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DUM 2025 OUTCOME REPORT

DISTRIBUTION UTILITY MEET DUM 2025

9th Annual Conference of Power Distribution Utilities for Collaborative Growth

04 - 05 NOVEMBER 2025

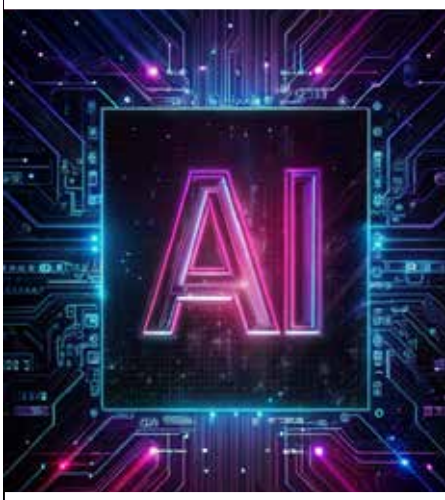
HOTEL SAHARA STAR, MUMBAI

INTRODUCTION

Distribution Utility Meet (DUM) is the annual flagship event of the India Smart Grid Forum (ISGF), designed to bring together the electricity distribution community to foster knowledge sharing and collaboration. With the motto "**Experience Sharing and Learning from Each Other**", DUM serves as a platform for DISCOMs and stakeholders to exchange insights, address challenges in energy transition, grid modernization, and digitalization, and explore innovative solutions for the evolving power sector. The event is hosted in collaboration with local DISCOMs in different states every year, offering a unique opportunity to connect and learn from diverse experiences across India.

The journey of DUM began in November 2017 with its first edition in Bengaluru, organized in partnership with Bangalore Electricity Supply Company (BESCOM), followed by the second edition in Mumbai in 2018, held in collaboration with Tata Power and Reliance Infrastructure. In 2019, the third edition was hosted in New Delhi, co-organized with TPDDL, BRPL, and BYPL. The fourth and fifth editions were conducted virtually due to covid pandemic in order to maintain the spirit of engagement despite the constraints. The sixth edition in November 2022 marked the return to the physical event format, hosted in Bhubaneswar in collaboration with Tata Power DISCOMs in Odisha. In 2023, the seventh edition took place in Kochi, co-hosted by KSEB Limited and the Energy Department of Kerala. In 2024, the eighth Edition was successfully hosted in Lucknow on the 14th and 15th of November, in collaboration with the Uttar Pradesh Power Corporation Limited (UPPCL) and the Energy Department of Uttar Pradesh.

The 9th Edition of DUM was successfully held on **04th and 05th November 2025** at Sahara Star Hotel, Mumbai, in partnership with Maharashtra State Electricity Distribution Co. Ltd. (MSEDCL) and The Tata Power Company Limited as Host Utilities; supported by the Ministry of Power, NITI Aayog, Central Electricity Authority, Energy Department of the Government of Maharashtra, and All India DISCOMs Association (AIDA). DUM 2025 brought together over **377+ senior officials from 45+ DISCOMs in India including CEOs, Directors and Chief Engineers.** DUM 2025 was attended by **688 delegates, 56 Exhibitors and Partners and 65 Speakers including Ministers, Regulators, Academia, Technology Companies, and senior officials** from across India and abroad. The sessions addressed a wide range of critical topics from innovative policies and regulatory frameworks for Discom's sustainability to AI, ML, robotics, EV integration and renewable energy, and grid modernization.



The event was jointly inaugurated by **Smt Meghana Sakore-Bordikar**, Hon'ble Minister of State for Energy, Government of Maharashtra and **Shri Atul Save**, Hon'ble Minister of State for New and Renewable Energy, Government of Maharashtra. The event garnered widespread appreciation from policymakers, regulatory officials, utility leaders, and global experts. Discussions centred on shaping the future of India's power sector, enhancing grid modernization, and leveraging digital technologies for improved operational efficiency and sustainability. The presence of international experts added depth to the dialogue, fostering a global exchange of ideas.

As DUM continues to evolve, the 10th Edition is scheduled to take place on 27th and 28th October 2026 in Jaipur, Rajasthan in collaboration with the Rajasthan Energy Department and the DISCOMs in Rajasthan.

DUM 2025 CONFERENCE THEMES

1. **Special Plenary Session** - Innovative Policies and Regulatory Interventions for Sustainability of DISCOMs
   Session Partners: All India Discoms Association (AIDA) and Power Foundation of India (PFI)
2. **Thematic Session:** Smart Meters as The Foundation for Digitalization of DISCOMs
   Session Partner: All India Discoms Association (AIDA)
3. **Thematic Session** - AI-ML-VR/AR-Robotics Applications for Utilities
4. **Thematic Session:** Digital Energy Grids and The Emerging Era of Energy Internet
   Session Partner: Impresa.ai

Breakfast Session: Special CEO Roundtable: Digitalization Roadmap for DISCOMs and Electrical Safety

5. **Thematic Session:** Grid Integration of Distributed RE (DRE)
6. **Thematic Session:** Electric Vehicles – A 200 Billion Opportunity in India and DISCOMs Role in Making this a Reality
   Session Partner: Power Foundation of India (PFI)
7. **Thematic Session:** Emerging Challenges for DISCOMs – GW-Scale AI Data Centers, MW-Scale EV Charging Stations, and Grid-Level Power Quality Challenges
   Session Partner: Enspar Energy Solutions Pvt. Ltd
8. **Thematic Session:** Extreme Weather Events and The Urgent Need for Revision of Standards and Specifications of Grid Equipment

DUM 2025 TECHNICAL TOURS

03 November 2025

Underground Submersible Substation at Tata Power, Mumbai

Distribution Command Centre at MSEDCL

Cyber Physical Lab at VJTI

06 November 2025

Distributed Solar Plants and Solar Irrigation Pumps in Nashik

Trambakeshwar Jyotirling Mandir in Nashik

KEY TAKEAWAYS FOR IMMEDIATE ACTION

Financial and Regulatory Issues

- DISCOMs maintain two separate accounts - Audited Accounts and Regulatory Accounts and the figures in these two accounts vary vastly. This gap need to be bridged ASAP and there should be only ONE SINGLE SOURCE OF TRUTH which must be enforced
- Introduce WPI-linked automatic tariff revision with MYT true-ups to avoid future revenue gaps
- Implement timely true-ups to prevent accumulation of regulatory assets
- Adopt tariff restructuring to ensure fixed cost recovery and prevent misuse of slab structure
- Operationalise central deduction of electricity dues of Panchayati Raj Institutions (PRI) from Finance Commission grants

Acceleration of Smart Meter Rollouts

- Address root causes of rollout delays - Direct Debit Facility (DDF) non-readiness in any of the states, inconsistent SAT practices, manpower shortages, non-contiguous installation areas
- Initiate a national level awareness campaign on the benefits of smart metering
- Accelerate consumer acceptance using check meters, proactive campaigns, and real-time consumption visibility through mobile apps

Data, Digitalisation and AI

- Treat data science as a critical utility function with clear policies and governance frameworks for data classification, data storage, data sharing, cyber security, and data lakes
- Adopt high-value AI use cases first: Demand forecasting, predictive maintenance, Non-Technical Loss (NTL) reduction, and outage management
- Create a National Centre of Excellence (CoE) on AI-ML and Robotics with experts who could shortlist and prioritise high impact use cases with minimum functionalities, technologies and reference cost. The CoE could also prepare
- standard bidding documents for different use cases. This will help DISCOMs in contracting for AI-ML-Robotics solutions.
- Establish AI Councils and cross-functional governance units in every DISCOM to sustain solutions beyond pilots
- Formalize Data Management and Data Governance Framework for DISCOMS on priority

Grid Modernisation & RE/DRE Integration

- National guidelines for storage procurement — standalone, hybrid, RTC, FDRE
- Promote demand response and accurate demand forecasting to reduce RE balancing costs
- Adopt smart inverters conforming to IS-18968:2025 and BESS for stability under high rooftop penetration
  Use the National Rooftop Registry for coordinated forecasting and scheduling DERs
- Transition towards DSO style operations — granular modelling, local balancing, reactive support and flexibility markets

