh)	1,400	4,800	7,400	6,400	10,000
Total capacity (GW) (including captive)	523	2,500-2,800	4,650-4,750	3,800-3,830	6,800-7,350
VRE (solar + wind) capacity (GW) (including captive)	136	1,890-2,200	4,150-4,200	3,150-3,200	6,150-6,700
Share of non-fossil-fuel-based generation capacity (including captive) (%)	40	81-83	94-95	89	98
Grid emission factor (kg CO_2 per kWh)	0.727	0.32	0.06	0.25	0
BESS capacity (GW)	<0.5	420-520	1,300-1,400	900-1,150	2,500-3,000
Pumped hydro capacity (GW)	3.3	117	131-163	117	150-165
Total investment required ($ trillion)	**–**	**3.5 (2025-50)**	**5.2 (2050-70)**	**5.15 (2025-50)**	**9 (2050-70)**

Source: NITI Aayog

solar modules, helping reduce dependence on critical mineral imports.

Financing is another major bottleneck. Clean energy projects are capital-intensive and require large upfront investment. Borrowing costs in India remain high and projects reliant on imported equipment face foreign exchange risks. While instruments such as green bonds and sustainability-linked loans are attracting investor interest, the financing ecosystem must de-risk emerging technologies. Finally, policy and regulatory challenges influence the pace and stability of the transition. India has provided strong central policy direction, but implementation varies across states. Furthermore, fragmented regulatory responsibilities across institutions such as the Central Electricity Regulatory Commission, the Bureau of Energy Efficiency and state commissions also lead to overlapping mandates. As such, greater harmonisation, strong enforcement and long-term policy stability will be critical for maintaining investor confidence, while ensuring smooth sectoral transformation.

Policy suggestions

To achieve the net zero target by 2070, the report proposes coordinated policy, technological and infrastructure measures across the power sector. Nuclear power is identified as a key pillar of deep decarbonisation, particularly for industrial users and large captive consumers. Replacing coal-based captive plants with small modular reactors can reduce emissions, while maintaining energy security. Scaling this transition will require the implementation of the SHANTI Act, with a target of expanding nuclear capacity to 100 GW by 2047 and 200 GW-300 GW by 2070. This must also be supported by dedicated budgetary allocations and access to green bond financing to improve project bankability.

At the same time, accelerated deployment of co-located solar-wind hybrid projects with integrated storage can improve land-use efficiency, reduce curtailment and ease transmission congestion. This will require early identification of high-potential hybrid zones, streamlined land aggregation and single-window clearances. In parallel, inefficient thermal plants, particularly those over 25 years old, should be retired in a phased manner and repurposed as clean energy hubs to utilise the existing infrastructure.

Further, distributed energy resources, especially decentralised solar, are critical for reducing transmission losses, easing land pressures and enhancing system resilience. Land-neutral solutions such as agri-voltaics, floating solar and rooftop systems should be supported through targeted viability gap funding (VGF). Moreover, as rooftop solar and behind-the-meter storage expand, peer-to-peer trading can enable local balancing and reduce stress on the grid. Additional VGF support is also required to scale emerging storage technologies, including pumped storage and hydrogen-based systems. These efforts should be complemented by market-based incentives such as time-of-day tariffs, ancillary services markets and capacity remuneration mechanisms.

Investment requirements under CPS and NZS ($ trillion)

Segment	2025-50		2025-70	
	CPS	NZS	CPS	NZS
Generation capacity	1.77	2.40	3.90	5.78
Storage	0.60	1.32	2.17	4.80
T&D	1.21	1.43	2.72	3.65
Total	**3.58**	**5.15**	**8.79**	**14.23**

Source: NITI Aayog

Additionally, with rising renewable capacity, transmission expansion must be fast-tracked to align with the commissioning timelines of upcoming projects. To minimise delays, land acquisition must be streamlined through coordinated planning between central and state governments, identification and pre-approval of suitable land parcels, digitalisation of land records and setting up of single-window clearance mechanisms. Alongside, grid modernisation through real-time monitoring systems, automation of substations and centralised control via supervisory control and data acquisition systems will further strengthen efficiency. Advanced digital tools leveraging AI and machine learning must also be utilised to strengthen demand and generation forecasting.

On the distribution side, improving the financial health of discoms remains essential. The report recommends a one-time debt restructuring package, with central support linked to the implementation of credible structural reforms. Gradual tariff rationalisation towards cost-reflective levels as well as monetisation of non-core assets, such as leasing surplus land, can further improve financial sustainability. Finally, strengthening domestic manufacturing value chains, fostering a robust research and development ecosystem, and leveraging concessional and blended climate finance will be necessary to mobilise large-scale investment in low-carbon power infrastructure.

Conclusion

Over the past two decades, India's power sector has undergone significant structural changes, characterised by universal household electrification, expansion of the national grid and rapid growth in renewable energy capacity. Looking ahead, electricity demand is projected to increase sharply, driven by urbanisation, industrial growth and deeper electrification across sectors. Meeting this demand while reducing emissions will require a continued shift towards renewables, supported by large-scale storage deployment, timely transmission expansion and appropriate market reforms. In the near to medium term, coal will remain important for grid stability, while nuclear power is expected to assume a larger role over the long term. At the same time, reforms in the distribution segment, focused on financial sustainability and operational efficiency, will be critical to managing the transition. ■

Ensuring Energy Security

Expanding generation capacity to meet rising power demand

The power generation segment is the cornerstone of India's economy, ensuring energy security for over 1.4 billion people and facilitating the nation's transition to a $5 trillion economy. Over the past decade, India's power generation landscape has witnessed expansion and evolution, fuelled by consistent regulatory measures, a swift pivot towards green energy and increased use of conventional power sources.

Power Line takes a look at India's power generation segment…

Segment growth and performance

According to the Central Electricity Authority (CEA), as of January 2026, the total installed generation capacity in the power sector stood at 520.51 GW. Fuel-wise, coal-and lignite-based power plants had the highest share at 43.77 per cent, followed by solar at 27.01 per cent. Large hydro contributed to 9.82 per cent of the installed generation capacity, followed by wind at 10.49 per cent, gas at 3.86 per cent, bioenergy at 2.23 per cent, nuclear at 1.68 per cent and small hydro at 1 per cent. The share of renewables reached nearly 50.56 per cent (including large hydro), as of January 2026.

The installed power capacity grew at a CAGR of 4.96 per cent between 2018-19 and 2024-25. While conventional power capacity has grown at a CAGR of 1.46 per cent during the past six years, renewable energy (excluding large hydro) has surged ahead and grew at a CAGR of 10.17 per cent driven by falling costs of renewable electricity generation, robust government policies, record investments, cost-reflective tariffs, rapid tendering and project allocation activities. Further, as per the CEA's General Review Report 2025, the installed capacity of captive power plants in India reached around 80,926.07 MW.

In 2024-25, about 33,399 MW of generation capacity was added. The renewable energy segment contributed the highest capacity addition of 28,724 MW, followed by thermal at 3,875 MW and hydro at 800 MW. In 2025-26 (till January 2026), generation capacity addition reached 52,537 MW, which included 39,657 MW of renewable energy sources. The cumulative electricity generation grew at a CAGR of 4.86 per cent between 2018-19 and 2024-25. Likewise, thermal generation grew at 3.93 per cent and renewable energy generation at 12.36 per cent during this period.

On the operational performance front, till January 2026, the plant load factor (PLF) of thermal power plants (TPPs) declined to 63.2 per cent from 65.41 per cent in the same period of the previous year. With respect to sectors, the PLF of TPPs in the central sector declined to 66.94 per cent from 69.57 per cent in the previous year. Likewise, the PLF in the state sector declined to 56.94 per cent from 59.21 per cent in the previous year.

Regarding new projects, the power generation segment has witnessed a slew of new announced capacities amid considerations on rising peak demand and resource adequacy. In this regard, the recent key announced thermal generation fleet includes Adani Power's 2,400 MW (3x800 MW ultra-supercritical units) at Pirpainti Bhagalpur, Bihar; NTPC's 2,400 MW (3x800 MW units) at the Nabinagar super TPP Phase II at Aurangabad, Bihar; Neyveli Uttar Pradesh Power Limited's 660 MW unit at Ghatampur, Kanpur, Uttar Pradesh; NTPC's 800 MW (advanced ultra-supercritical unit) at Korba, Chhattisgarh; and Adani Power's 800 MW unit in Bihar.

Likewise, the recent key announced hydropower projects include NHPC Limited's 1,856 MW Sawalkote hydropower project in Jammu & Kashmir; North Eastern Electric Power Corporation Limited's 700 MW Tatto II project in Arunachal Pradesh; Adani Power and Druk Green Power Corporation Limited's (DGPCL) 570 MW Wangchhu hydropower project in Bhutan; Tata Power and DGPCL's 1,125 MW Dorjilung hydroelectric project in Bhutan; and the Brahmaputra basin master plan to establish 76 GW of hydropower projects in India's north-eastern region.

Year-wise growth in installed capacity (MW)

	Thermal	Large hydro	Renewables	Nuclear	Total
2018-19	226,279	45,399	77,642	6,780	**356,100**
2019-20	230,600	45,699	87,028	6,780	**370,106**
2020-21	234,728	46,209	94,434	6,780	**382,151**
2021-22	236,109	46,723	109,885	6,780	**399,497**
2022-23	237,269	46,850	125,160	6,780	**416,059**
2023-24	243,217	46,928	143,645	8,180	**441,970**
2024-25	246,935	47,728	172,368	8,180	**475,212**
2025-26*	248,541	51,165	212,025	8,780	**520,511**

*Till January 2026
Source: CEA

Recent developments

Draft National Electricity Policy 2026

The draft National Electricity Policy [NEP], 2026, notified in January 2026, has highlighted multi-pronged approaches to ensure energy security and integrate clean energy generation into the grid. It recognises the importance of coal-based power stations in catering to baseload electricity demand, along with an emphasis on co-firing/blending of alternative fuels and coal gasification to facilitate clean operations in TPPs.

