

High-Level Workshop Accelerating The Decarbonisation Of India's Electricity Sector

Friday 12 December 2025, 17:00 – 20:15 Hours IST

Annexe, India International Centre, New Delhi

CONTEXT AND BACKGROUND

The Lantau Group convened a high-level knowledge sharing workshop titled Accelerating the Decarbonisation of India's Electricity Sector – Integrating Global Best Practices with National Realities on Friday, 12 December 2025, from 17:00 to 20:15 hours IST, at Lecture Room I, Annexe, India International Centre, New Delhi. The event was attended by senior policymakers, regulators, system planners, developers, and sector experts.

After decades focused on capacity addition and access, India's power sector is now grappling with the operational, financial, and institutional implications of large-scale renewable energy integration. India's renewable energy programme has delivered scale, with non-fossil sources accounting for over half of installed generation capacity and a clear policy trajectory towards 500 GW of non-fossil capacity by 2030. This progress has been underpinned by long-term power purchase agreements, competitive procurement, and reforms enabled by the Electricity Act, 2003. However, as renewable penetration has crossed the 200 GW threshold, new system-level challenges have become increasingly visible, including renewable curtailment, growing risk aversion among distribution utilities, uneven rooftop solar adoption, and rising concerns around flexibility and balancing resources.

At the same time, the policy and regulatory landscape is evolving. Initiatives such as the National Green Hydrogen Mission, the Carbon Credit Trading Scheme, plans to expand nuclear capacity, and ongoing reforms related to smart metering, Time-of-Use tariffs, Battery Energy Storage Systems, and Pumped Storage Projects signal a shift towards a more complex and market-oriented power system. These changes raise fundamental questions around market design, investment signals, consumer protection, and the allocation of risks between generators, utilities, and consumers. The workshop was designed to address these questions by placing India's transition within a comparative international context. Drawing on experience from markets such as Australia, China, and the Philippines, the discussion focused on identifying which elements of global practice are relevant for India, where adaptation is required, and where India's scale, institutional structure, and social priorities demand a distinct approach.

Opening Remarks

Rajat Sarawat, Partner, The Lantau Group

Rajat Sarawat opened the discussion by noting that the global energy transition is advancing along two tracks simultaneously: strong momentum driven by new technologies, policy ambition, and electrification, alongside a persistent gap between plans and delivery. Drawing on experience across markets including Australia and India, he observed that while investors accept the inevitability of the transition, it is not yet fully investable, not due to a lack of capital but due to weak confidence arising from planning delays, transmission constraints, rising costs, and policy uncertainty. Capital, he emphasised, is rational rather than risk-averse, and responds to clear policy frameworks, stable rules, predictable returns, and credible delivery pathways rather than aspirations or announcements. Turning to India, he noted that the sector is entering a new phase shaped by the twin goals of becoming a developed economy by 2047 and achieving net zero by 2070, where earlier reforms have largely been exhausted and progress now depends on tackling deeper structural and institutional challenges, revisiting previously underexplored ideas, and ensuring that promising solutions are not lost to inertia or politics, with the roundtable intended to help move the discussion from ideas to action.

Setting the Context

Mike Thomas, Managing Director, The Lantau Group

Mike framed his presentation around the idea of the “missing Goldilocks” in electricity sector decarbonisation: the absence of a clear sense of what constitutes a “just right” pathway between moving too slowly and pushing too hard. He argued that while renewable technologies such as solar and batteries have become cost-competitive and, in many cases, the technologies of choice, they are being introduced into power systems through strong policy forcing mechanisms such as auctions, feed-in tariffs, and long-term contracts. This is occurring in markets that were originally designed to expose investors to market outcomes, creating a hybrid system where market signals and policy interventions interact in complex and sometimes unintended ways.

He described the transition as unfolding in three broad waves. In the first wave, renewables enter cheaply by using existing system slack and resilience, with limited attention to balancing or ancillary services. In the second wave, that slack is exhausted and system complications emerge, requiring explicit investment in flexibility, balancing, and complementary resources such as batteries. The third wave represents the most difficult stage, where legacy generation must be displaced and the remaining decarbonisation challenge addressed, with no low-hanging fruit left. Using examples such as the Philippines, he showed how auction-driven renewable procurement can outpace demand growth, place downward pressure on wholesale prices, but not necessarily delivered tariffs, and increase uncertainty around investment signals and capacity exit. He cautioned that excessive reliance on auctions risks turning them into de facto capacity allocation tools, distorting market signals and complicating the task of aligning decarbonisation, reliability, and market confidence.