EV Load and New High-Risk Loads

- Forecast AI/EV load hotspots and plan grid upgrades proactively
- Introduce BESS (30–50%) and STATCOMs at critical EV/AI nodes for harmonics and PQ stabilisation
- Mandate PQ meters at all critical nodes, not just substations
- Promote battery leasing and depot-based microgrids to accelerate EV economics
- Ensure DISCOM participation in ISTS transmission planning forums
- Push TBCB for intra-state transmission for competitive pricing and timely execution

Capacity Building and Institutional Strengthening

- Create a national fund for capacity building — AI/ML, smart meter analytics, forecasting, managerial skills
- Mass skill development in RF planning, SAT for smart metering, installation, analytics, O&M and AI
- Operationalise steering and conciliation committees in every state for dispute resolution and project governance; and avoid litigations to the extent possible

Digital Architecture and Systems Thinking

- Adopt a Unified Digital Architecture integrating SCADA, AMI, DERMS, EVMS, PQ, IoT, and AI
- Accelerate development of the Digital Energy Grid/Unified Energy Interface (UEI) – population-scale digital rails for
- energy, similar to UPI
  Prioritise interoperability across HES, MDMS, NICs, SCADA, and OEM systems to protect long-term investments

Climate and Disaster Resilience

- Create climate-zone-specific BIS/CEA standards for equipment resilience and update the existing standards and specifications on fast track
- Build a dedicated Infrastructure Resilience Fund to enable investments even in financially stressed utilities
- Adopt predictive resilience – IoT sensors, AI analytics, digital twins, climate risk modelling
- Prioritise hardening of the most critical network sections that are affected repeatedly

INAUGURAL SESSION

DUM 2025 was inaugurated jointly by **Smt Meghana Sakore-Bordikar,** Hon'ble Minister of State for Energy, Government of Maharashtra, and **Shri Atul Save**, Hon'ble Minister of State for New and Renewable Energy, Government of Maharashtra, on **4th November 2025** at Hotel Sahara Star, Mumbai. The event emphasized the transformative role of the power sector, focusing on grid modernization, the exponential growth of data centers, the adoption of advanced digital technologies such as AI, ML, and Robotics, and the critical need for financial viability and cybersecurity in distribution utilities.

Short films were screened, highlighting the pioneering works and innovations led by the stakeholders:

Maharashtra State Electricity Distribution Company Limited (MSEDCL) screened a short film on the impressive progress made in driving the state's green energy revolution

Tata Power Company Limited screened a short film highlighting their legacy and transition towards a sustainable, technology-driven enterprise

All India Discoms Association (AIDA) screened a short film detailing the journey and rapid growth of the organisation since its inception in DUM 2024

India Smart Grid Forum (ISGF) screened a brief film showcasing its decade-long leadership in policy advocacy and technology demonstration since its establishment by the Government of India in 2011, highlighting groundbreaking projects in the recent past

Link: https://www.youtube.com/watch?v=vDzN1R1OBQA

Shri Reji Kumar Pillai, President, India Smart Grid Forum (ISGF), extended a warm welcome to the dignitaries and participants at DUM 2025. He expressed gratitude to the host utilities, partners and exhibitors for their collaboration in organising the 9th edition of the Distribution Utility Meet in Mumbai. Mr Pillai highlighted the unprecedented pace of technological revolutions, citing recent scientific breakthroughs in achievement of efficiencies above the Carnot Cycle limits in certain processes.

Stating that “the development of Artificial Intelligence (AI) will not be constrained by chips, but by the availability of **electrons** (or electricity supply),” he drew attention to the massive surge in electricity demand driven by AI and data centers, noting that data centers are shifting from “square feet and megawatts” to “square miles and gigawatts” scales—exemplified by a new data centre in Abu Dhabi by OpenAI and Nvidia, which is spread over 10 square miles (6,400 acres) that will consume 5 GW of electricity. He also mentioned the Adani Group and Google's announcement of a gigawatt-scale data centre in Andhra Pradesh. He emphasised that “DISCOMs are the true engines of the economy” as the world moves toward an era where AI is constrained not by chips, but by the availability of electrons. He concluded by extending individual welcomes to Hon’ble Ministers **Smt Meghana Sakore Bordikar**, and **Shri Atul Save** including the dignitaries on the dais.

Shri Atul Save, Hon’ble Minister of State for New and Renewable Energy, Government of Maharashtra, in his inaugural address, highlighted Maharashtra’s leadership in renewable energy, with a total installed capacity of 27,674 MW. He outlined the state’s aggressive roadmap, including the Mukhyamantri Saur Krishi Vahini Yojana 2.0, which aims to provide daytime power to farmers. The Minister highlighted that Maharashtra’s solar agriculture pumps under PM KUSUM is the largest in India. He stated that Maharashtra currently ranks first in the country for solar pump installations, having already installed approximately 6.64 lakh solar pumps across the state, and under the leadership of the Honourable Chief Minister of Maharashtra, they aim to install another 5 lakh pumps within the next two years. He announced that Maharashtra will be coming up with a new green hydrogen policy soon, under which Maharashtra plans to establish a capacity of about 500 kilotons per annum by 2030, for which Maharashtra has already signed an MoU with eight green hydrogen manufacturers with a total capacity of 1010 KTPA. This project brings an investment of around about Rs 291,300 crores to reduce 5.67 million tonnes of carbon emission and create about 68,000 new jobs in the state of Maharashtra. The minister also announced an attempt at a Guinness World Records, with a massive drive to install 35,000 solar pumps in a single month (November 2025). He also shared the vision of 100% solarisation of government buildings within the next two years and announced that Maharashtra is aiming higher, targeting a 65% share of renewable energy in its total energy mix by 2035. He concluded by highlighting the need for battery energy storage.

Dr Srikant Nagulapalli, Director General, Power Foundation of India (PFI) and Additional Secretary, Ministry of Power, GoI, emphasised that while India has achieved universal electrification and "One Nation, One Grid", the share of renewable generation has increased from negligible to 22%. The sector now faces the dual challenge of DISCOM financial turnaround and renewable integration. He spoke on the need to reimagine the distribution sector to power the vision of Viksit Bharat 2047, moving from monopoly suppliers to regulated competition to improve service delivery.

Dr Ashish Kumar Goel, Chairman, Uttar Pradesh Power Corporation Limited (UPPCL) and General Secretary, AIDA, updated the forum on the progress of the All India Discoms Association, which now has 51 DISCOM members. He highlighted consumer interest and the country's progress in terms of industry, services and all other economic activities that depend on the viability of DISCOMs. He highlighted the problems faced by the DISCOMs: non-cost-reflective tariffs, overreach by regulators, financial constraints, infrastructure and technological gaps and challenges due to energy transition, Renewable Purchase Obligation (RPO), open access etc. He raised critical issues regarding the financial viability of DISCOMs, suggesting that current Indian Accounting Standards (Ind AS) do not fully reflect operational realities, and called for new performance metrics for the better reflection of the actual financial, operational and commercial performance of the DISCOMs. He highlighted that the infusion of smart devices is a major challenge for the DISCOMs, which need interventions and innovation. He also stressed the need for capacity building in AI and data analytics for utility professionals.

Dr Praveer Sinha, MD and CEO, Tata Power Company Limited, emphasized the rapid transformation of the power sector across generation, transmission, and distribution, driven by 24/7 clean energy through solar-wind-storage solutions and increasing decentralized supply. Transmission is advancing to 400kV AC, 765 kV HVDC systems, with superconductors emerging to address space and right-of-way challenges. Distribution reliability has improved, but further reform is needed to meet rising consumer expectations for quality service and transparency. He highlighted policy and regulatory progress, including proposed Electricity Act amendments and competition in distribution, citing Mumbai's model. He underscored the next two decades as a major opportunity for innovation and technology-led growth.

Shri Alok Kumar, Director General, AIDA and Former Secretary, Ministry of Power, emphasised that the viability of DISCOMs is central to India's energy security, and viable and capable distribution companies are critical for India to achieve the vision of Viksit Bharat 2047. He cautioned against the high cost of new assets with lower utilisation factor and stressed the need to protect the affordability of tariffs. He advocated for professionalising DISCOMs boards and mandated prepaid metering for government consumers to address dues. He also highlighted the need for a technology roadmap and capacity building for all the DISCOMs to come even; he suggested developing use cases and standard software at the national level with government funds and giving them free of cost to the DISCOMs for an actual technological revolution. He concluded by requesting assistance from the GoI and the Ministry for initiatives of AIDA, such as the Resource and Knowledge Centre and the Training Program for senior, middle and field level management for AI/ML. He also announced the First AIDA Annual Conference and Awards in January 2026.