The thermal power generation segment has consistently experienced issues in fuel management. With respect to issues such as fuel

transportation cost and logistical roadblocks, the draft NEP 2026 has recommended the development of new coal-based power plants in proximity to coal mines. Apart from this, the need for advance planning of transport infrastructure such as rail links, conveyor belts and pipe conveyors for coal power plants has been put forward in the draft policy to ensure supply chain readiness. Likewise, the draft policy spotlights coal quality monitoring and recommends coal suppliers to keep quality checks on an "as-delivered at plant-end" basis to reduce coal grade slippage.

Regarding the operationalisation of gas-based power plants in India, the draft NEP 2026 acknowledges the need for adequate arrangements for flexible gas supply to cater to peak and balancing loads. Further, it also suggests exploring the opening of capacity markets to guarantee the long-term financial sustainability of gas-based power plants.

SHANTI Bill, 2025

India's rising energy consumption and clean energy initiatives strongly necessitate the expansion of nuclear power generation capacity. In this regard, in December 2025, the government notified the Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India [SHANTI] Bill, which aims to modernise India's nuclear energy legal framework. Among multiple developments, the bill intends to enable private sector participation and repeal the Atomic Energy Act of 1926 as well as the Civil Liability for Nuclear Damage Act of 2010. Further, it confers statutory status to the Atomic Energy Regulatory Board and strives to enhance regulatory oversight over safety, security, safeguards and liability in nuclear power generation operations. On the other hand, the bill preserves certain activities and facilities to be undertaken only by the central government or its wholly owned institutions.

Captive generation

In October 2025, the Ministry of Power (MoP) issued the draft Electricity (Amendment) Bill, 2025 to provide regulatory certainty by empowering the central and state governments to devise rules to govern captive generation. Likewise, in September 2025, the MoP issued draft amendments proposed in Rule 3 (Requirements of Captive Generating Plant) of the Electricity Rules, 2005, which aimed to resolve regulatory issues related to group captive structures, proportionate consumption and entitlement of captive users, verification of captive status and assessment period, among others. In brief, the draft amendment is likely to reflect more scrutiny for group captive arrangements, provide more regulatory governance, and avoid contentions on captive ownership and consumption aspects.

Utilisation of advanced technologies in power generation

The necessity of power plant generation automation has arisen as a result of the growing complexity of operations, challenges associated with grid integration, need for flexibilisation, and the demand for increased efficiency and reliability in contemporary electricity systems.

In power plant operations, digital control systems (DCSs) and supervisory control and data acquisition (SCADA) systems have emerged as essential technologies as they offer automated control, centralised monitoring and data-driven decision-making capabilities. Further, SCADA systems have helped DCSs by facilitating real-time plant monitoring, swift detection of key faults through alarms, and collection of pertinent data for further analysis and process optimisation. Further, the implementation of smart grid technologies supports the optimal balancing of power generation aligned with demand by enabling real-time monitoring and dynamic demand response.

The adoption of emerging technologies such as carbon capture, utilisation and storage (CCUS) is likely to accelerate, driven by policy push, pilot projects and increased investments. The outlay of Rs 200 billion in Union Budget 2026-27 over the next five years to support the deployment of CCUS and its initiatives across different sectors, including power, offers a pathway to decarbonise the power generation segment.

Likewise, biomass co-firing has been recognised as a major technology intervention towards cleaner coal power generation, as well as to mitigate agricultural stubble burning and address waste management challenges. In November 2025, the MoP issued a policy on co-firing biomass pellets in coal-based power plants. As per the policy, coal-based power plants must utilise 5 per cent of biomass pellets/torrified charcoal from FY 2025-26 onwards.

Alongside these technologies, interventions such as ammonia co-firing and advanced ultra-supercritical technology are likely to help coal-based power plants in reducing their carbon footprint. Although these technologies are under the feasibility/pilot project stages and await large-scale deployment, they are expected to support incremental decarbonisation of coal-based power plants in the near future.

Manufacturing

Manufacturing has become critically important in the power sector for ensuring energy security, economic development, supply chain resilience and technological self-reliance. India has a robust manufacturing ecosystem for power plant equipment, led by major domestic and joint venture companies. Further, initiatives such as Make in India have catalysed the growth of power generation equipment manufacturing in recent years. Manufacturing firms, such as Bharat Heavy Electricals Limited, have been driving indigenous manufacturing and have diversified into several engineering and manufacturing activities across the core sectors of the economy. Other players, such as Toshiba JSW Power Systems Private Limited, Triveni Turbine Limited and GE Power India Limited, have developed state-of-the-art manufacturing facilities for power generation equipment in India.

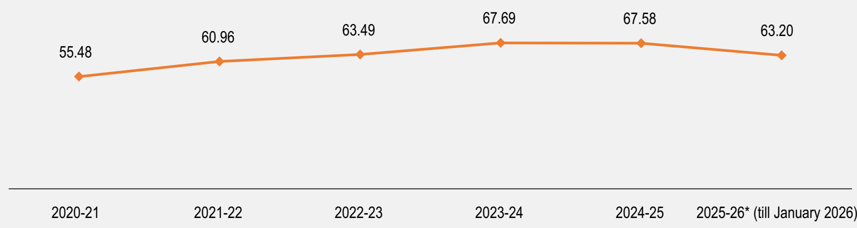
Future outlook

As per the power generation capacity expansion plan of the MoP, the projected thermal capacity requirement is likely to reach 307 GW by FY 2034-35. To cater to this demand, the installation of an additional 97 GW of coal-and lignite-based generation capacity is expected to be integrated into the grid.

Further, to fulfil this estimated target, thermal capacity installation of about 17.3 GW has been commissioned since FY 2023-24. As of January 2026, the under-construction capacity of thermal stood at 39.5 GW (including 4.8 GW of stressed TPPs). Moreover, contracts of 229 GW have been awarded and await construction. In addition, about 24 GW of coal-and lignite-based capacity is at various stages of planning. Under-construction hydropower capacity stands at 12.9 GW, while planned capacity hovers at 4.2 GW, which is envisaged to be executed by FY 2031-32. Likewise, under-construction nuclear capacity is 6.6 GW and is envisaged to be completed by FY 2029-30, while the planned capacity stands at 7 GW.

In energy storage systems, as of January 2026, under-construction pumped storage project capacity stands at 11,620 MW/69,720 MWh, while the concurred and capacity of projects yet to be constructed stands at around 6,580 MW/39,480 MWh. Further, under-construction BESS capacity is 9,653.94 MW/26,729.32 MWh, while BESS capacity under tendering is around 19,797.65 MW/61,013.4 MWh. Such under-construction, planned and tendered capacities in the power generation segment are expected to cater to the upcoming electricity demand in the coming years.

PLFs of TPPs from 2020-21 to 2025-26 (%)



Source: CEA

Challenges and the way forward

Cybersecurity has become a critical concern as the industry transitions towards a more digitalised, decentralised and interconnected grid. The primary challenges arise from the convergence of information technology (IT) and operational technology (OT), which increases vulnerability against potential intruders.

Further, as the penetration of renewable energy increases, the wide adoption of decentralised assets like solar inverters and battery storage systems introduces thousands of new entry points for cyber threats. This necessitates the strengthening of cybersecurity regulations and mandatory vulnerability assessments of IT and OT systems.

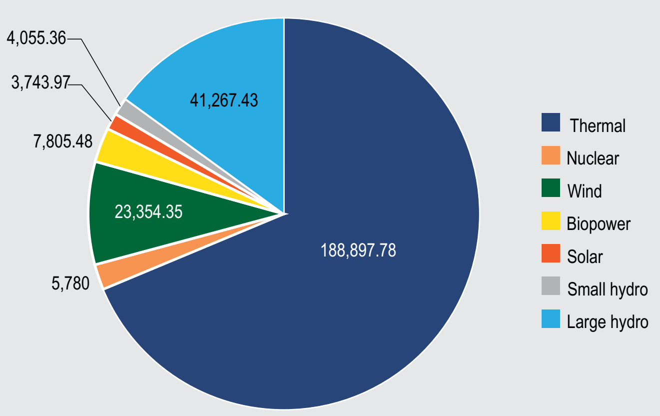
Coal-based power generation is expected remain dominant in India, accounting to for over 70 per cent of the total generation despite aggressive renewable energy integration. The sector continues to suffer from financial challenges propelled by outstanding payment dues from discoms, in addition to environmental and regulatory hurdles, and operational challenges such as falling plant load factors (PLFs). These issues can be resolved by the introduction of reforms, regulatory and policy overhaul, and the swift implementation of operational and technical modernisation.