The Energy Transition in Western Australia

Toby Price, Manager, WA Future Systems Design, AEMO

Operating an isolated power system with very high renewable penetration has forced Western Australia to confront many of the issues that other jurisdictions are only beginning to face. The South-West Interconnected System, which serves around 1.2 million consumers and is not electrically connected to other grids, has already reached close to 90 percent instantaneous renewable contribution. This has been driven largely by customer-led rooftop solar, which now exceeds the capacity of the largest utility-scale generator by a factor of ten. In 2025 alone, the system recorded new peak demand and renewable penetration records, including periods where installed renewable capability exceeded total system demand, leaving technical and commercial constraints, rather than resource availability, as the primary limits to further decarbonisation.

Against this backdrop, Toby Price explained how AEMO and the Western Australian government have restructured market and operational frameworks to manage the transition. Reforms introduced in 2023 included security-constrained economic dispatch on a five-minute basis, co-optimisation of essential system services such as frequency control, contingency reserves and inertia, explicit treatment of network constraints, and changes to the reserve capacity mechanism to ensure forward adequacy. These tools have enabled the system to manage extreme operating conditions, including very low minimum demand, with large-scale batteries absorbing excess renewable generation while allowing critical generators to remain online and provide security services. Looking ahead, he described AEMO's use of a "transition point planning framework" to identify milestones in the transition, such as major plant exits or rising participation of new technologies, and to assess whether the system operator has the operational tools and market arrangements needed at each stage, working in coordination with Western Power and Energy Policy WA.

The Philippines Power Sector Experience

Monalisa Dimalanta, Senior Partner, PJS Law

The Philippines' electricity story, as presented by Monalisa Dimalanta, starts with the physical reality of an archipelago: even after Luzon, Visayas and Mindanao were interconnected in 2024, she noted that more than 200 islands remain off grid, meaning the "Philippine power system" is effectively multiple systems rather than one integrated grid. She then traced four major shifts. First, a renewables-led system built around hydro (and later geothermal), where she stated the country was effectively powered by renewables through the early 1980s. Second, a diversification and financing shift driven by political pressure to keep tariffs artificially low, which led to large subsidies and mounting debt at the state utility and created pressure to open generation to private capital. The third shift was formalised through the Electric Power Industry Reform Act (2001), which restructured the sector, drove privatisation, and enabled the development of a wholesale spot market, but also coincided with a falling renewable share and rising coal dependence, with the added vulnerability that the Philippines imports most of its coal.

She positioned today's transition as a fourth shift: returning to renewables while deepening competition at the retail end. On the supply side, she described the evolution from a time-limited feed-in tariff programme to a Green Energy Auction Programme launched in 2022, which awards long-term offtake contracts with priority dispatch, but she also cautioned that the Philippines may be becoming "addicted" to auctions and should reassess whether they remain fit for purpose. She highlighted how auctions have expanded beyond variable renewables into system-balancing technologies (including pumped storage and geothermal in one round), and flagged the scale of upcoming ambition, including an offshore wind auction. On the demand and market side, she described "network shift" measures such as net metering, DER and smart grid programmes, and "source shift" measures that allow eligible consumers to contract directly with retail suppliers, including newer accelerators like retail aggregation and advanced metering infrastructure rollout, which she presented as key to unlocking competition and bankable greenfield contracting beyond traditional distribution-utility offtake.

Power Sector Decarbonisation: India

Rajnath Ram, Adviser, Niti Ayog

India's power sector decarbonisation strategy, as presented by Rajnath Ram, was anchored to two recent government announcements: achieving developed economy status by 2047 and reaching net zero emissions by 2070. He set this within a macroeconomic transformation that will fundamentally reshape energy demand, noting an aspirational \$30 trillion economy by 2047, per-capita income rising from about \$2,700 to over \$18,000, sustained GDP growth of around 7 percent, population growth to over 1.6 billion, and urbanisation increasing from roughly 36 percent to more than 51 percent.