Shri Pankaj Agarwal, Secretary, Ministry of Power, Government of India, lauded the role of AIDA in shaping policy, particularly in Renewable Consumption Obligations. He spoke on the "Energy Trilemma"—balancing Security, Sustainability, and Affordability - noting that India maintains affordable retail tariffs compared to global peers. He highlighted the need for readiness in tier 2 and tier 3 leadership of the utilities for better technological adoption and utilisation. He also called for urgent focus on cyber security, rating the current readiness of utilities at a low level (1-2 out of 10), and urged the sector to develop concrete use cases for AI and analytics to reduce losses and improve efficiency.

Smt Meghana Sakore-Bordikar, Hon'ble Minister of State for Energy, Government of Maharashtra, described Maharashtra as the growth engine of India's power story. The minister reiterated the state's commitment to the Panchamrit goals and Net Zero by 2070. She expressed confidence that India will achieve Net Zero status before the 2070 deadline through aggressive non-fossil fuel adoption. She highlighted specific initiatives such as Mukhyamantri Solar Krishi Vahini Yojana, a revolutionary scheme providing farmers with daytime power, effectively ending rural load shedding. She highlights that this initiative mirrors the global "One Sun, One World, One Grid" and also emphasises that Maharashtra is set to attempt Guinness World Record by installing 35,000 solar pumps in a single month. She concluded by emphasizing the collaborative spirit of DUM 2025, noting that both government and private DISCOMs are 'sailing in the same boat' and must work together for collective reform.

Smt Reena Suri, Executive Director, ISGF, emphasised that the shift from fossil fuels to renewables must be accompanied by a parallel transition toward **gender diversity and inclusion**. She announced that ISGF has joined the "**Equal by 30**" global campaign initiative under the Clean Energy Leadership and Equal Opportunities for Women in Energy, pledging to work towards 50% women representation in leadership roles in the energy sector by 2030; promoting gender-sensitive recruitment. She concluded by emphasising that a just energy transition requires inclusivity.

RELEASE OF REPORTS

The dignitaries released several pioneering reports during the session:

- **PFI Report: Incidence of Electric Bus Charging on DISCOMs Network and Scope for Optimal Power Purchase**
  Link: ***https://www.powerfoundation.org.in/assets/downloads/pfi-report-electric-bus-charging.pdf***

- **PFI Report: Strategic Pathways for Energy Storage in India through 2032**
  Link: ***https://bit.ly/4oHfsiO***

- **PFI Report: Tapping the Potential of Agriphotovoltaics in India**
  Link: ***https://www.powerfoundation.org.in/assets/downloads/pfi-report-agriphotovoltaics.pdf***

- **ISGF Report: Handbook of AI, ML, VR, AR and Robotic Solutions and Roadmap for it's adoption in Electric Utilities**
  Link: ***https://indiasmartgrid.org/white-papers-technical-reports***

- **ISGF and OCA Report: OCPP and UPI Mobile Payments Integration**
  Link: ***https://indiasmartgrid.org/white-papers-technical-reports***

Shri Sachin Talewar, Director – Projects, MSEDCL, set a strategic tone for the two-day conference. He emphasised the critical need for collaboration to identify scalable models that will drive the transition toward future-ready power utilities.

Vote of Thanks was delivered by **Shri Yogesh Gadkari, Director - Commercial, MSEDCL**, who thanked the dignitaries, partner utilities, and delegates for their participation.
Following this, the dignitaries inaugurated the Exhibition at DUM 2025.



VIDEO LINK - **https://www.youtube.com/watch?v=AOOb8LJ4NiU&list=PLgSiPGd4Nr-cj70ts6LIkU02aratmxVkxq&index=1**

SESSION 1: SPECIAL PLENARY SESSION
INNOVATIVE POLICIES AND REGULATORY INTERVENTIONS FOR SUSTAINABILITY OF DISCOMs

INTRODUCTION

Distribution Companies (DISCOMs) are the backbone of India's power sector, but they face chronic issues—high AT&C losses, poor cost recovery, subsidy delays, ageing infrastructure, and mounting debt. While big programs like Revamped Distribution Sector Scheme (RDSS), Smart Metering, PM-KUSUM, Battery Energy Storage Systems (BESS) and Firm and Dispatchable Renewable Energy (FDRE) Projects, PMSG: MBY etc. are underway, long-term sustainability of DISCOMs need innovative and progressive policies and regulatory measures. Innovative business models such as network strengthening through TOTEX/OPEX contracts, and function specific outsourcing have shown improvements in revenue collection, loss reduction, and infrastructure upgrades in some DISCOMs. Alongside, regulatory interventions like cost-reflective tariffs, time-of-day (ToD) pricing, market-based procurement, and enabling distributed energy resources (DER) integration can strengthen DISCOM operations. This session will explored practical pathways combining innovations in business models with supportive policies to achieve financial stability, operational efficiency, and consumer satisfaction in DISCOMs.

PARTICIPANTS

Pankaj Agarwal, Secretary, Ministry of Power; **Alok Kumar**, DG - AIDA and Former Secretary Ministry of Power; **P Ravi Kumar**, Chairperson, Karnataka ERC; **Srikant Nagulapalli**, DG, Power Foundation of India (PFI)/Additional Secretary, Ministry of Power, GoI; **Ashish Kumar Goel**, Chairman – UPPCL and Gen Secretary – AIDA; **Gajendra Tiwari**, Member, MPERC; **Himanshu Chawla**, Head - Regulatory, Power Foundation of India (PFI); **Nilesh Kane**, Chief – Transmission and Mumbai Distribution, **Tata Power Company**; Abhishek Ranjan, CEO, BRPL; **D Radhakrishna**, Former Chairperson, Tripura ERC.

1. Alok Kumar, DG, AIDA and Former Secretary, Ministry of Power: Moderator of the Session

- Opened the plenary by grounding the discussion in a simple truth: **DISCOM viability is the backbone of India's entire power sector.** If DISCOMs fail, the entire chain – generation, transmission, renewables and smart grids will collapse.
- Pointed out that while India is progressing in reforms, policies, regulations, and ground implementation do not always align
- Highlighted a practical issue: when Ministry or regulators release draft rules, comments must be submitted within 30 days. But many analytical studies (like cost impact or tariff modelling) take 6–9 months.
- Indicated that AIDA will need the support from the Ministry for creating a **rapid-response analytical team** capable of evaluating draft rules quickly

2. Pankaj Agarwal, Secretary, Ministry of Power: Chair of the Session

- Acknowledged that DISCOM challenges are deep-rooted and accumulated over decades
- Gave a candid message: "**There is no substitute for financial discipline. Cash must come on the table.**"
- Raised concern about poor smart meter implementation in many states, urging DISCOMs to adopt a scientific and consumer-trust–oriented approaches
- Stressed the importance of:
  - **Structured, anonymized data** to enable AI/ML forecasting
  - **Machine Learning driven demand–generation triangulation** (weather + RE patterns + consumption)
  - **Effective participation by DISCOMs** in transmission planning
- Strongly encouraged reconciliation and mediation instead of litigation - the sector cannot bleed for 6–10 years waiting for court judgments
- Indicated that good recommendations from the DUM 2025 will be included in the National Electricity Policy

3. Himanshu Chawla, Power Foundation of India (PFI)

- Made a presentation in which he brought out a major faultline in the power sector: **The existence of two financial accounting systems:**
  - **Audited Accounts**: Show huge losses of INR 7 lakh crore+, LPSC burden, high O&M cost and high working capital requirements.
  - **Regulatory Accounts**: Show far lower losses – only INR 1.7 lakh crore of Regulatory Assets across all the states.
- The key issue is: **Which "cost" should define cost-reflective tariff?**
  - If audited costs are used, consumer tariff will explode
  - If regulatory norms alone are used, DISCOMs sink deeper every year
- Given state-level examples where:
  - LPSC of over INR 10,000 crore is not allowed by regulators
  - Government dues ~INR 83,000 crore distort collection efficiency
  - Working capital norms allowed ~INR 900 crore while actual requirements exceed ₹6,000–7,000 crore.
- Requested the sector to acknowledge these distortions honestly because "**financial viability cannot be built on parallel accounting.**"
- Ways to reduce case load and improve efficiency in disposal of cases in higher courts
- Persistent problem of huge unmetered sales. Improper Energy Accounting leads to incorrect distribution losses. Measures needed to Expedite Smart Metering.
- Energy Transition comes at a cost and hence should be judiciously utilized. As RE matures, it is important to reduce promotional measures so that actual cost becomes visible and provides correct price signals

- Need of performance-based regime for transmission utilities. Transmission losses to be linked with transmission charges like in generation and distribution sectors where Auxiliary losses and Distribution losses are linked to their revenue mechanism.