In conclusion, India's power generation segment is at a critical juncture, balancing the shift towards clean energy generation technologies and the conventional energy generation technologies needed for serving baseload demand. The segment's future will be determined by its capability to modernise its conventional thermal fleet to serve as a flexible backup and integrate 500 GW of non-fossil fuel capacity by 2030. ■

Key Statistics

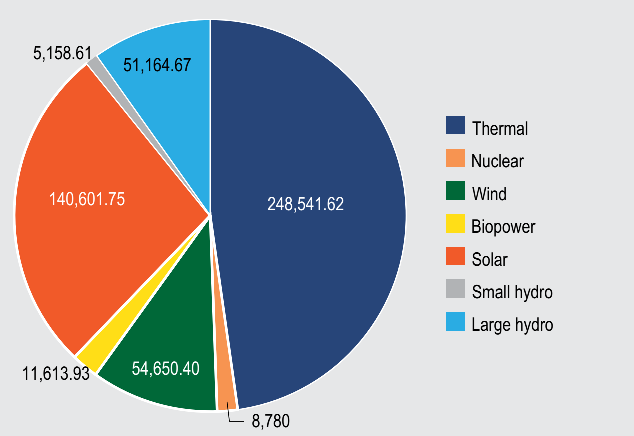
Source-wise power capacity and generation trends

Source-wise capacity mix in 2014-15 (MW)

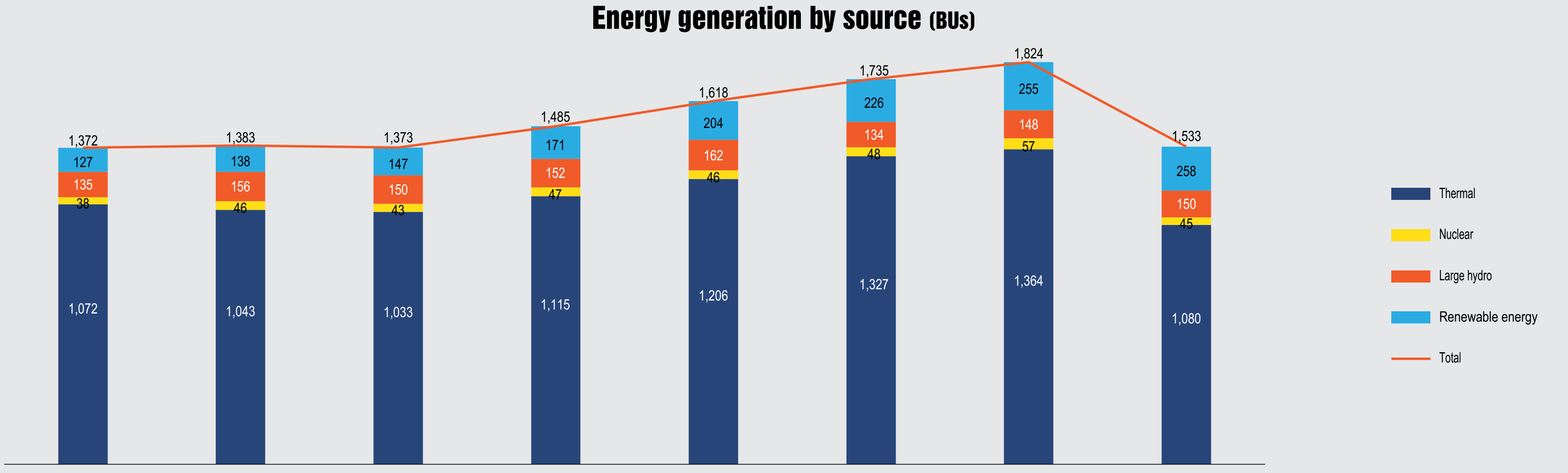


Source: Central Electricity Authority (CEA)

Source-wise capacity mix as of January 31, 2026 (MW)



Energy generation by source (BUs)



Sources: CEA; National Power Portal

Driving Change

Draft NEP 2026 proposes the next phase of sector reforms

The Ministry of Power has released the Draft National Electricity Policy (NEP) 2026, a landmark document aimed at steering India's power sector towards the vision of Viksit Bharat @2047. Once finalised, the policy will replace the existing National Electricity Policy notified in 2005, reflecting the transformation that the sector has undergone over the past two decades and the new challenges that have emerged.

Since the National Electricity Policy (NEP) 2005 was issued, India's power sector has undergone a transformation. The access challenge has largely been addressed through universal electrification, with all villages and willing households connected. Generation delicensing has attracted significant private investment, and the private sector now accounts for over 50 per cent of the installed generation capacity. Regional grids have also been unified into a single national grid, enabling seamless power flow across regions.

However, the draft NEP, 2026, notes that the financial condition of distribution utilities has deteriorated even as sector outcomes improved on access and adequacy. Looking ahead, the draft frames the next phase of sector reforms around the energy transition and the national development vision. By 2047, over 80 per cent of the installed capacity and nearly two-thirds of the total electricity generation are expected to come from non-fossil sources, while the share of electricity in total energy consumption is projected to double.

The draft NEP, 2026, includes the following major interventions.

Resource adequacy

The draft NEP, 2026, places renewed emphasis on resource adequacy as a planning tool to ensure that sufficient capacity and energy are available to meet demand reliably and at a reasonable cost. The draft proposes a decentralised planning framework under which discoms and state load despatch centres (SLDCs) would prepare resource adequacy plans at the utility and state levels, in line with regulations issued by state electricity regulatory commissions (SERCs). Parallelly, the Central Electricity Authority (CEA) is expected to prepare a corresponding national resource adequacy plan, in consultation with stakeholders, with the objective of ensuring adequacy at the all-India level.

Financial viability and economic competitiveness and distribution sector reforms

The draft NEP, 2026, argues that in many states, tariffs have continued to be set below the cost of supply, contributing to persistent revenue gaps and repeated debt accumulation in the distribution segment. To address this, the draft places tariff and loss reforms at the centre of the proposed distribution turnaround. It emphasises cost-reflective tariffs, timely pass-through of legitimate costs and sharper outcomes on aggregate technical and commercial (AT&C) loss reduction. A notable provision is the proposal to link tariffs to a suitable index for automatic annual revision in cases where the SERC does not issue a tariff order, with the intent of reducing regulatory and procedural slippages that delay cost recovery. The draft also proposes that tariffs progressively recover a larger share of fixed costs through demand charges, with the objective of limiting cross-subsidisation across consumer categories and within tariff components. The draft proposes that appropriate commissions provide distribution licensees adequate freedom to take timely market-based power purchase decisions to ensure reliable and good quality supply, supported by structured training programmes to build market operation skills within utilities. The distribution infrastructure also needs to modernise using new technologies to reduce technical losses and theft alongside time-bound energy audits and accounting. To manage bidirectional flows from distributed renewables, storage and electric vehicles, the draft proposes adopting smart inverters, vehicle-to-grid systems and advanced control mechanisms and calls for establishing a distribution system operator at the discom level for real-time network management. Service quality is to be tightened through national benchmarks and online disclosure of performance, with state commissions monitoring indices such as SAIDI, SAIFI and CAIDI. For cities with a population of more than 1 million by 2032, N-1 redundancy at the distribution transformer level must be implemented and considered for the undergrounding of the distribution network in congested areas. It proposes exemption of cross-subsidy and surcharge components for the manufacturing industry, railways and metro railways to reduce power costs for key economic and logistics segments.

Beyond tariffs, the draft flags two supporting measures. First, it targets the completion of solarisation of all agricultural feeders by 2030, backed suitably with storage, to enable stable daytime supply and reduce the subsidy burden on state governments. Second, it calls for strengthening dispute resolution mechanisms in addition to regulatory commissions, with the aim of reducing the caseload on commissions, speeding up dispute outcomes and limiting the downstream financial impact on consumers.

Renewable energy generation and storage

The draft NEP, 2026, places accelerated integration of renewable energy at the core of system planning, while also highlighting the need to manage the associated network and balancing requirements. It calls for transmission cost-optimised siting of renewable energy projects to reduce overall system costs and do away with avoidable network augmentation as variable capacity scales up. With renewable additions expected to outpace growth in conventional capacity, the draft also signals a tighter operational framework for maintaining grid discipline. It proposes that by 2030 or earlier, the central and state commissions should ensure parity in scheduling and deviation treatment between renewable energy and conventional sources, with the objective of strengthening grid stability as renewable penetration rises. The draft promotes market-based deployment of storage, including the adoption of emerging battery energy storage system technologies. On the demand side, the draft signals the use of targeted incentives where required, including viability gap funding for pumped storage projects. In addition, the draft proposes measures to expand the use of renewable energy through captive routes.

> The draft NEP, 2026 signals a shift towards a more market-driven and technology-advanced power system that is anchored in decentralised resource adequacy planning, cost-reflective tariffs and faster integration of renewables and storage.

Thermal generation

The draft recognises the need to enhance flexibility in thermal operations, including through the integration of storage solutions and the repurposing of older units for grid support services so that the fleet can better respond to the variability introduced by higher renewable penetration. It also flags a broader utilisation approach for thermal stations during periods of high renewable output. In particular, it proposes exploring the direct use of steam from thermal plants for non-power applications such as district cooling and industrial processes, with the intent of improving overall asset utilisation.

Nuclear generation

Against the backdrop of Union Budget 2025–26, which has set a target of 100 GW of nuclear capacity by 2047 and the Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Act, 2025, the policy framework encourages faster adoption of advanced nuclear technologies, including modular reactor designs and smaller reactor configurations. It also opens up the possibility of nuclear power being used by commercial and industrial consumers, indicating a push to expand deployment pathways beyond the traditional utility-led model.

Hydropower generation

Hydropower is a strategic resource, and there is a need for optimal utilisation of India's hydropower potential through improved site assessment practices, streamlined clearances and supportive financing and tariff structures, along with incentive mechanisms to improve project viability. The draft proposal also links hydro development to climate adaptation and water security. With climate risks increasing and per capita storage capacity for water and energy requirements declining, it underlines the need for adaptation measures that can protect lives and economic activity. In this context, it highlights storage-based hydroelectric projects as a priority, given their potential role in flood moderation and irrigation support, alongside their value as firm and flexible capacity for the power system.

Power markets

The draft policy signals a push towards a broader set of market-enabling reforms, including stronger frameworks for bilateral contract settlements, greater standardisation of contract structures and the phased development of capacity market mechanisms. It also points to regulatory changes required to bring smaller and more distributed participants into organised market activity. These include enabling the aggregation of distributed renewable generation and small storage systems as well as market-based procurement of ancillary services and demand response arrangements. To support confidence in market operations, the policy calls for a stronger market monitoring and surveillance framework aimed at preventing collusion, market dominance and strengthening transparency for stakeholders.

Transmission

The draft proposal calls for a more flexible transmission system with a clear emphasis on strengthening intra-state networks to integrate variable renewable energy and support open access-driven flows. A key shift proposed is that transmission planning and execution should be consumer-oriented and anticipate network needs that would arise under an open access regime. The CEA is tasked with preparing rolling transmission plans including a detailed five-year plan and a 10-year perspective plan, in consultation with the Central Transmission Utility (CTU), state transmission utilities (STUs), load despatch centres (LDCs), state governments and industry associations. In line with these plans, the CTU and STUs are expected to formulate five-year capacity expansion plans that incorporate generation growth, general network access demand, congestion mitigation, margins and redundancy and right-of-way constraints.