He highlighted that these shifts will be accompanied by structural changes in demand drivers, including higher manufacturing output and sharply rising passenger mobility and material consumption. Against this backdrop, India faces a unique development challenge: unlike today's developed economies, which grew using fossil fuels, India is attempting to achieve rapid economic growth and deep decarbonisation simultaneously, despite contributing only about 3.3 percent of cumulative global emissions.

From an energy-system perspective, the presentation underscored several key realities:

- Low electrification today: only around 20 percent of final energy demand is electrified.
- Fossil-heavy generation: around 75 percent of electricity generation still comes from fossil fuels, even though more than 50 percent of installed capacity is now non-fossil.
- Scale of growth ahead: by 2047, total energy demand could rise nearly threefold, electrification could increase to about 40 percent, and electricity demand could grow roughly fivefold.

He outlined a set of priority areas under active consideration by the government to manage this transition while preserving energy security, affordability, and reliability:

- Scaling firm clean capacity, including a target of 100 GW of nuclear by 2047, supported by proposed amendments to the Atomic Energy Act, 1962 and easing of civil liability constraints to enable private participation.

- Accelerating renewable deployment, alongside addressing transmission bottlenecks, shifting part of capacity addition towards decentralised, floating and agri-PV solutions, repowering existing wind assets, and pursuing offshore wind.
- Strengthening system reliability, through solar-wind hybrids, long-duration storage, and more flexible operation of coal plants.
- Market and institutional reforms, including wider adoption of Time-of-Day tariffs, development of ancillary markets, digitalisation through an “India Energy Stack”, and deeper DISCOM reforms to address persistent financial losses.
- Supply-chain and end-of-life considerations, such as clean-tech manufacturing policies, circularity for renewable and battery waste, and deployment of CCUS to manage residual emissions expected even in 2070.

He concluded by noting that multiple working groups are already engaged in translating these priorities into roadmaps, reflecting the scale and complexity of aligning India’s development ambitions with its long-term decarbonisation pathway.

Experiences From Energy Transition in China

David Fish, Principal, The Lantau Group

China’s energy transition is unfolding at a scale unmatched by any other power system. With installed capacity exceeding 3,600 GW by mid-2025, China today operates the world’s largest electricity sector, with wind and solar accounting for nearly half of cumulative capacity additions over the past decade. This scale has allowed hundreds of gigawatts of renewables to be absorbed with limited system instability, but it has also begun to expose new stresses in pricing, dispatch, and market design.

David Fishman explained that China is now moving decisively away from supply-side support towards demand-side drivers of renewable deployment. Following the gradual withdrawal of feed-in tariffs and grid-parity PPAs, renewables are increasingly required to sell into wholesale markets, with Contracts for Difference available only for limited volumes and shorter durations. As a result, developers are being pushed to operate on market fundamentals rather than guaranteed returns, a transition that is proving challenging, particularly in provinces experiencing sustained low or negative daytime spot prices. Several recent policy shifts illustrate this rebalancing:

- **Green consumption obligations** are being extended beyond power suppliers to large end-users such as cement, steel, polysilicon, and data centres, requiring them to procure minimum shares of renewable electricity.
- **Direct green power supply mechanisms** now allow eligible consumers to take equity stakes in generation assets and claim physical green power consumption, including for compliance with export-related carbon requirements.
- **Market exposure to renewables** has increased, with new projects required to sell into spot markets, heightening price volatility and curtailment risk while strengthening signals for storage deployment.

He highlighted Shandong province as an example of the growing pains associated with market reform, where prolonged negative prices over several hours a day signal not failure, but the need for complementary investments such as grid-scale storage and improved flexibility. While negative prices are not inherently problematic, their persistence points to structural imbalances between renewable growth and system absorption capacity.

Looking ahead, Fishman noted that China's renewable expansion is likely to slow modestly in the near term as developers adjust to reduced guarantees and higher market risk. However, strong state involvement, continued demand-side stimulus, and a clear national objective to stabilise emissions by 2030 provide a window to strengthen market institutions before the next phase of decarbonisation. Despite short-term pressures on project returns, the policy environment and scale of demand underpin cautious optimism for China's renewable trajectory through the remainder of the decade.