4. Ashish Kumar Goel, Chairman UPPCL and General Secretary, AIDA

- Made a presentation and Shared AIDA's vision of **making DISCOMs viable, capable, and future-ready** through policy advocacy, capacity-building, and standardization of technical specifications
- Admitted that the power sector data in India is not fully reliable because the numbers change depending on methodology (cash vs accrual, audited vs regulatory, provisional vs true-up)
- **Highlighted serious systemic issues**:
  - Tariffs not cost-reflective
  - Irrational disallowances by regulators
  - High financing cost (typically 3% higher than Central PSUs)
  - Poor recovery from agriculture and rural consumers
  - Complex tariff structure confusing for consumers and discouraging compliance
- Proposed following major reforms:
  - **Tariff revision linked to WPI**, with multi-year true-up
  - **Central policy to deduct unpaid panchayat electricity bills from Finance Commission grants**
  - **A National DISCOM Capacity-Building Fund** to strengthen AI, forecasting, cyber security, managerial skills etc
  - Demand forecasting + smart meter data analytics to reduce expensive short-term power purchases
- Warned: Huge subsidies and losses borne by states (~INR 6–7 lakh crore) are **financially unsustainable.**

5. P Ravi Kumar, Chairperson, Karnataka ERC

- Offered a rare regulatory perspective grounded in both policy and field realities
- Made bold, honest observations such as:
  - DISCOM employees still behave like old electricity boards — **commercial discipline is missing**
  - Field-level implementation breaks down even if high-quality reforms are designed
- Recommended strong structural reforms:
  - **Remove tariff slabs** which will enable efficient prepaid metering and remove manipulations
- **Eliminate cross-subsidy** – the governments should directly subsidize poor and the agricultural consumers, not penalize the industry
  - **Government dues must be fully paid**, otherwise no tariff reform will succeed

  Warned against blaming regulators for all DISCOM failures – In India we can regulate only what comes to us. The field reality is far deeper.

6. Srikant Nagulapalli, DG, Power Foundation of India (PFI) and Additional Secretary, MoP

- Deep-dive into renewable energy integration challenges:
  - Solar/wind may be cheap per unit, but **variability adds hidden costs** (balancing, flexing, transmission upgrades). Suggested four tools to reduce RE integration cost:
    - **Storage (BESS + PSP)**
    - **Demand Response**
    - **Localization of RE (Rooftop, Agri-PV, Feeder Solar)**
    - **Accurate forecasting**
- Strong push for Tariff Based Competitive Bidding (TBCB) for intrastate transmission to tap private investment and accelerate grid expansion
- Shared New Data: India has 3,363 GW of solar potential, meaning every state has enough RE capacity to meet 20+ years of future demand without expensive interstate transmission.

7. D. Radhakrishna, Former Chairperson, Tripura ERC

- Introduced two human-centric regulatory ideas: "**happy tariff**" and "**humanizing regulation**."
- Shared Kerala's success story:
  - Very low AT&C losses
  - 99.5–100% collection efficiency
  - Six-day work week
  - Strict culture of accountability
- Suggested replicable ideas:
  - **Offer rebate for paying within 4 days** of bill submission - improves collection dramatically (Tripura experience)
  - **Strict enforcement for high-consumption families to upgrade to 3-phase connections**
  - **Better electrical safety and cyber safety norms**
- Warned that excessive court cases break the sector: one 2004 case was disposed only in 2024

8. Gajendra Tiwari, Member, MPERC

- Clarified that the true meaning of regulatory assets (RA) – RA are not **assets, but postponed tariff hikes to meet the expenses already incurred by the DISCOMs**
- Explained how RA spirals:
  - Overestimation of sales
  - Underestimation of power purchase
  - Inflated subsidy assumptions
  - Delayed true ups

  All these leads to creation of RA which burdens consumers in later years.
- Supreme Court's strong message:
  - RA should be rare (force majeure only)
  - Cap RA at 3% of ARR
  - Liquidate accumulated RA within 3–7 years
- Emphasized predictive regulation and fiscal discipline going forward

9. Nilesh Kane, Chief, Transmission and Mumbai Distribution, Tata Power Company Ltd

- Focused on **technology-led cost optimization**:
  - AI/ML for forecasting with <1% error
  - Drones for maintenance
  - Sensors + SCADA for network monitoring
  - Robotic Process Automation (RPA) for metering, billing, collection to reduce manpower and errors
- Highlighted MERC reforms:
  - Behavioural demand response
  - Time-of-use tariffs flattening load curve
- Stressed that better short-term, mid-term, and long-term power purchase planning significantly reduces power purchase cost (which is 70%+ of DISCOMs cost)

10. Abhishek Ranjan, CEO, BRPL

- Presented a strong case for **distributed solar and solar + storage:**
  - Avoids T&D losses
  - Supports voltage stability
  - Reduces peak demand
  - Minimizes expensive short-term power purchases grid-value creation."

- Delhi's learnings:
  - Distribution transformers can handle **up to 75% of its capacity** of rooftop solar if combined with local battery storage
  - Rooftop solar for residential feeders gives **positive net revenue**, unlike commercial segments which heavily reduce cross-subsidy
- Recommended:
  - Dynamic subsidy models based on feeder hosting capacity
  - Inclusion of BESS in resource adequacy planning
  - Clearer operational guidelines for group/virtual net metering
- Concluded by saying: "**Solar must move from cost-reduction to grid-value creation**."

SESSION 1 KEY TAKEAWAYS

- Urgent need to examine the gap between audited accounts and regulatory accounts of the utility and take regulatory interventions to remedy the imbalance
- Enable organizations like AIDA to expeditiously analyse the draft policy/regulatory proposals and submit well evidenced responses in 3 to 4 weeks
- Tariff revisions by WPI linked formulae with MYT true up
- National policy for deducting electricity dues of panchayats from Finance Commission Grants
- Create a national fund for capacity building of DISCOMs in AI/ML, Smart meter data analytics, managerial skills, demand forecasting etc
- Consumer centric approach to speed up smart meter rollout
- Effective participation of DISCOMs in ISTS transmission planning process
- Tariff restructuring and balancing to ensure recovery of fixed costs and prevent misuse of slabs
- Guidelines required for Discoms to procure storage; whether Standalone, Hybrid, RTC, and FDRE
- Focus on promoting Demand Response and accurate Demand Forecasting to reduce RE integration costs
- Stronger push to TBCB for intra-state transmission projects to achieve competitive costs
- Replicate innovative steps like effective staff incentives in Kerala and rebate to consumers for timely payments in Tripura
- Timely true up to avoid regulatory assets
- Focus on technology led cost optimization in demand forecasting and power procurement planning, network maintenance etc.
- Rational roll out of solar rooftop programme based on Feeder Hosting Capacity

Video Link:

https://www.youtube.com/watch?v=q1h25kZE8LQ&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=2

SESSION 2:
SMART METERS AS THE FOUNDATION FOR DIGITALIZATION OF DISCOMS

INTRODUCTION

The power distribution sector in India is undergoing a rapid transformation to meet the demands of reliability, efficiency, and sustainability. At the core of this transformation lies the deployment of smart meters, a pivotal technology enabling the digitalization of DISCOMs. Smart meters provide real-time, two-way communication between utilities and consumers, replacing manual meter reading with automated, accurate, and remotely accessible data. The time-stamped 96 (or 48) meter reads per day empowers DISCOMs to estimate demand more accurately, enhance billing efficiency, reduce AT&C losses, improve load management, and enable demand side interventions. Ministry of Power, Government of India (GoI) launched world's largest Smart Metering program covering 250 million customers in 2021. This program has a very innovative business model - Metering as a Service - first of a kind (FOAK) program in the world, originally suggested in a White Paper by ISGF in 2017. GOI is offering 15% of the project cost as grant; and the rest 85% of the project cost is paid by the utility to the AMI Service Provider (AMISP) in monthly instalments per meter for 93 months. Smart metering has also emerged as the foundation for digitalization of DISCOMs. The digitalization journey of DISCOMs, encompassing automation, AI/ML driven analytics, and customer centric services cannot be realized without this foundational data layer. Hence, smart meters are not just a metering upgrade but the gateway to smart grids and the enabler of India's vision for a modern, resilient, and consumer-friendly power distribution sector.