Grid operations

To support smoother renewable integration, the policy emphasises the use of advanced forecasting and scheduling tools. It also outlines a role for energy storage systems in grid operations by suggesting that grid operators may be assigned storage for managing ancillary services. On the institutional side, a key proposal is the functional unbundling of STUs and the creation of independent state-level entities for SLDC operations and transmission planning functions. Strengthening LDCs through advanced technologies, along with adequately skilled and trained manpower, is also highlighted as necessary to manage operational challenges arising from large-scale renewable integration and the growing presence of distributed energy resources.

Cybersecurity

The policy calls for a robust cybersecurity framework, which is anchored in strict compliance with advisories issued by the central government and a stronger focus on mitigating supply chain vulnerabilities that can introduce systemic risks. A notable proposal is the mandatory storage of power sector data within India, positioned as a measure to ensure data sovereignty and strengthen system resilience. The policy also assigns a central coordination role to the CSIRT-Power (computer security incident response team for the power sector) as the nodal agency for cyber incident response and sector-wide coordination.

Data sharing

Data is framed as a foundational input for innovation and more efficient sector operations. The policy mandates that all power sector entities share operational and market data under a framework to be prescribed by the central government. It further proposes that all such data, except personally identifiable information, be made available to enable the development of technology-driven solutions by a wider set of participants and other new market entrants.

Technology and skill development

Grid modernisation is linked with domestic capability-building and for ramping up local manufacturing and the acquisition of critical technologies to reduce external dependence in key power system components. The proposal also emphasises the role of artificial intelligence and other digital tools in improving planning, operations and service delivery across the value chain. To address execution capacity, it recommends a structured skill development framework to align training programmes with emerging technology requirements and deepen industry–academia collaboration for workforce upskilling.

Conclusion

The draft NEP, 2026, signals a shift towards a more market-driven and technology-advanced power system that is anchored in decentralised resource adequacy planning, cost-reflective tariffs and faster integration of renewables and storage. Its success will hinge on timely regulatory follow-through on tariff and market reforms, along with accelerated transmission and distribution upgrades to manage bidirectional flows and maintain grid stability. As the consultation process advances, the key test will be whether states and utilities can translate the policy intent into measurable improvements in service quality and discom finances. ■

Global Partnerships

India's initiatives to promote cross-border energy cooperation

India is rapidly advancing its domestic clean energy transition while simultaneously strengthening international partnerships. This reflects a deliberate strategy to make energy cooperation a core part of its economic and geopolitical agenda. This approach is reinforcing India's position as a clean energy leader, particularly in the Global South.

Against this backdrop, this article examines India's evolving global partnerships in the energy sector, focusing on cross-border electricity trade expansion, its stance at recent the Conference of the Parties (COP) summits, cooperation on critical minerals and engagement with the International Solar Alliance (ISA).

Expanding cross-border energy supply

According to Central Transmission Utility of India Limited's Inter-State Transmission System Rolling Plan 2030–31 (Interim Report), India's cross-border transmission network now connects its national grid with Nepal, Bhutan, Bangladesh and Myanmar through a mix of synchronous and asynchronous links at 11 kV, 33 kV, 132 kV and 400 kV levels. These interconnections form the backbone of regional electricity trade in South Asia.

As per the table, the country's installed cross-border transmission capacity with Bangladesh, Bhutan, Nepal and Myanmar stands at 10,323 MW as of September 2025. Bhutan accounts for the largest share at 7,560 MW, largely reflecting long-standing hydro-based power trade; followed by Nepal at 1,600 MW and Bangladesh at 1,160 MW. The interconnection with Myanmar is currently modest at 3 MW. Together, these links form the foundation of India's regional electricity exchange framework in South Asia. In addition, 8,100 MW of cross-border transmission capacity is currently under construction along the India–Nepal corridor. Looking ahead to 2030–31, a further 7,354 MW of capacity is planned, including 5,350 MW with Nepal, 1,000 MW with Bangladesh, 504 MW with Myanmar and 500 MW through a proposed interconnection with Sri Lanka.

Given its central geographic location in South Asia, India is well positioned to facilitate electricity exchange in the region. Through these expanding transmission links, it is gradually shaping a regional electricity market in the area. By promoting infrastructure connectivity, affordable power trade and renewable integration, India is strengthening its position as an important energy partner in the Global South.

India's stance at COP summits on equity, finance and just transition

India has been a proactive participant at COP summits over the years, consistently shaping discussions around equity, climate finance and sustainable development. At COP21 held in Paris in 2015, India submitted its first nationally determined contribution (NDC) targets and co-launched the ISA with France to promote solar energy globally. At COP26 in Glasgow in 2021, the country updated its NDC targets and announced the Panchamrit commitments. In June 2025, it fulfilled one of these commitments and achieved the milestone of 50 per cent non-fossil fuel-based installed power capacity, five years ahead of the 2030 target.

Furthermore, it has led discussions on climate finance, which remains one of the most contentious issues between developed and developing countries at the COPs. At the last two COPs, COP30 and COP29, India, on behalf of the like-minded developing countries bloc, pushed for higher climate finance commitments from developed countries. COP29 concluded with the adoption of the Baku Finance Goal, which commits developed nations to mobilise $300 billion annually by 2035 and sets a long-term commitment of $1.3 trillion in climate finance for developing countries. However, India rejected the deal, calling it inadequate and inequitable, as it fell short of the $1.3 trillion annual target by 2030 sought by developing nations, amounting to less than one-fourth of the target. At COP30, India reiterated that the burden of climate mitigation must not shift to those least responsible for causing the crisis. It stressed the need for greater financial and technological support for vulnerable populations, particularly in the Global South, and reaffirmed its commitment to science-based, equitable and rules-based climate action that respects national sovereignty.

Collaborations with ISA for solar diplomacy and global grid integration

India has contributed politically, diplomatically and institutionally to the ISA's establishment by providing early seed support and driving its agenda on cost reduction, demand aggregation, technology adoption and capacity building for solar energy. Through the ISA platform, India has helped mobilise support for enabling environments for solar project financing, promoted technology transfer, and enhanced skill development for member countries.

The alliance now includes over 120 signatory and member countries and aims to mobilise more than $1 trillion in solar investments by 2030 to deploy 1,000 GW of solar energy capacity globally, thereby strengthening energy access, energy security and affordable clean transitions worldwide. Complementing its role in the ISA, India has also advanced the visionary One Sun-One World-One Grid (OSOWOG) initiative. OSOWOG envisions a globally interconnected electricity grid through which solar power generated in one region can be transmitted to another, ensuring round-the-clock access to clean energy across time zones.

Building on this vision, India also partnered with the UK to align OSOWOG with the UK-led Green Grids Initiative, culminating in the launch of the Green Grids Initiative — OSOWOG (GGI–OSOWOG) at the COP26 climate summit in Glasgow in November 2021, with support from the ISA and the World Bank. In addition, India is looking to collaborate with Saudi Arabia and the UAE on a cross-border energy exchange project involving subsea power cables to facilitate electricity trade. This initiative would enable electricity supply between the countries as required, further strengthening regional energy cooperation.

Collaborations on critical minerals

India is in discussions with various countries, including Australia, Brazil, Canada, France and the Netherlands, to forge partnerships for the joint exploration, extraction, processing and recycling of critical minerals. India recognises the importance of critical minerals as key inputs for solar cells and battery energy storage systems. Securing partnerships in this area is therefore a strategic step to strengthen supply chains of such inputs.

In 2022, the AU Critical Minerals Office and Khanji Bidesh India Limited signed an MoU to undertake joint due diligence for the selection of lithium and cobalt projects in Australia for investment and sourcing these minerals to India. More recently, in November 2025, India, Australia and Canada entered into the Australia-Canada-India Technology and Innovation Partnership. The partnership will focus on advancing green energy innovation and building resilient supply chains, including those for critical minerals.

Key global partnerships on biofuels and offshore wind

India is also forging partnerships in emerging renewable energy segments. In this regard, it launched the Global Biofuels Alliance, along with leaders from the US, Brazil, Italy, Argentina, Singapore, Bangladesh and Mauritius. The alliance now comprises 33 countries and 14 international organisations, and seeks to position biofuels as a key solution in the global energy transition while contributing to socio-economic growth. India has also deepened cooperation with Denmark in the offshore wind sector. The Centre of Excellence for Offshore Wind and Renewable Energy was established as a joint initiative between India's Ministry of New and Renewable Energy and the Danish Energy Agency. This collaboration aims to bring together industry, public authorities and civil society to facilitate and accelerate the implementation of India's offshore wind strategy.

Outlook

India is emerging as a key destination for global investments in the clean energy space. According to a Rajya Sabha response dated August 19, 2025, the country received foreign direct investment of $12,674 million in the renewable energy sector between April 2020 and March 2025. Major renewable energy players in India have also secured investments from global pension funds and sovereign wealth funds.

India's domestic delivery, cross-border engagement, and multilateral climate participation provide it with both operational experience and diplomatic advantage. Its ability to scale up renewable capacity while maintaining grid stability and expanding regional cooperation reinforces its position as an important voice of the Global South in shaping the future energy order. ■

Cross-border power transfer capacity till 2030-31 (MW)

Countries	As of September 2025	Under construction (by 2027-28)	Planned (by 2030-31)	Total
India-Bangladesh	1,160	0	1,000	2,160
India-Bhutan	7,560	0	0	7,560
India-Myanmar	3	0	504	507
India-Nepal	1,600	8,100	5,350	15,050
India-Sri Lanka	0	0	500	500
Total	**10,323**	**8,100**	**7,354**	**25,777**

Source: Central Transmission Utility of India Limited's Interstate Transmission System Rolling Plan 2030–31 (Interim Report)

Distribution Reforms

Progress under the RDSS

The Revamped Distribution Sector Scheme (RDSS) marks a shift towards outcome-linked reforms in the distribution segment, with a focus on addressing persistent financial stress and operational inefficiencies at the discom level. The scheme aims to improve the quality, reliability and affordability of power supply, while strengthening the financial health of the distribution segment. Key objectives include reducing aggregate technical and commercial (AT&C) losses to 12-15 per cent on a pan-India level and eliminating the average cost of supply (ACS)-average revenue realised (ARR) gap through operational efficiency and targeted reforms. Despite earlier reform efforts, losses of around 68 paise per unit of electricity sold continue to weigh on discom finances, underscoring the need for tighter implementation and accountability mechanisms.