Regulatory Reflections on India's Power Sector

Harpreet Singh Pruthi, Secretary, CERC

India's renewable energy transition, as reflected by Harpreet Singh Pruthi, has been both rapid and consequential. He noted that installed renewable capacity has grown from about 4.7 GW in 2003 to around 172 GW by 2024–25, implying a compound annual growth rate of nearly 19 percent, and that India has already crossed 50 percent non-fossil fuel-based installed capacity. While this aggressive pace has enabled cleaner power supply, it has also introduced a new set of regulatory and system-level challenges that must be addressed to preserve reliability and flexibility.

From a regulatory perspective, he highlighted several emerging stress points:

- Rising integration costs, particularly on the transmission side. While ISTS charges have been waived to promote renewables, transmission costs have risen to about ₹0.57/kWh and are expected to increase further to around ₹1.07/kWh, largely due to network expansion required to integrate large solar and wind parks.
- Limits of thermal flexibility, which has so far absorbed much of renewable variability. Regulations mandating minimum technical operation of thermal plants (reduced from 70 percent to 55 percent, and potentially towards 40 percent) have helped, but this flexibility is now reaching technical limits.
- Growing balancing and security risks, evidenced by multiple grid events between 2022 and 2025 involving sudden losses of 1–7 GW of renewable generation and sharp frequency deviations.

Pruthi stressed that these trends fundamentally affect how resource adequacy must be approached. He noted that adequacy assessments can no longer focus only on generation capacity and energy balance, but must explicitly account for transmission availability and cost, reserve requirements, and locational implications of where generation and storage are built. Under the resource adequacy framework mandated by CERC and CEA, variable renewables have low-capacity contribution factors (for example, around 10 percent for wind), implying the continued need to procure capacity that may be infrequently dispatched but must remain available. Ignoring transmission costs in this context, he cautioned, risks producing sub-optimal capacity mixes and higher system-wide costs. Looking ahead, he outlined areas where regulatory frameworks are evolving:

- Integrating transmission costs into planning and adequacy assessments, potentially through locational signals such as transmission rights, to guide investment in generation and storage towards system-optimal locations.
- Scaling flexibility resources, including longer-duration battery storage and pumped storage, as thermal support during night hours declines.
- Evolving market mechanisms, moving beyond PPA-dominated procurement towards capacity markets, contracts for difference, and a revamped ancillary services framework.
- Demand-side participation, particularly aggregation of demand response to provide reserves and flexibility.

He concluded by emphasising that future regulatory design must be technology-neutral, market-aligned, and explicitly co-optimised across generation, transmission, and reserves, while continuing to meet the core objectives of reliability, affordability, and sustainability.

Keynote Speech

Steve Edwell, Chair, Economic Regulation Authority, Western Australia

Steve Edwell framed his remarks around the idea that modern power systems evolve less from textbook economics and more from the specific political, demographic, and institutional contexts in which they operate. Drawing on Australia's experience, he stressed that vast geography, low population density, and exposure to climate risks fundamentally shape how markets are designed and regulated, making simple comparisons with India or China inappropriate. He argued that today's transition is marked by an unprecedented convergence of risks: rapid renewable deployment, accelerating climate impacts that threaten system resilience, and new technologies such as AI-driven bidding that introduce fresh market complexities. In response, Australia has relied on highly codified resource adequacy frameworks, clear reliability standards set by governments, and strong separation between market operation, regulation, and policy, while accepting that markets alone cannot always deliver timely investment. Targeted government interventions, including CfD-like mechanisms and capacity support outside the market, have therefore been used to manage risk without undermining price discovery. Throughout, he emphasised that policy stability, transparent wholesale pricing, vigilant regulation of market power, and deliberate handling of affordability and resilience are essential to keeping the transition investable while sustaining public confidence.

Chief Guest's Remarks

Ghamshyam Prasad, Chairperson, CEA

In his closing remarks, the Chairperson of the Central Electricity Authority emphasised that India's energy transition must be grounded in country-specific conditions, particularly its sustained demand growth of 7–8 percent annually. He cautioned against directly transplanting international solutions, noting that India's scale, growth trajectory, and system constraints differ markedly from those of mature markets. While reaffirming the pace of renewable capacity addition, he stressed that system appetite must guide deployment to avoid excess capacity and downstream challenges.