This session discussed how smart meters serve as the foundational building blocks for the digital transformation of DISCOMs, enabling data-driven operations, improved efficiency, consumer empowerment, and seamless integration with advanced digital platforms.

PARTICIPANTS

Ashish Kumar Goel, Chairman – UPPCL and Gen Secretary – AIDA; **Shashank Mishra**, Joint Secretary, MoP; **Anil Rawal**, MD, IntelliSmart and Chair of ISGF Working Group on AMISPs; **Suresh Makwana**, Chief Engineer, BEST, Mumbai; **Sandip Sinha**, Vice President – Sales, Trilliant Networks; **Anoop Kaur Bowdery**, CEO, EDX Wireless; **Anand Budholia**, President – IT and CIO, BSES; **Gurpreet Oberoi**, Chief Business Officer, Kimbal; **Atul Bali**, Director, NSGM; **Dwijadas Basak**, CEO, TPDDL; **Rahul Kumar**, MD, North Bihar Power Distribution Company Ltd; **Teppo Hemia**, CEO, Wirepas; **Vivek Chandra**, Head-IT, MPPuKVVCL; **Ashutosh Goel**, CMD, Allied Engineering Works Limited; **Jaideep Singh**, Advisor Radius

1. Ashish Kumar Goel, Chairman - UPPCL and General Secretary – AIDA: Session Chair

- Emphasised that smart metering is no longer a technology project, but the fundamental building block of India's distribution-sector digital transformation
- Digitalization without smart meters is impossible, as they are the gateway for real-time and near-real-time data that utilities urgently need
- The RDSS program is the largest digital infrastructure project in India's power sector, and therefore challenges are expected. However, the magnitude of work completed so far—contracts awarded for over 15 crore meters and more than 4.5 crore installations—demonstrates that the sector has entered a stable execution phase.
- The consumer trust has improved through the check-meter policy, which has significantly reduced misinformation on "**smart meters inflating bills**."
- Stated firmly that the future of grid management, DER integration, rooftop solar, EV charging, and demand-side management depends entirely on meter-driven digital visibility. Without smart meters, utilities cannot handle the emerging "bi-directional power flow" environment.
- Delays in meeting contractual milestones—especially the 7-month go-live requirement and the 18-month 50% installation benchmark—which most states have missed.
- Both DISCOMs and AMISPs to adopt a practical, collaborative approach instead of a contractual or adversarial one
- The need for SAT standardisation, DDF activation, and stronger field-level coordination, noting that these three items alone are responsible for more than 50% of rollout delays
- Called for a joint AIDA–MoP Working Group for documenting best practices, resolving state-specific frictions, improving stakeholder coordination, and accelerating rollout
- India's smart meter program is not about "**meter replacement**" it is about modernising an entire electricity ecosystem for the next 30 years

2. Shashank Mishra, Joint Secretary - Distribution, Ministry of Power: Session Moderator

- Smart meters as the foundation of the digital DISCOM, enabling India to move from manual and assumption-based decision-making to data-driven operations with unprecedented granularity
- Mentioned that despite India generating huge volumes of meter data, proper utilisation is still low, largely because DISCOMs struggle to provide clean, structured datasets to solution providers. Even for innovation programs like Powerthon, Non-Disclosure Agreements (NDA) and data-sharing challenges slow down progress.
- The role of digital systems in handling India's fast-growing RE penetration and EV load, noting that distribution infrastructure was never designed for two-way flows—**hence digitalisation is essential**.
- The success of AMI in creating a consistent data pipeline for billing, demand analytics, energy accounting, and forecasting, but warned that the next phase will require DISCOMs to actively utilize this data effectively for different business purposes, not just collect it.
- DISCOMs must take ownership of data governance, cyber security, and integration of AMI with SCADA, RMS, GIS, MDMS, and other digital platforms
- Flagged the need for a national level consumer communication campaign to build trust and accelerate acceptance, as misinformation remains a major barrier in multiple states
- Attention to the urgency of meeting RDSS timelines, as delays compress the 27-month window and slow down the overall modernization of the distribution sector

3. Anil Rawal, Managing Director, IntelliSmart and Chair, ISGF Working Group on AMISP

- Presented a comprehensive sector wide assessment from the perspective of an AMISP, noting that India is implementing the largest digital metering program in the world, with an investment scale of USD 38.5 billion and potential job creation of 25 million over the program's lifetime.
- **Highlighted Key Achievements:** Almost all projects have achieved go-live, transition has been smooth, and consumer acceptance has drastically improved after check meter deployment. The narrative of "**smart meter gives high bill**" has reduced sharply.
- The most contracts were signed between Oct 2023 and Jun 2024, meaning that by 2026 all projects should be completed, but current progress is behind milestones, making on ground acceleration critical.

- Identified three areas causing rollout delays:
  - Delayed go-lives (Average 15 months Vs mandated 7 months)
  - Manpower mobilisation issues and shortage of skilled installers
  - Revenue flow constraints due to non-operational Direct Debit Facility (DDF) and inconsistent SAT processes
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  - Manpower mobilisation issues and shortage of skilled installers
  - Revenue flow constraints due to non-operational Direct Debit Facility (DDF) and inconsistent SAT processes
- AMISPs also have responsibilities and must improve installation speed, enhance communication networks, and strengthen O&M performance, as AMI systems support millions of consumers for 10 years
- The failure of contiguous area provisioning (20% area at once), which forced AMISPs into slower, scattered deployment, reducing productivity and increasing cost
- Strongly advocated for:
  - SAT standardisation across India
  - State-level steering/conciliation committees
  - National PR campaign
  - Large-scale training and manpower development
  - Clear definition of AI/ML use cases under SBD Clause 6
- AMI must shift from "loss-reduction focus" to value creation through analytics, demand response, grid planning, and DER integration

4. Suresh Makwana, Chief Engineer, BEST, Mumbai

- Shared BEST's journey as a legacy utility with over 100 years of service, yet among the earliest adopters of SCADA, GIS, and now smart metering
- Reported 83% DT metering completion and ~46% consumer metering completion, noting that strong system integration with New Financial Management System (NFMS) has improved system-level visibility significantly
- Consumer resistance as the biggest challenge, due to misconceptions about bill hikes, RF radiation, and prepaid conversion. BEST countered this through street plays, camps in the societies, social media outreach, and informative banners displayed in our buses.
- The need for State-level government orders supporting meter rollout to reduce resistance and ensure smoother implementation
- Showcased BEST's consumer-facing innovations such as the "MyBEST" app, allowing real-time hourly/weekly/monthly consumption visibility, bill verification, and personalised energy insights.
- Demonstrated how AMI helps:
  - DT overload identification
  - Feeder overload monitoring
  - Faster resolution of outages
  - Improved billing transparency
- The ToD/ToU tariff implementation is not feasible with old meters, and smart meters are enabling tariff reforms and consumer-friendly pricing
- The AMI delivers a strong win-win for DISCOM and consumers, but success depends on customer engagement and internal capacity building

5. Sandeep Saha, Vice President – Trilliant Networks

- Presented Trilliant's global experience with over 200 utility customers and 40 million endpoints, emphasizing how global AMI learnings can guide India's large-scale rollout
- Showed that smart meters create a unified data environment supporting automated billing, ToU/Dynamic tariffs, theft analytics, outage management, EV charging analytics, and load forecasting
- The need for multi-technology communication systems (cellular + RF), as India's geographical diversity demands hybrid networks
- MI data must evolve from billing-only use to grid planning, loss reduction, segmentation, and DER optimisation
  Without a robust IT backbone, India risks the same failures faced by utilities abroad where AMI was deployed without adequate analytics and integration frameworks
- DISCOMs to adopt enterprise-level visibility tools, unified dashboards, and standards driven integration practices