Progress so far

As per PFC Limited's 14th Integrated Rating and Ranking Report, its aggregate technical and commercial (AT&C) losses declined from 15.97 per cent in 2023-24 to 15.04 per cent in 2024-25. During 2024-25, 38 utilities – 33 discoms and five power departments – reported AT&C losses below 15 per cent. Further, 22 utilities registered an improvement of more than 2 percentage points in AT&C losses compared to the previous year.

Billing efficiency improved marginally from 86.99 per cent in 2023-24 to 87.59 per cent in 2024-25. Additionally, collection efficiency across power distribution utilities improved from 96.60 per cent in 2023-24 to 97 per cent in 2024-25, indicating better revenue realisation across the sector.

The average cost of supply-average revenue realised (ACS-ARR) gap (cash adjusted) improved by Re 0.25 per kWh, narrowing from Re 0.32 per kWh in 2023-24 to Re 0.07 per kWh in 2024-25, indicating a notable strengthening of the sector's overall cost recovery position.

The power distribution segment achieved a positive profit after tax (PAT) on an accrual basis at the all-India level for the first time, reporting a combined PAT of Rs 27.01 billion in 2024-25, compared to a loss of Rs 270.22 billion in 2023-24. The ACS-ARR gap on a tariff-subsidy-received basis narrowed sharply to Re 0.06 per kWh in 2024-25 from Re 0.20 per kWh in 2023-24, underscoring improved cost recovery. Subsidy realisation rose to 98.9 per cent in 2024-25 from 97.45 per cent in 2023-24, with full subsidy dues for the past three years cleared in multiple states.

While structural and execution challenges persist, these trends point to early operational and financial gains under the RDSS and other concurrent distribution sector reforms.

In terms of sanctions and disbursals, as per the RDSS portal (accessed on March 13, 2026), the total sanctioned cost under the RDSS stands at Rs 2,817.11 billion. Of this, Rs 1,302.32 billion has been allocated for smart metering works, while Rs 1,499.21 billion has been earmarked for loss reduction works. The total gross budgetary support (GBS) under the scheme amounts to Rs 1,213.27 billion, with Rs 244.33 billion allocated for smart metering and Rs 955.87 billion for loss reduction works. So far, Rs 329.93 billion of the GBS has been released, comprising Rs 17.89 billion for smart metering works and Rs 312.04 billion for loss reduction works.

Loss reduction

There has been moderate progress under the loss reduction component of the RDSS, particularly in the installation of high tension (HT) lines, low tension (LT) lines and distribution transformers (DTs). As per the RDSS dashboard (accessed on March 13, 2026), the overall financial and physical progress under this component stands at 32.64 per cent and 38.19 per cent respectively.

State-wise, Goa emerged as the frontrunner, achieving 86.89 per cent physical progress, followed by West Bengal at 61.47 per cent and Tripura at 55.34 per cent.

Component-wise progress indicates that a total of 920,845 ckt km of LT lines have been sanctioned, of which 852,639 ckt km has been awarded and 525,034 ckt km installed. For HT lines, 814,408 ckt km has been sanctioned, 720,834 ckt km awarded and 337,007 ckt km installed. Under the DT segment, 804,192 units have been sanctioned, 728,104 units awarded and 358,118 units installed. Further, under the substation segment, 2,010 units have been sanctioned, 1,815 units awarded and 975 units installed.

Smart metering

As per the RDSS portal (accessed on March 13, 2026), around 198 million smart consumer meters have been sanctioned, of which 123 million (62 per cent) have been awarded. Progress has been slower than expected, with only 43.21 million (22 per cent) installed and communicating so far.

In addition, about 5.2 million DT meters have been sanctioned, with 4.8 million (93 per cent) awarded and 1.5 million (28 per cent) installed and communicating. A total of 195,211 feeder meters have been sanctioned, of which 183,060 (94 per cent) have been awarded and 150,340 (77 per cent) installed and communicating.

Progress in loss reduction works under the RDSS

Category	Unit	Sanctioned	Awarded	Installed
LT lines	ckt km	920,845	852,639	525,034
HT lines	ckt km	804,192	728,104	358,118
DTRs	no.	358,118	567,021	167,552
Substations	no.	2,010	1,815	975

Source: RDSS portal, accessed on March 13, 2026

Initial implementation challenges, largely linked to low consumer awareness, are being addressed through ministry-issued advisories and standard operating procedures. These include consumer incentives for prepaid meter installation, relaxation of penalties linked to maximum demand, structured recovery of past arrears, provision of check meters to build confidence, mobile applications for consumption tracking and recharges, and advance alerts for low balance and emergency credit.

The smart metering ecosystem is being shaped by rapid advancements in digital technologies and evolving utility requirements. Artificial intelligence and machine learning are enabling predictive analytics, demand forecasting and anomaly detection, while edge computing, combined with 5G and low-power wide area network connectivity, is supporting faster, decentralised data processing. Cloud-based and software-as-a-service meter data management (MDM) platforms are gaining traction as scalable and cost-efficient tools to improve grid responsiveness and operational efficiency.

Growing emphasis on smart grid integration and real-time data is expanding the role of MDM systems in demand response, load management and renewable energy integration. At the same time, greater system connectivity has increased the focus on cybersecurity and data privacy.

Key issues

The pace and quality of implementation under the RDSS vary significantly across states, reflecting a combination of institutional, financial and execution-related constraints. Many discoms continue to face capacity limitations, particularly the absence of in-house IT and OT teams to manage advanced metering infrastructure (AMI) service provider contracts, backend system integration and smart metering operations, leading to heavy reliance on nodal agencies and coordination challenges. Procurement delays, prolonged tendering cycles and bankability concerns have further affected contract finalisation and execution timelines, resulting in wide interstate cost variations.

Financial stress at the discom level continues to limit execution capacity, with high AT&C losses and persistent ACS-ARR gaps contributing to the underutilisation of RDSS funds in several states. Regulatory and data readiness challenges, including variations in prepaid metering regulations, grievance redressal mechanisms and interoperability standards, have slowed operationalisation, with a large share of installed meters yet to transition to prepaid or communicating mode.

Monitoring data indicates that physical progress has not consistently translated into consumer-level outcomes, particularly in prepaid metering adoption and loss reduction. Field-level constraints, such as a shortage of trained installers and integration engineers, along with connectivity limitations in rural pockets, continue to affect AMI performance.

Outlook

Over the next 6-12 months, the focus under the RDSS is expected to shift towards a mid-term evaluation of the scheme to assess on-ground impact, identify implementation gaps and enable course correction to meet targeted outcomes. Emphasis will be placed on optimising fund utilisation through streamlined disbursal processes, closer monitoring of qualifying parameters and the de-sanctioning of unawarded works to improve allocation efficiency.

Technology will play a central role in strengthening oversight, with wider use of the RDSS and National Feeder Monitoring System portals to support data collection, monitoring, evaluation and document verification. Greater focus on data analytics is also expected to identify and scale smart metering use cases, while aligning system capabilities with the broader India Energy Stack. In parallel, efforts will be directed towards strengthening cybersecurity and interoperability frameworks for smart metering and related digital systems. ■

IES Blueprint

India Energy Stack seeks to create an interoperable electricity ecosystem

Marking a significant step towards creating a digital public infrastructure (DPI) for the power sector, the Ministry of Power has released Version 0.3 of the India Energy Stack (IES) architecture and strategy documents. The strategy outlines how the IES will be developed and scaled, while the architecture sets out the technical blueprint to enable interoperability, trust and seamless coordination across the electricity ecosystem.

The IES aims to build open, interoperable and secure DPI for the power sector that would enable seamless participation, innovation and efficient coordination among various stakeholders, including consumers, utilities, markets and energy assets. It builds on the concept of DPI within the power sector, similar to Aadhaar, unified payments interface, DigiLocker, eKYC and eSign.

ZAt the core, IES will identify and connect stakeholders and assets, as well as facilitate open data exchange and interoperability in the power system through uniform specifications and standards. Essentially, IES will redefine how power sector entities (such as discoms, gencos, transcos, charger booking apps and consumer-producers) interact with one another, which would be facilitated by a set of services (application programming interface [API] definitions and calls), along with a data model/taxonomy.

IES architectural framework: Building blocks for a modular ecosystem

The IES framework is built on several core components that are essential for enabling large-scale coordination across the energy sector. These building blocks are summarised below:

Identity and addressing

Identity and addressing will provide a common reference framework for the power sector. It will assign unique, standardised identifiers to consumers, connections, meters and grid assets so that every data exchange and transaction is unambiguously attributed. It will cover persistent unique IDs, standard attributes and mapping rules that link local or legacy identifiers to common references. By creating a single reference layer across systems, identity and addressing would eliminate ambiguity and reduce manual reconciliation. Data from different utilities and vendors will be aligned consistently, enabling solutions to be reused and scaled across geographies.

Registries and directories

Registries and directories are authoritative records that establish who is authorised to operate in the ecosystem and where their digital endpoints can be discovered. They include role-based registries capturing the authorisation status, scope and validity of institutions and service providers, and directories that enable machine-readable discovery of services and interfaces. Governance arrangements define who can publish, update and query these records. This building block replaces bilateral onboarding and manual verification with a shared, trusted source of legitimacy and discovery. Systems can automatically verify counterparties and locate services, enabling plug-and-play participation.

Registries and verifiable credentials also allow participants to securely validate identities, claims and actions without centralising sensitive data. For instance, a rooftop solar installer with a digitally verified licence can be authenticated instantly by a utility during onboarding. Such capabilities will become increasingly important as energy markets grow more decentralised.