He highlighted the growing role of storage, inertia, and system stability, pointing to hydro, pumped storage, and nuclear as critical sources of rotating mass, while noting the additional costs associated with alternatives such as synchronous condensers. He further observed that CEA's planning and resource adequacy work is increasingly taking a holistic view of system costs, with transmission and other associated elements being incorporated to arrive at least-cost outcomes for consumers.

He concluded by underlining the need to respond to evolving demand profiles, particularly from C&I consumers and emerging loads such as green hydrogen and data centres and reiterated that no single pathway fits all systems.

Post Roundtable Discussions

The discussion centred on whether India should move more decisively towards market-based dispatch and capacity mechanisms, drawing comparisons with China's recent shift to spot markets alongside CfD-type support. Responding to questions from distribution utilities, panellists noted that China's transition has been rapid and uneven, shaped as much by administrative deadlines and cost declines as by coherent market design, and cautioned against drawing direct parallels. On capacity markets, there was broad agreement that depressed spot prices and rising system adequacy needs make some form of capacity remuneration increasingly necessary, though views differed on design. While energy-only markets were defended on efficiency grounds, several speakers argued that capacity mechanisms or targeted procurement are better suited to managing the current "bow wave" of investment and system risk. The CERC highlighted the possibility of starting with secondary capacity markets to unlock surplus contracted capacity, while CEA linked the debate directly to resource adequacy obligations on DISCOMs. Questions on nuclear expansion underscored its role as firm, low-carbon capacity, with speakers emphasising a mix of large reactors, brownfield expansion, and eventual SMR deployment to meet India's long-term growth and decarbonisation objectives. Across the discussion, a consistent theme emerged: market design choices must be pragmatic, context-specific, and aligned with system reliability, affordability, and investor confidence rather than textbook models.

Key Takeaways for Policymakers, Alok Kumar

- **Plan the transition ahead of the curve, not in response to stress**
A central message from the discussion was that India's transition has often been reactive. Transmission, system flexibility, and market reforms must be planned of capacity additions. Anticipating transition pressure points is cheaper, faster, and less disruptive than correcting them later.
- **Match the pace of renewable deployment to what the system can absorb**
Faster is not always better. The speed of renewable addition must be calibrated to system readiness, including balancing capability, storage, and inertia. Demand-side electrification and market-based procurement can help absorb higher RE volumes and reduce the risk of overbuilding supply ahead of system capability.
- **Use demand-side reform to unlock faster decarbonisation**
International experience shows that large consumers matter. China and the Philippines have pushed C&I consumers into market-based procurement, accelerating clean energy uptake. India's green open access and aggregation rules are a start, but deeper and faster liberalisation of large consumers will be essential at higher RE penetration levels.

- **Let markets shape prices, but do not expect them to work alone**

There is a clear global shift towards market-based mechanisms and shorter-tenure contracts. However, markets on their own struggle to provide investment certainty in a volatile transition. Carefully designed interventions are unavoidable, but they should support markets rather than replace them.
- **Create credible benchmark prices through market signals**

Opaque PPA pricing weakens planning and public confidence. Market-based dispatch and CfD-type mechanisms can help reveal the real cost of energy and capacity, improving price discovery and enabling more credible least-cost system planning.
- **Move faster towards shorter dispatch intervals**

Five-minute dispatch, already in place in Australia and the Philippines, improves flexibility, price signals, and system responsiveness. India should accelerate the shift from 15-minute scheduling to support a high-renewables grid.
- **Retail contestability is no longer optional at scale**

As renewable penetration rises, freeing large consumers to procure power directly becomes unavoidable. Legislative and regulatory reforms in India are aligned with this direction, but implementation will need to move faster to avoid bottlenecks.
- **Accept that government policy will remain central**

Even mature markets depend heavily on policy direction. Policy volatility creates uncertainty that markets cannot absorb on their own. Stable, credible government signals remain critical to attracting long-term investment.
- **Prepare for some form of capacity remuneration**

Energy-only markets, especially under policy uncertainty, struggle to deliver timely capacity investment. Capacity remuneration or evolution mechanisms may be necessary to bridge this gap, particularly during periods of rapid system transformation.
- **Strengthen regulatory oversight as markets deepen**

More market exposure brings greater risk of market power abuse. Regulators must have the authority, tools, and visibility to intervene decisively as market complexity increases.
- **Fix network pricing to avoid inefficient investment**