6. Anoop Kaur Bowdery, CEO, EDX Wireless

- Presented on the global experience of AMI failures and successes, emphasising that connectivity, not meters, is the weakest link in any smart meter program
- India's terrain diversity (Dense buildings, rural expanses, mountains, coasts) requires sophisticated RF propagation modelling, otherwise meters will not communicate reliably
- Cited examples from the US, Canada and Australia where AMI rollouts failed due to poor RF planning, low redundancy, and inadequate consumer awareness, forcing utilities to halt and relaunch entire programs at huge cost
- The need for redundant communication channels in disaster-prone areas, as seen in CenterPoint Energy (Texas), where outages caused massive packet losses
- DISCOMs to adopt an enterprise integration layer, since fragmented AMI–CRM–MDMS–OMS integration leads to billing errors, mistrust, and operational inefficiencies
- Reiterated that policy support, consumer education, and structured standards are as important as technology for large-scale AMI success
- The critical need for robust IT infrastructure capable of handling high-frequency real-time data
- India is in a unique position to leapfrog by avoiding global mistakes and adopting strong modelling, strong redundancy, and strong data integration from the start

7. Gurpreet Oberoi, Chief Business Officer, Kimble

- The tremendous progress in meter manufacturing and AMI ecosystem development in India, noting that the industry is now fully capable of supplying the required meter volumes
- Discussed how early concerns about supply shortages, integration capacity, and HES–MDMS interoperability have largely been resolved through coordinated efforts of OEMs and AMISPs
- The need for accelerating implementation, India must reach installation rates of 7–8 million meters/month to complete the RDSS target by 2028, while the current pace is around 40–45% of this requirement
- AMISP payments must be timely, predictable, and strictly aligned with the SBD, as delays in payments ripple across the entire supply chain
- Indicated strong progress in universal NIC development, enabling transition between RF, NB-IoT, 4G and future 5G modes
- The emergence of AMI 2.0, where meters act as sensors feeding data to digital twins, load forecasting engines, and DERMS platforms
- DISCOMs, OEMs, and AMISPs must collectively focus on speed + quality + data utilisation to unlock the full value of AMI

8. Anand Budholia, President – IT and CIO, BSES

- Explained that BSES has treated smart metering not as a loss-reduction project (Losses already at 6%) but as the foundation for Digital Transformation 2.0, covering AI-ML analytics, DER integration, and advanced grid operations
- Reported rapid progress on DT smart metering, aiming for 100% completion by January 206, enabling accurate loading profiles, voltage insights, and reliability of data
- BSES's shift from full 100% consumer rollout to strategic category-wise rollout is driven by operational priorities and global learnings
- The importance of interoperability, especially during phased rollouts where different meter types and HES providers coexist
- MDMS and data engineering are more critical than hardware—DISCOMs must capture only meaningful data in correct structure, or else data lakes become unusable
- Deploying AI/ML use cases is not straightforward: developing even one high-quality model requires strong domain knowledge, clean data, repeated training cycles, and cross-functional collaboration
- BSES's strong focus on cyber security, SOC integration, and segmentation of OT networks to protect millions of consumer endpoints
- Skilled manpower is still insufficient for full-scale AMI operations, and large-scale training programs are urgently needed

9. Rahul Kumar, Managing Director, North Bihar Power Distribution Company Limited

- Shared Bihar's experience as India's largest prepaid smart meter utility, with 8 million + smart meters installed, representing 30% of the national AMI footprint and 70% of India's total prepaid smart meters
- The consumer resistance was significant initially, but sustained awareness and operational refinements have improved acceptance dramatically
- The interoperability challenges faced due to using multiple AMISPs and meter makes; to address this, NBPDCL has developed an in-house RMS for unified data management
- Omni-channel CRM which integrates GIS, billing, customer care, and smart meter data—allowing customer service agents to instantly view DT, feeder, location, and consumption history
- Utilities are sitting on a "gold mine of data" but lack structured capacity to convert data into insights
- Successful pilot submission of energy accounting data to MoP, marking a major step forward under SBD Clause 6

10. Dwijadas Basak, CEO, TPDDL

- Shared TPDDL's early adoption journey starting 2017, using RF, NB-IoT, and 4G technologies, with universal Network Interface Card (NIC) enabling seamless shifts between communication modes
- TPDDL's pioneering work in last-gasp outage detection, where meters automatically notify the utility of outages before consumers call, integrated with ADMS
- Demonstrated major operational benefits:
  - 30% reduction in unnecessary crew visits due to remote ping verification
  - Faster restoration through automated crew dispatch
  - Improved Distribution Transformer (DT) health monitoring through Digital Input–Digital Output (DIDO) function inputs
- Integration of AMI with DERMS, enabling behavioural demand response, P2P trading pilots, and prosumer participation
- The importance of data lakes and AI-ML platforms for extracting insights from terabytes of AMI data
- Cyber security as a strategic priority due to millions of end-points being exposed to the grid
- The smart meters will unlock the future of integrated distribution operations, including EVs, rooftop solar, DSM, and DER coordination

11. Vivek Chandra, Head-IT, MPPuKVVCL

- Smart metering as a "**ray of hope**" for DISCOMs, as it provides visibility from feeder to DT to consumer—a visibility never possible earlier
- Full feeder metering and ongoing DT metering, enabling real-time loss analysis, billing efficiency calculation, and reliability indices that were previously inaccurate

- The significance of DT mapping, consumer indexing, and energy flow visibility, enabling accurate load balancing, DT swapping, and predictive maintenance
- Strong outcomes from AMI–GIS–OMS integration, particularly in rural areas where manual detection of faults was extremely challenging earlier
- Demonstrated use cases like DT failure prediction, monitoring of capacitor banks, daily loss monitoring, and feeder-wise dashboards
- Hackathons and open challenges issued to startups to develop new AI/ML use cases, showing strong interest and

12. Teppo Hemia, CEO, Wirepas

- Presented a new communication model where the gateway is shifted to the meter, combining the speed of cellular deployment with the performance of mesh networks
- Shared results from a 25,000-meter simulation where cellular connectivity achieved <40% coverage while the new concept achieved 98.7% coverage, demonstrating massive reliability improvements
- RDSS for detailed meter and HES specifications, which allow interoperability and integration of new technologies
- The adoption of performance-guaranteed communication, wherein vendors take financial responsibility for non-performing meters
- India as the most challenging and most exciting, AMI market in the world due to scale, density, and diversity
- Soon Wirepas will operate as an AMISP with performance obligations, not just as a technology provider

13. Ashutosh Goel, CMD, Allied Engineering Works

- Focused on the hardware foundation, emphasising that while software can be upgraded, meter hardware is locked for 10 years and must therefore be future-ready
- India risks missing future AMI 2.0 opportunities if meter hardware does not include advanced capabilities such as analogue/digital I/O ports, home network integration, and enhanced processing capability
- Hardware scalability and robustness are essential to support advanced grid-edge applications
- The need for stronger enforcement of hardware standards under RDSS to ensure long-term value creation
- Sustained R&D investment in modular meter design, NIC flexibility, and greater integration with home energy management systems

14. Jaideep Singh, Advisor – Strategy and Stakeholder Engagement, Radius

- Emphasized the importance of shifting from data to information, DISCOMs collect large volumes of data, but decision-making improves only when that data is analysed and contextualised
- Highlighted the importance of real-time, high-frequency telemetry, giving examples from UP and J&K where 2-minute interval data transformed billing transparency and operational insights.
- Distributed intelligence at the NIC level to reduce cloud processing loads and improve system responsiveness
- Cited examples of successful edge processing reducing consumer complaints and improving field staff visibility
- Strict policy-level enforcement of interoperability, real-time data visibility, and standardised architecture across states
- Consumer trust hinges on real-time data transparency, just like UPI or GPS—smart meters must deliver the same experience in electricity