Transaction protocols

Transaction protocols define standardised rules for exchanging data across systems, including common message structures and data semantics. The IES specifies protocol definitions covering message envelopes, data models, interaction patterns and error handling. These protocols are extensible and designed to operate above heterogeneous legacy and vendor systems without prescribing internal architectures. Transaction protocols decouple applications from underlying systems. A service built for one utility can interoperate with another without custom integration, reducing costs and accelerating replication.

Energy credentials

Credentials are verifiable digital proofs that establish the eligibility, authority or status of actors and assets, in alignment with regulatory and institutional requirements. The framework supports the issuance, verification and revocation of standard credential types such as consumer consent, asset certification and licences. Standardised credentials enable systems to verify permissions automatically. This reduces fraud risks, strengthens compliance and enhances auditability across the ecosystem.

Policy as code

Policy as code converts regulatory and policy logic into machine-readable rules that can be evaluated consistently and transparently by systems. Policies are expressed in executable formats with defined inputs, outputs, versioning and governance, while the human-readable intent remains linked to the code to ensure explainability and oversight. Policy packs can be configured for different states or programmes. By standardising how policies are packaged and applied, Policy as code ensures uniform interpretation and accessibility across utilities and applications, while still allowing for jurisdiction-specific variation.

Use case illustrations of the building blocks

Consumer onboarding

- Identity and addressing: Links the consumer, connection and meter to a common reference.
- Registries and directories: Verifies authorised utilities and service providers and enables endpoint discovery. Registries would also contain credential revocation information (if any).
- Credentials: Captures and verifies consumer consent and eligibility.
- Transaction protocols: Standardises onboarding requests, confirmations and acknowledgements.
- Policy as code: Applies eligibility rules, consent scope and consumer protection logic.

Peer-to-peer trading

- Identity and addressing: Links buyers, sellers, assets and settlement accounts to common references.
- Registries and directories: Registries will act as a ledger that will contain trade information updated by the trading platforms, as well as export-import information updated by the discoms.
- Credentials: Validates trading permissions, consumer consent and platform authorisations.
- Transaction protocols: Handles trade offers, matching, execution and settlement exchanges.
- Policy as code: Applies trading constraints, price limits, consumer protections and settlement rules via policy packs.

Regulatory data exchange

- Identity and addressing: Ensures the traceability of reported data to verified entities and assets.
- Registries and directories: Confirms reporting roles, obligations and authorised reporting channels.
- Credentials: Establishes authority and authenticity of data submissions.
- Transaction protocols: Standardises submission, acknowledgement, validation and correction workflows.
- Policy as code: Defines reporting thresholds, formats and compliance checks.

Need for a national power sector data policy

While digitalisation offers a clear pathway to operational efficiency and improved service delivery, the sector's data landscape remains fragmented across state boundaries and locked within proprietary silos. In the absence of a unified governance framework, ongoing digital investments risk degenerating into "data swamps" rath-

Core IES stakeholders

Stakeholder	Role in IES
Gencos	Participate in IES via platform integration, generation data sharing, forecasting and market participation
Transcos	Implement IES via platform integration, transmission network data sharing, asset registries and grid visibility enhancement
Discoms	Implement IES via platform integration, data sharing, consumer service enhancement and retail market enablement
System operators	Coordinate grid operations, integrate real-time data flows, and enable balancing and ancillary services through IES protocols
Market operators	Facilitate market clearing, settlement and trading platforms aligned with IES standards and APIs
Regulators	Frame regulatory guidance, support innovation and ensure frameworks enable IES adoption
Consumers	Participate in IES-enabled services, and benefit from transparency, improved access and empowerment
Start-ups/Tech providers	Develop IT/OT solutions conforming to IES standards and ensure interoperability; build, pilot and scale new solutions leveraging IES APIs; integrate and manage smart metering (advanced metering infrastructure service providers); and access and disseminate data securely through IES-standard APIs

er than strategic assets. The proposed National Power Sector Data Policy is envisaged as the governance "constitution" for the IES, ensuring that data flows securely, seamlessly and interoperably across the ecosystem. By standardising data governance and embedding trust into digital interactions, the policy can unlock greater value from physical infrastructure investments and lay the foundation for a grid that is secure, financially sustainable and future-ready in a decarbonising economy.

The policy operationalises the IES as the sector's shared digital foundation. The IES architecture is structured around four foundational layers:

- Data layer: Distributed systems of record, exposed through standardised adapters to enable secure and interoperable data exchange.
- Identity layer: Unique registries for assets (such as transformers and meters) and entities, providing a common reference framework to support interoperability.
- Exchange layer: Adoption of a common data model to ensure semantic consistency and uniform interpretation of data across utilities.
- Consent layer: A robust consent mechanism enabling consumers to approve, limit or revoke the sharing of their smart meter data with designated third parties for specified purposes, supported by clear audit trails and legal compliance.

To conclude, the IES has been designed to address the gaps in the sector by creating a shared digital foundation. Rather than replacing existing platforms, it establishes common protocols, data models and interaction standards to facilitate secure and standardised data exchange across stakeholders. By enabling interoperability and improving coordination, the IES is expected to strengthen system efficiency, market development and the delivery of reliable, and affordable electricity. ■

Reference use cases built on IES architecture

Across all the use cases, the intent is to reuse the same core primitives (identity, registries/credentials, policy as code, standard APIs and interaction patterns) rather than building bespoke protocols or patterns per use case.

- **Inter-discom peer-to-peer (P2P) energy trading:** Cross-state, cross-discom P2P trading involves buyers and sellers operating under different utilities, while contracting, delivery verification, wheeling and billing, and dispute resolution span multiple organisations without a central coordinating authority. At present, identities and connection-meter linkages do not translate seamlessly across boundaries, evidence is generated in disparate formats, and verification and settlement processes remain slow and fragile.
  IES enables repeatable P2P trading by standardising discovery and contracting interactions, and by defining common evidence and receipt artefacts (such as signed meter-derived actuals) that all participants can rely on while platforms, exchanges and discoms remain autonomous. This ensures interoperable platforms, consistent discom visibility into scheduled versus actual trades, and evidence-based reconciliation and dispute resolution through shared protocol receipts and versioned records.
- **Energy policy as code:** Policies issued as PDF documents often lead to inconsistent interpretation, slow and uneven implementation, and disputes over whether the correct rules were applied in billing and operations. Utilities and vendors frequently re-implement the same policy logic with variations, increasing complexity and risk.
  IES enables a shift to machine-readable, digitally signed and versioned policy packs with clear provenance and deterministic evaluation. Systems can automatically identify the applicable policy version and generate explainable outputs linked to the source, making policy implementation consistent, portable and verifiable at scale.
- **Distributed energy resources (DER) visibility:** DER scale is constrained by fragmented registries and weak linkages between the consumer, premises, connection, meter and DER asset. This results in discom-specific portals, inconsistent identifiers, repeated verification, spreadsheet-based exchanges and limited comparability for regulatory or market reporting.
  IES enables federated registries and canonical DER schemas, supported by strong identity linkages, credentials and interoperable exchanges with built-in validation and receipts. DER data becomes consistently discoverable and auditable, reducing reconciliation effort, improving planning and enabling aggregators and programmes to scale across utilities.
- **Consumer-side flexibility:** While technically feasible, flexibility remains difficult to scale due to fragmented enrollment, consent, despatch, measurement and settlement processes. Weak discoverability, non-portable consent, varying despatch semantics and disputed baselines often delay settlements and undermine trust.
  IES standardises the full lifecycle – from programme discovery and reusable consent to despatch events, policy-as-code rulebooks, verification and settlement receipts. This makes flexibility programmes repeatable across discoms and service providers, with faster onboarding, verifiable outcomes and itemised settlements, while retaining a federated architecture.
- **Electric vehicle (EV) charging:** EV charging is inherently multi-operator, making interoperability critical. Currently, discovery, access, reservation and session management vary across networks, leading to fragmented user experiences and high integration costs.
  IES establishes common semantics for discovery (location, connector type, availability), reservation and charging sessions. This shared interaction framework allows multiple providers to participate seamlessly. Drivers can discover, reserve, charge and pay across networks through interoperable applications, while charge point operators retain operational autonomy and the ecosystem scales without bespoke integrations.

Green Energy Future

Emerging opportunities in the renewables sector

India's renewable energy transition is at a crossroads. While solar and wind continue to anchor capacity growth, emerging segments such as storage, hybrids, biofuels and green hydrogen are increasingly shaping the next stage of expansion. Union Budget 2026-27 reinforces this shift, with higher allocations (Rs 329.14 billion) to the Ministry of New and Renewable Energy (MNRE) for renewable deployment.

This article provides an overview of the current renewable energy landscape, highlighting the market trends, domestic manufacturing status and growing digitalisation shaping India's transition towards a greener and more resilient energy future...

Solar

As of January 31, 2026, as per the MNRE, cumulative solar capacity reached 140.6 GW, the highest among renewable segments. Solar led capacity expansion during the year, adding 35 GW during April 2025 to January 2026 – the fastest pace recorded so far.

The segment has also seen a rapid shift towards distributed solar. Under the PM Surya Ghar scheme, 6.02 million applications have been received (as of February 9, 2026), with 2.33 million installations completed, adding 8,555 MW. Subsidies worth Rs 165.64 billion have been disbursed so far. The PM-Kusum scheme also witnessed record progress. As on November 30, 2025, a total of 10,203 MW has been installed under all components of the scheme, with a total of 2,042,443 beneficiaries. As per the demand received from the states, Rs 71.06 billion has been released under the scheme.

On the manufacturing front, the Approved List of Models and Manufacturers (ALMM)-listed module capacity has reached 162.11 GW (February 7, 2026), while installed solar cell capacity stands at 26.35 GW (as per a Lok Sabha question dated July 30, 2025). This solar cell manufacturing landscape is poised for further expansion, supported by recent policy developments. At the same time, digitalisation is becoming central to solar asset management. Advanced analytics, artificial intelligence (AI)-driven forecasting, remote monitoring and automation are enhancing operational precision, optimising performance and lowering life cycle costs across utility-scale and distributed portfolios.