Transmission costs are becoming a dominant system expense. Investment signals must reflect network costs, including on the generation side, to avoid poor siting decisions. Emerging ideas such as auctioning connectivity represent an important first step.
- **Deliver government support through competitive mechanisms**

Where public support is needed, competitive auctions and transparent instruments such as VGF should be preferred over waivers or implicit subsidies. This preserves price discipline and public trust.
- **Adopt global lessons selectively, and act early**

No single international model can be copied wholesale. The real challenge for India's policymakers is not choosing the right ideas but selecting what fits India's context and implementing it before system stress forces reactive decisions.

Short Biographies of Speakers

Chief Guest, Mr Ghanshyam Prasad, Chairperson of the Central Electricity Authority (CEA)

Ghanshyam Prasad, besides being the Chairperson of the Central Electricity Authority (CEA), also serves as the Ex-Officio Secretary to the Government of India.

With over three decades of experience in the power sector, he has been closely involved in strengthening India's grid, supporting renewable integration, and guiding key national reforms. He continues to play a thoughtful, steady role in shaping India's transition toward a cleaner and more reliable power system.

Mr Mike Thomas, Managing Director at The Lantau Group

Mike brings over 30 years of consulting experience in the energy sector, advising a broad spectrum of stakeholders on strategy, market design, sustainability, and regulatory issues. He has worked extensively across Asia-Pacific, providing expert counsel in electricity and gas markets, including high-stakes commercial disputes and regulatory proceedings.

Mr Alok Kumar, Partner at The Lantau Group and Former Secretary, Ministry of Power

Alok has more than 35 years of experience in public policy and economic development in India's premier federal civil service (IAS). Prior to joining TLG, he was the Secretary to Government of India in the Ministry of Power and successfully managed the operations of one of the largest power systems of the world along with steering wide-ranging sectoral reforms. He has developed deep understanding of global energy transition aspects as chair of G20 Energy Transitions Working Group.

Mr Steve Edwell, Chairman of the Economic Regulation Authority of Western Australia

Steve is an economist specialising in economic regulation. Most of Steve's work has been in the energy sector on behalf of Federal and State Governments across Australia, where he has both consulted and held various Government statutory appointments.

Steve has a deep understanding of energy markets, with over 25 years high level policy, regulatory and management involvement in both the Eastern State National Electricity Market and the Wholesale Electricity Market in Western Australia.

Mr Toby Price, Manager at the Australian Energy Market Operator (AEMO)

Toby is adaptable and passionate renewable energy professional with broad experience in the delivery of industry leading Projects. In technical leadership roles in the renewables industry, he has managed the development of solutions incorporating Solar PV, BESS and hydrogen technologies for hybrid stand-alone and micro-grid applications.

Mr David Fishman, Principal at The Lantau Group

David's areas of expertise cover regulatory and economic intelligence for the Chinese power sector, including solar, wind, coal, nuclear, hydro, transmission grid, and power markets. His specific project experience includes Chinese power market and policy intelligence and forecasting, solar and wind tariff policies, renewable asset transactional due diligence, China business matchmaking, and green power procurement support for multinationals operating in China.

Ms Monalisa Dimalanta, Senior Partner at PJS Law

Monalisa has been a recognized energy practitioner in the Philippines and Southeast Asia, a leader in the power sector and other various areas. who will present the Philippines' experience and unique journey in this space.

Mr Rajnath Ram, Adviser (Energy) at NITI Aayo

Rajnath Ram supports strategic policy formulation and programmes across power, renewable energy, oil & gas, coal, and related sectors. He also leads key initiatives on energy data management, energy modelling, and GIS-based planning to strengthen decision-making and long-term strategy. With over 25 years of experience in the energy domain, he has contributed to national policy frameworks, technical standards, and international energy dialogues.

Mr Harpreet Singh Pruthi, Secretary of Central Electricity Regulatory Commission

Pruthi is a senior energy sector professional with extensive experience across regulatory frameworks, market design, and power sector reforms in India. He has worked closely with government agencies, utilities, and industry stakeholders to support policy development and enable sector-wide transformation. Known for his analytical approach and collaborative leadership, he contributes to advancing efficient, transparent, and future-ready energy systems.