15. Atul Bali, Director, NSGM

- Smart meters are the first layer of a smart grid, enabling DER integration, DR programs, and EV ecosystem development
- There is a misconception around "**real-time**" data—explained that smart meters give near-real-time (15–30 minutes), which is sufficient for distribution operations
- The critical importance of consumer indexing, calling it the single most important ingredient of digitalisation, without correct indexing, all analytics become garbage
- The need for DISCOMs to activate consumer notifications (neutral failure, earth leakage, last gasp) as per MoP guidelines
- The need for interoperable NICs, as already included in the SBD, covering both RF and cellular modules
- Importance of using DT meters with digital inputs, enabling DTMS and predictive maintenance
- Demonstrated home automation integration with smart meters at the India International Trade Fair
- RDSS interoperability measures must be uniformly adopted so that India can transition smoothly to AMI 2.0

SESSION 2 KEY TAKEAWAYS

- Smart meters are now universally recognised as the foundation of DISCOM digitalisation, enabling visibility from grid to meter; the sector cannot progress on RE and EV integration, or DSM programs (DR, TOD/TOU) without AMI
- Connectivity, interoperability, DDF activation and SAT standardisation emerged as the top challenges requiring urgent attention from DISCOMs, AMISPs, and the Ministry
- 57–60% of project delays are due to non-operational DDF, inconsistent SAT, manpower shortages, and lack of contiguous installation areas. Addressing these will automatically accelerate rollout
- Consumer acceptance is improving nationwide, thanks to check-meters, and mobile apps providing real-time consumption visibility
- Future readiness of hardware is critical, meters must support AMI 2.0 use cases, including AI-ML, DERMS, IoT integration, and home energy management
- Data engineering is as important as meter installation, utilities must focus on structured data, data lakes, data governance, cyber security, and analytics readiness
- Interoperability of HES, MDMS, NICs, and communication layers is essential for long-term sustainability, especially as India is adopting multiple AMISP models statewide
- AMI 2.0 use cases, DER integration, DR programs, predictive maintenance, last-gasp outage management, digital twins, and AI-driven forecasting, must now be developed and adopted systematically
- Large-scale skill development and manpower training are urgently required, especially for RF planning, installation, commissioning, analytics, and O&M
- Steering and conciliation committees should be operationalised in all states to resolve operational and contractual issues quickly and transparently
- National-level PR and consumer education campaigns are necessary to counter misinformation and accelerate rollout in high-resistance states
- DISCOMs must take ownership of data utilisation, moving beyond billing to forecasting, planning, reliability improvement, and advanced grid operations

Video Link:

https://www.youtube.com/watch?v=K7t-F4zRVos&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=3

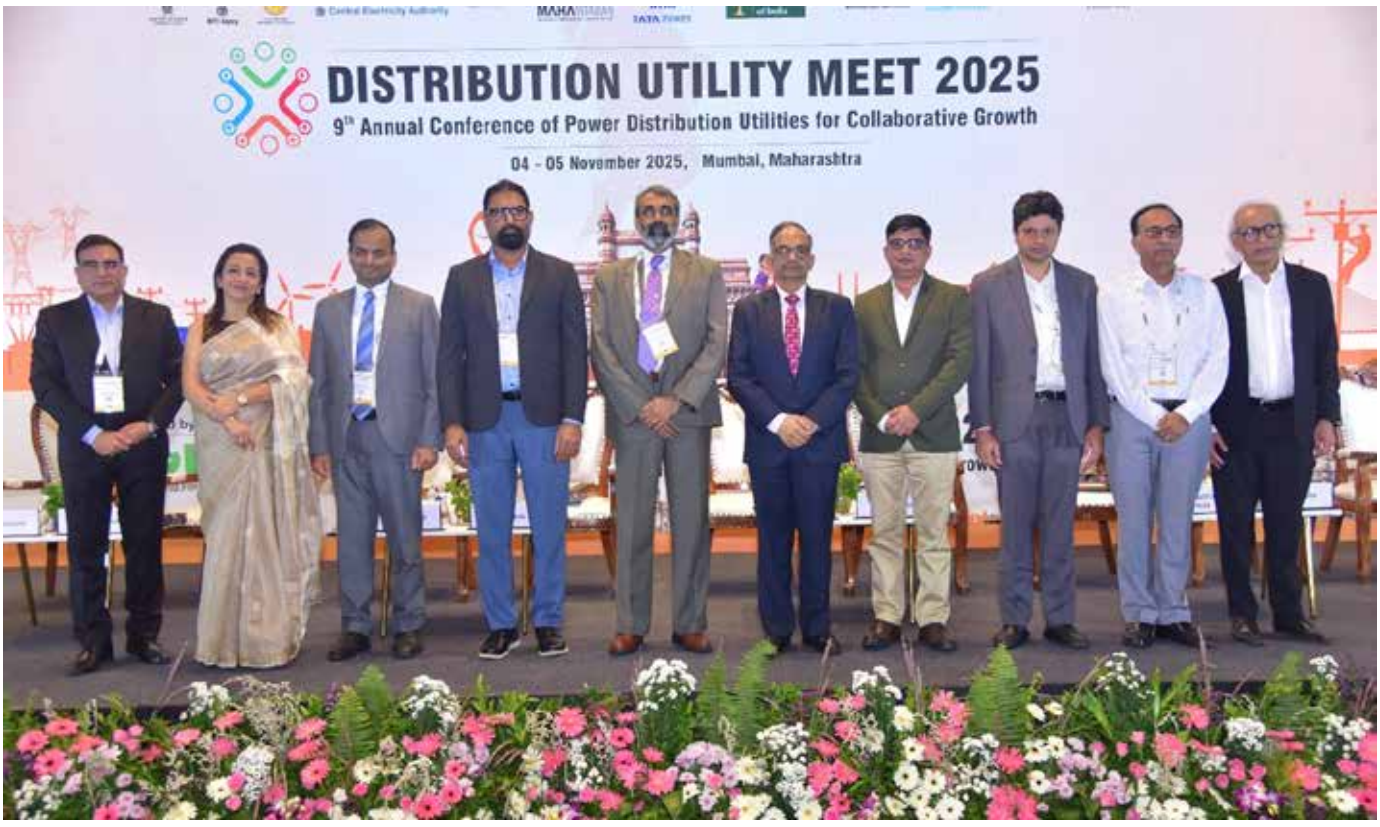
SESSION 3
AI-ML-VR/AR/aR AND ROBOTICS APPLICATIONS FOR UTILITIES

INTRODUCTION

The rapid evolution of Artificial Intelligence (AI), Machine Learning (ML), Virtual/Augmented/Assisted Reality (VR/AR/aR), and Robotics is opening new horizons for electricity distribution utilities. It has capabilities to enhance operational efficiency, reliability, safety, and customer experience. AI and ML are helping DISCOMs to analyse huge datasets for applications like predictive maintenance, demand forecasting, loss detection, and optimization of network operations. VR/AR/aR solutions are enabling workforce training and field operations through simulations and real-time remote assistance. Robotics is increasingly being deployed for asset inspection, fault detection, and hazardous task automation, significantly improving safety and reducing downtime. For Indian DISCOMs, integrating these technologies can help tackle critical challenges such as high AT&C losses, network maintenance delays, and skill gaps, while catering to the demands of renewable integration, electric mobility, and distributed energy resources. This session explored practical applications, global best practices, and the roadmap for deploying AI, ML, VR/AR/aR, and Robotics in power distribution utilities to achieve next-generation performance standards.