Together, expanding domestic manufacturing capabilities and smarter, tech-enabled asset management, alongside record installations and strong distributed solar uptake, signal sustained sectoral momentum, keeping India on track towards its 280 GW by FY 2030 solar target.

Wind

As of January 31, 2026, India's wind power capacity stands at 54.6 GW, the second largest renewable segment. Between April 2025 and January 2026, 4,612.58 MW has been added. Since FY 2025-26, discovered utility-scale wind tariffs have ranged between Rs 3.43 per kWh (Gujarat Urja Vikas Nigam Limited's 250 MW Phase X auction) and Rs 3.97 per kWh (Solar Energy Corporation of India's 600 MW Tranche XVIII auction). This activity has translated into a robust pipeline. As per the Central Electricity Authority's December 2025 quarterly report, 26.27 GW of standalone wind and 28.14 GW of hybrid wind projects are under construction, accounting for 17.7 per cent and 19.7 per cent of their respective pipelines.

Offshore wind gained policy traction in 2024, but momentum slowed in August 2025 when SECI cancelled two offshore tenders, citing limited developer participation, despite viability gap funding support and extended timelines.

On the manufacturing front, India has emerged as the world's third largest wind manufacturing hub, according to GWEC's India Wind Report 2025. Capacity expanded from 12 GW in 2022 to 20 GW in 2024 – a 74 per cent increase, enabling India to meet nearly 10 per cent of global wind demand.

At the same time, digitalisation in wind operations and maintenance is transforming the industry by enabling remote monitoring, predictive maintenance and automation through AI analytics, digital twins, drones and robotics. These technologies improve efficiency, reduce downtime and lower reliance on manual intervention, helping optimise generation performance and life cycle costs as assets grow in scale and complexity.

Going forward, achieving long-term energy transition goals will require scaling annual wind installations to 10-15 GW by 2030, accelerating offshore deployment and maximising onshore potential – backed by strong domestic manufacturing and smart, technology-enabled asset management.

Bioenergy

India's bioenergy sector is steadily gaining traction, with the total installed capacity reaching 11.6 GW as of January 31, 2026. Maharashtra is leading with 2,998.3 MW of installed bioenergy capacity, followed by Uttar Pradesh and Karnataka at 2,310.39 MW and 1,917.05 MW respectively. To harness the full potential of the segment, newer areas such as compressed biogas (CBG), ethanol blending and biomass co-firing in thermal plants have received strong policy and industry backing.

The uptake of CBG projects has shown positive momentum in recent years, even though overall progress falls short of the ambitious initial target of setting up 5,000 CBG plants and achieving 15 million metric tonnes (mmt) of CBG production by 2023-24 under the Sustainable Alternative Towards Affordable Transportation scheme. Under the GOBARdhan scheme, 190 CBG plants have been commissioned as of February 13, 2026. Furthermore, the ethanol blending segment has slowly matured, with the country achieving 20 per cent of ethanol blending in petrol in June 2025, five years ahead of the

initial 2030 target. Overall, with strong policy support and emerging subsegments, bioenergy is becoming a key pillar of India's clean energy push.

Hydropower

According to the MNRE, the installed large hydro power and small-hydro power capacities in the country stand at 51.2 GW and 5.16 GW respectively as of January 31, 2026, up from 41 GW and 4.06 GW respectively in March 2015. However, the contribution of large hydro to the total installed power capacity has declined from 16 per cent to around 10 per cent during the same period. As per the CEA, large-hydro generation reached 142,187.03 MUs during April-December 2025, reflecting a 13.3 per cent increase over the same period in the previous year. Meanwhile, small-hydro generation rose by 5.23 per cent to 10,277.39 MUs.

Pumped storage project (PSP) uptake has shown renewed momentum. As per the CEA, as of December 31, 2025, India has a total of 82 PSPs aggregating 105.46 GW at various stages of development. Such renewed focus is timely, as PSPs are indispensable in providing clean balancing power, making their accelerated deployment central to India's grid reliability and energy transition.

Green hydrogen

Green hydrogen is emerging as a catalyst in India's transition to a low-carbon economy. The National Green Hydrogen Mission is the backbone of this transition, providing a clear road map for domestic uptake as well as export-oriented growth.

The past year witnessed strong bidding activity, particularly for green hydrogen and green ammonia under the Strategic Interventions for Green Hydrogen Transition (SIGHT) programme. In March 2025, SECI announced the results of its auction under the SIGHT programme (Mode 1, Tranche II) to select producers for setting up green hydrogen production facilities in India. In September 2025, SECI announced results of the Tranche 2A green ammonia auction under SIGHT Mode 1 for the uptake of green ammonia by fertiliser companies. The lowest tariff discovered was Rs 49.75 per kg of green ammonia. This marked a significant milestone, with prices only marginally higher than prevailing grey ammonia costs, indicating rapid progress towards cost competitiveness.

Going forward, the focus should be on scaling pilots. Furthermore, continued tendering under the SIGHT programme, combined with a maturing green ammonia market, is likely to draw stronger investment in 2026.

Battery storage and hybrids

Batteries are emerging as a key technology in India's power transition, offering a flexible solution to the challenges of a high-renewables grid. The year 2025-26 marked a decisive scale-up phase for India's standalone BESS market, with around 16 auctions being conducted by a mix of central and state procuring agencies.

During this period, the lowest (L1) tariffs discovered for two-hour standalone BESS ranged from Rs 148,000 per MW per month (Transmission Corporation of Andhra Pradesh's 1,000 MW/2,000 MWh) to Rs 280,000 per MW per month (GUVNL's 500 MW/1,000 MWh). Overall, L1 tariffs for four-hour duration storage ranged from Rs 285,000 per MW per month (Rajasthan Rajya Vidyut Utpadan Nigam Limited's 500 MW/2,000 MWh auction) to Rs 444,000 per MW per month (Bihar State Power Holding Company Limited's 125 MW/500 MWh) during the period. For both two-hour and four-hour standalone BESSs, the auction outcomes reflect that higher capacity tenders witnessed comparatively lower per MW per month tariff.

There has also been an increased focus on the uptake of round-the-clock (RTC), firm and despatchable renewable energy (FDRE), and hybrid projects as utilities and commercial and industrial clients both demand firm clean energy. During the period January 2025-February 2026, India witnessed two RTC auctions. The L1 tariffs ranged from Rs 4.35 per kWh (Railway Energy Management Company Limited's 1 GW) to Rs 5.06 per kWh (SECI's 1.2 GW). During the same time period, three auctions were conducted in the FDRE space. The L1 tariffs ranged from Rs 4.82 per kWh (SJVN Limited's 1.2 GW FDRE-03) to Rs 8.5 per kWh (SECI's 8 GWh FDRE-VI). In line with this upward tariff trend, FDRE project tenders and auctions are expected to see significant growth in the coming years, as consumers increasingly demand reliable and consistent power supply. Meanwhile, three auctions have been conducted in the hybrid space. The L1 tariff was Rs 3.35 per kWh for NTPC Limited's 1.2 GW inter-state transmission system (ISTS). The highest tariff of Rs 3.41 per kWh was observed in NHPC Limited's 1.2 GW hybrid ISTS.

The way forward

With Budget 2026-27 increasing allocations for renewables, storage and green hydrogen, and reducing input costs by reducing basic customs duty on select technologies, policy intent is clearly aligned with the sector's evolving needs. The priority now is translating fiscal support into timely execution – scaling firm and flexible capacity, accelerating offshore wind and storage deployment, and strengthening domestic manufacturing ecosystems. ■

New Applications

Green hydrogen emerges as an energy carrier

Green hydrogen is slowly becoming a key component of India's low-carbon transition. Its role in cutting industrial emissions, reducing dependence on imported fossil fuels, and improving long-term energy security has elevated it to the policy priority list. Policy measures, such as the National Green Hydrogen Mission, waivers on interstate transmission system charges, and production-linked incentives for green hydrogen and electrolysers, have helped build a strong policy foundation for its uptake. As a result, industry interest has gained momentum, with public and private players announcing projects across green hydrogen, green ammonia and electrolyser manufacturing.

Green hydrogen functions not just as an energy source, but as an energy carrier as well. When excess electricity from solar or wind sources is available, it can be used to split water into hydrogen through electrolysis, effectively storing renewable energy in a chemical form rather than losing it. This hydrogen can be stored for long periods, transported with relative ease, and later used to generate electricity, produce heat, or fuel industrial processes. This way, green hydrogen acts much like a large-scale, long-duration battery. This makes it particularly valuable for seasonal energy storage and for hard-to-abate sectors where direct electrification remains challenging.

The Indian hydrogen energy storage market is valued at around $720 million, according to Ken Research. Hydrogen's fundamental advantage is that it has the highest energy content per unit mass of any fuel, making it well suited for storing large quantities of energy over long periods. Hence, over the long term, green hydrogen could gradually compete with pumped hydro storage and battery energy storage systems. As domestic manufacturing expands and production volumes rise, economies of scale are expected to drive down costs. This cost trajectory is critical. According to the FICCI-EY report "India's Green Hydrogen Strategic Opportunities, Key Challenges, and Demand Potential by 2030", the cost of green hydrogen could fall to Rs 260-Rs 310 per kg, significantly improving its viability for long-duration and grid-scale storage applications. Growing uptake across applications will further assist in cost reduction. Some sectors where the uptake of green hydrogen can already be observed are fertiliser and transportation, with pilots and early-stage initiatives in steel and microgrids.

Fertilisers

Hydrogen is the fundamental building block for ammonia, which is a key component in the production of fertilisers. According to the FICCI-EY report, ammonia consumption in India stands at 17-19 million tonnes per annum (mtpa), and the fertiliser sector accounts for over half of this demand. As most of this ammonia is derived from imported natural gas, it makes the fertiliser sector both carbon-intensive and import-dependent. Green ammonia addresses this challenge while also underscoring hydrogen's role as an energy carrier and storage medium: by binding hydrogen with nitrogen, it converts a hard-to-store gas into a stable liquid that can be transported using existing infrastructure and later cracked back into hydrogen when needed.

In September 2025, the Solar Energy Corporation of India announced the results of the Tranche 2A green ammonia auction under SIGHT Mode 1 for fertiliser offtake. In total, 13 green ammonia projects were awarded under this tender, collectively targeting a capacity of 724,000 tonnes per annum to be supplied to fertiliser plants. The discovered tariff ranged from Rs 49.75 per kg to Rs 64.74 per kg, a notable milestone as prices were only marginally higher than the prevailing grey ammonia costs. This outcome clearly signals that green ammonia as an energy carrier and storage vector is moving rapidly towards cost competitiveness and large-scale commercial adoption in India.

Transportation

According to the Institute for Energy Economics and Financial Analysis report "Enabling Sustainable Demand for Green Hydrogen in India", green hydrogen demand from the transportation sector is projected to be substantial by 2030. Under the base case with minimum policy interventions, the demand is estimated at around 1.35 million metric tonnes per annum (mmtpa), increasing to nearly 1.8 mmtpa in a more mature scenario where green hydrogen prices fall by about 50 per cent. This growing demand outlook is already being mirrored in on-ground deployments across road, maritime and railways.

In March 2025, the Ministry of New and Renewable Energy (MNRE) launched five pilot projects to deploy 37 hydrogen-powered buses and trucks covering both fuel cell and hydrogen internal combustion engine technologies, supported by nine refuelling stations and an allocation of Rs 2.08 billion.

In September 2025, India inaugurated its first port-based green hydrogen pilot at V.O. Chidambaranar Port, where green hydrogen is being used for local energy needs within the port.

In January 2026, Northern Railway announced that it would soon commence a pilot run of India's hydrogen train on the Jind Sonipat route.

Steel

India is the world's second largest producer of crude steel and the largest producer of direct reduced iron (DRI), supported by rapidly growing domestic demand, according to the "India Insights Briefing: Unlocking India's Clean Industrialisation Opportunity", published by the Industrial Transition Accelerator (ITA) and BCG. As of FY 2024-25, the sector contributed nearly 2 per cent to India's GDP, accounted for about 8 per cent of global crude steel production, and nearly 40 per cent of the global DRI output. In such a situation, decarbonising the steel sector becomes critical, and the use of green hydrogen in the sector emerges as a key pathway to reduce emissions.

Application of green hydrogen is in early stages in the steel sector, with just two commercial-scale projects having been announced. The first project is a 4 mtpa green steel project by JSW (to be carried out in two phases of 2 mtpa each) involving the phased transition of a natural gas-based plant to a green hydrogen plant, according to the ITA-BCG report. Furthermore, in a major development, JSW Energy Limited has commissioned its first and the country's largest green hydrogen manufacturing plant in November 2025. The project is under the production-linked incentive scheme Tranche I and is located adjacent to the JSW Steel facility at Vijayanagar, Karnataka. The plant will supply green hydrogen directly to the DRI unit of the steel facility for low-carbon steel production. The second major initiative is a pilot for green hydrogen injection into a blast furnace by Steel Authority of India Limited. Beyond these two projects, a few other pilot projects are in the testing phase, and some of these are supported by the Ministry of Steel.

Microgrids

Green hydrogen can also be used in microgrids, providing electricity to remote areas and enabling energy independence. In November 2025, NTPC's 3.7 MW solar plant, a solar-hydrogen project, was inaugurated in Ladakh. The company has designed a standalone microgrid using hydrogen as the storage medium to supply 200 kW of power at any time of the day, throughout the year. Furthermore, the solar-hydrogen microgrid will replace the diesel generator sets currently operating at remote army sites. This will help in cutting carbon emissions and ensuring a cleaner, more dependable energy supply for the region. In 2021, NTPC Simhadri awarded a standalone fuel-cell-based 50 kW microgrid pilot project with hydrogen production using an electrolyser to Bloom Energy India Private Limited, Bengaluru. The hydrogen will be produced using the advanced 240 kW solid oxide electrolyser by taking input power from the nearby floating solar project.

Challenges and the way forward

Despite growing interest, several barriers continue to impede the adoption of green hydrogen in India. Cost remains the single biggest hurdle. As per the FICCI-EY report, while grey and black hydrogen are available at Rs 150-Rs 220 per kg, green hydrogen costs are twice as high, hovering around Rs 350-Rs 500 per kg, even without factoring in additional expenses for compression, liquefaction, or conversion into ammonia.

Another key constraint is the availability of round-the-clock renewable power. Large electrolysers require continuous, reliable, clean electricity to operate efficiently, but the variable nature of renewable generation complicates this. Regulatory uncertainty around transmission access, energy banking and storage integration, particularly for gigawatt-scale projects, continues to dent developer confidence.

Water availability is yet another issue. Producing 1 kg of hydrogen typically requires 12-13 kg of purified water. Given that pure water is a scarce commodity in the country, the government is prioritising the development and demonstration of technologies that can enable hydrogen production from low-grade water sources, such as seawater and wastewater. At the same time, delays in clearances and competing land-use priorities have already slowed project execution. Scaling up to support India's 5 mmt per year green hydrogen target by 2030 will require an estimated 125 GW of additional dedicated renewable energy capacity, along with robust water logistics and strong domestic electrolyser manufacturing capabilities.

Addressing these challenges is critical if green hydrogen is to move beyond niche applications and emerge as a viable energy storage solution at scale. A combination of cost support, clear long-term mandates, and better system-level planning will be crucial. As costs decline and policies mature, green hydrogen can gradually assume a meaningful role in India's energy storage and decarbonisation landscape. ■

Bharat Electricity Summit 2026

Agenda: Thursday, March 19, 2026 (Day 1)

Strategic Conference

Time: 11:40 – 12:40

Meeting the electricity needs of the Global South: Key catalysts for cross-border collaboration, investment and innovation

- Shri Manohar Lal, Minister of Power and Housing and Urban Affairs, Government of India
- H.E. Shri Kumara Jayakody, Minister of Energy, Sri Lanka
- H.E. Lyonpo Gem Tshering, Minister of Energy and Natural Resources, Bhutan
- H.E. Hussain Ageel Naseer, Deputy Minister of Tourism and Environment, Maldives
- H.E. Juma Daler Shafoqir, Minister of Energy and Water Resources, Tajikistan
- Hon. Dr Jean Mathanga, Minister of Energy and Mining, Republic of Malawi

Time: 14:00 – 14:50

A resilient global energy mix: Strengthening reliability, affordability and clean growth

- Gurdeep Singh, Chairman and MD, NTPC Limited
- Gauri Singh, Deputy DG, IRENA
- Guilherme Mendonca, CEO and MD, Siemens Energy India Limited
- Damitha Kumarasinghe, DG, Public Utilities Commission of Sri Lanka (PUCSL)
- Burra Vamsi Rama Mohan, Director, Projects, Power Grid Corporation of India Limited (POWERGRID)

Time: 14:50 – 15:40

India's power sector roadmap to 2047: Translating national vision into a resilient, integrated and future-ready electricity system

- Ghanshyam Prasad, Chairperson, Central Electricity Authority (CEA)
- Guirec Servan, CEO, EDF Power Solutions India Private Limited
- Dr Praveer Sinha, CEO and MD, Tata Power Company Limited
- Dr R.K. Tyagi, Chairman and MD, Power Grid Corporation of India Limited (POWERGRID)

Time: 15:40 – 16:30

Digital energy stack: Building a secure and interoperable backbone for the modern grid

- Dr Ram Sewak Sharma, Chairperson, India Energy Stack, Ministry of Power
- N. Venu, MD and CEO, India and South Asia, Hitachi Energy and MD, Hitachi India
- Jitendra Srivastava, Chairman and MD, Rural Electrification Corporation Limited (REC)
- Ashish Kumar Goel, Chairman, Uttar Pradesh Power Corporation Limited

Technical Conferences

Time: 12:30 – 14:30

ESG and Workforce Transformation (Enablers of Power Sector Transformation)

- Sabyasachi Pattanaik, Country Director, Regulatory Affairs and Market Development, Utilities, Oracle
- Munish Sharma, Head of Group, ESG, ISO Standards and Consumer Connect, BSES Rajdhani Power Limited
- Sai Shankar G. Nair, Senior Executive, Ministry of Industry and Commerce
- Anand Mayank, Manager, POWERGRID
- Sachin Gupta, HoD (BE and TQM), Tata Power Delhi Distribution Limited
- Amresh Ray, Sustainability Officer, Corporate Saatvik Green Energy Limited

Time: 12:30 – 14:30

Grid Technology, Infrastructure and Planning (Transmission and Grid Operations)

- Rajmohan T., Head, Technology and Renewable Power, Essar Power
- Yashpal Choudhary, DGM, POWERGRID
- Akshay Sharma, Manager, POWERGRID
- Radha Manohar T., Chief Manager, POWERGRID
- Bharath Kumar Sundar, Business R&D and Senior Professional, Hitachi Energy, Technologies Services Private Limited

Time: 15:30 – 17:30

Decarbonisation and Net-Zero Strategies (Enablers of Power Sector Transformation)

- Rashika Gupta, VP, Power and Renewables Research, Wood Mackenzie
- Ravi Kumar Nethi, Carbon Capture Integration Leader, GE VERNOVA
- Manish K. Tiwari, AGM, NTPC Limited
- Shubhra Shah, DGM, NHPC Limited
- Tania Guha, Senior Manager, Engineers India Limited
- Nikhil Thejesh Venkataramana, Prime Minister's Research Fellow, Indian institute of Technology Bombay

Time: 15:30 – 17:30

Asset Management (Transmission and Grid Operations)

- Rajil Srivastava, Executive Director, AM, Power Grid Corporation of India Limited (POWERGRID)
- Vijay Doijadkar, Lead Engineer, Tata Power Company Limited
- G.S. Papneja, National Sales Manager, OMICRON
- Sunil Bansod, Executive Engineer, Automation, MSETCL India
- Shivanjali Singh, Lead Engineer, Transmission Lines, Tata Power Company Limited

As of 6:30 PM on March 18, 2026