PARTICIPANTS

Alok Kumar, DG - AIDA and Former Secretary - Ministry of Power, GoI; **Reena Suri**, Executive Director, ISGF; **Rohit Pareek,** Chief Product Officer, Impresa.ai; **Abhishek Ranjan**, CEO, BRPL; **Ganesh Das**, Chief – Collaboration and Innovation, Tata Power Company Ltd; **Pareekshit Bharadwaj**, Sr VP, BYPL; **Alok Mishra**, Market Area Manager - Power Grids, DNV; **Swapnadeep Banerjee**, Customer Solutions Manager, Trilliant; **Anish Kalucha**, CIO and Head - IT and Automation, NPCL; **Reji Kumar Pillai**, President, ISGF



1. Alok Kumar, Director General, AIDA & Former Secretary, Ministry of Power: Session Chair

- Utilities are investing heavily in smart meters, automation and digital systems, but the real value will come only when AI/ML and allied tools extract intelligence from this data
- Pointed out a clear "disconnect" between solution providers and utilities, suppliers are offering many AI/Robotics products, but most DISCOMs are not fully clear on which solution to choose, how to use it, and what benefit it will give
- AI/ML, AR/VR and Robotics as "enablers and multipliers": They don't replace utility work, but make existing processes faster, safer, cheaper, and more scalable (Example: AR/VR reducing training time drastically)
- Four strong suggestions for India:
  - **National Clearing House for Utility AI Solutions**: A central expert body and group of DISCOMs should validate which AI/ML solutions actually work at scale.
  - **Centralised Procurement After Validation**: Once proven, these solutions can be bulk-procured and offered to all DISCOMs so every state need not "reinvent the wheel."
  - **Capacity Building and Continuous Hand-Holding**: One-time training won't work; field staff and HQ teams need sustained support while adopting AI tools.
  - **National Resource Repository and Working Groups**: A place where DISCOMs can share issues, get help, and identify what needs policy/regulatory interventions.
- Concluded that this session should help DISCOMs move from confusion to clarity on practical adoption pathways

2. Reena Suri, Executive Director, ISGF: Session Moderator

- Framed the session under the theme of the 4th Industrial Revolution reshaping power distribution, where intelligent algorithms, immersive interfaces, and autonomous machines are becoming part of daily utility operations
- Explained in simple terms how each technology is already helping utilities:
  - **AI/ML**: Enabling predictive failure detection, real-time load optimisation, demand forecasting, and analytics driven loss reduction.
  - **VR/AR**: Transforming workforce training and troubleshooting via simulations and remote expert assistance.
  - **Robotics and Drones**: Taking over hazardous, repetitive, and time-consuming inspection tasks, increasing safety and uptime.
- Highlighted ISGF's role in compiling and supporting real pilots, and introduced the new ISGF handbook on AI-ML-VR/AR-Robotics use cases, meant as a "practical roadmap" for Indian DISCOMs.
- These new technologies are now operational tools, not futuristic demos, and scaling them will depend on collaboration, skill building, and strong data governance

3. Rohit Pareek, Chief Product Officer, Impresa.ai

- Presented that Indian utilities will generate more data in the next 5 years than the world generated in the first 100 years of electrification, hence AI readiness is both a huge opportunity and a big challenge.
- Brought in the critical concept of "**AI Sovereignty**": India must own its utility intelligence rather than depending fully on foreign foundation models or vendor-controlled AI.
- Defined three core pillars of AI Sovereignty for utilities:
  - Indigenised foundation models crafted specifically for Indian power sector context
  - Native graph databases to capture relationships inside utility data (Consumer behaviour, payment behaviour, energy patterns), not just raw numbers
  - Localised, industry-centric language models suited for Indian utilities
- Large utilities already ingest 20 TB/day data and must run multiple AI use cases within hours, so data pipelines and compute architecture must be ultra-fast and scalable
- The future will include 120+ transformational AI use cases, but utilities must first operationalise ~40 foundational ones.
- Proposed a "**Digital Quadruplicate Architecture**":
  - Data lake (Storage)
  - Cognitive layer (AI models)
  - Operational layer (AI feeding business processes)
  - Engagement/interface layer (Apps + dashboards for people and customers)

4. Abhishek Ranjan, CEO, BRPL

- Shared three concrete, already-running AI/tech use cases in BRPL:
  - AI-based demand forecasting (Day-ahead and intra-day): Intra-day forecast error reduced to ~1.3–1.5%, day-ahead now below 4%.
  - Hyper-local weather modelling: Building 1 km x 1 km city-grid weather models for feeder-wise demand forecasting. Expected to mature into 11 kV feeder-level precision forecasting.
  - AI-driven predictive / prescriptive asset maintenance: Drone + mast imagery analysed by AI to prioritise defects (0-1-2-3 action tags). Expanded from 11 kV feeders to 33/66 kV feeders and HT substations.
- Highlighted VR-based training modules for workforce, now becoming a mainstream internal course and expanding to transformers and other critical assets
- AI is giving BRPL measurable results in reliability, planning, and asset health, not just pilot-level proofs

5. Ganesh Das, Chief Collaboration and Innovation Officer, Tata Power Company Ltd

- AI/Robotics adoption is expensive for regulated utilities, so use cases must be chosen only where customer value and cost-justification is visible

  Explained that utilities are entering an era of:
  - Two-way power flows (RE + Prosumers)
  - BESS and long-duration storage
  - EV loads
  - Changing consumer behaviour and appliances usage patterns
- Utilities must be strategic in picking priorities, focus first on core forecasting, RE-integration optimisation, resource planning, and only then expand to periphery tech like drones/robotics
- AI must be introduced in a structured, careful manner, similar to how smart meters were phased in

6. Alok Mishra, Market Area Manager, Power Grid DNV

- Presented two international examples to show what “good AI adoption” looks like:
  - **Australia - Solar Energy Forecasting System**: A dedicated national team forecasts solar generation with AI, integrating weather, plant performance, and grid conditions which has greatly improved RE balancing.
  - **Netherlands / Urban Cable Networks**: Smart cable monitoring + AI analytics help detect partial discharge and prevent failures, cutting cable-related faults sharply.
- Also cited California flood-impact prediction models where AI predicts which areas will be hit, expected downtime, and damage patterns, helping utilities prepare before disasters.
- AI is extremely useful for forecasting, preventive maintenance, and climate-resilience planning, especially for flood-prone and hilly states in India

7. Swapnadeep Banerjee, Customer Solutions Manager, Trilliant

- **Re-positioned AI/ML Correctly**: It should not sit in isolation and it must be embedded across AMI/utility infrastructure.
- Highlighted benefits AI results can be stored historically and used for targeted field action

8. Pareekshit Bharadwaj, Sr VP, BYPL

- In BYPL, the grid equipment from substations down to 11 kV is fully SCADA-integrated
- Predictive monitoring prevents collapse/blackouts by alerting discrepancies early
- Presented measurable outcomes:
  - Supply reliability at ~99.57%
  - Restoration time reduced from >1 hour to ~41 minutes
- Drones + analytics have reduced breakdowns by ~63% due to better inspection and proactive maintenance
- Utilities already have huge data; if this data is put into AI tools in the right way, Indian DISCOMs can become world leaders
- Provide specialised training for young engineers so AI/ML tools can be driven meaningfully and sustainably

9. Anish Kalucha, CIO and Head - IT and Automation, NPCL

- Key enablers NPCL adopted:
  - Building an AI Culture: AI is not only IT initiative or business initiative, but it must also be cross-company driven.
  - NPCL has constituted AI Council - Cross-functional: Members from every department define use cases and objectives, ensuring AI solves real business problems.
  - Clear Objectives First: Start with "what outcome we want," then decide the model/data needed.
  - Data Completeness + Correctness: Many DISCOMs assume data exists, but it may be missing or wrong (Example: Half-hour smart meter profile data must be verified before modelling).
- DISCOMs must institutionalise AI through governance structures, not treat it as a one-time tech procurement

SESSION 3 KEY TAKEAWAYS

- AI/ML, AR/VR/aR and Robotics are no longer futuristic, Indian utilities are already using them for forecasting, asset health, loss analytics, training, and reliability improvement
- The biggest barrier is utility readiness: DISCOMs face a disconnect between many available solutions and clarity on which to adopt, how to adopt, and what value they bring.
- A National Clearing House + Resource Repository should be created to validate proven AI solutions, enable central procurement, and provide continuous hand-holding for DISCOM adoption.
- AI adoption must start with foundational readiness: Clean/structured data pipelines, verified completeness and correctness, and clear objectives for each use case.
- AI Sovereignty is emerging as a strategic requirement, India needs indigenous sector-specific foundation models, and localised language models to protect utility intelligence.
- Utilities must prioritise high-value, cost-justified use cases first (forecasting, predictive maintenance, NTL reduction, RE integration), before scaling into broader robotics/AR/VR deployments
- AR/VR is proving crucial for fast workforce training and safer troubleshooting, while drones/robotics are cutting inspection effort and breakdown rates
- Measurable benefits shared include forecast error reduction (to ~1.3–1.5%), reliability improvement (~99.57%), restoration time drop (to ~41 min), and breakdown reduction (~63%).
- Institutional mechanisms like AI Councils and cross-functional governance are essential so AI solutions survive beyond pilots and vendor contracts

Video Link:

https://www.youtube.com/watch?v=hEGiqxyeAuI&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=4

SESSION 4:
DIGITAL ENERGY GRIDS AND THE EMERGING ERA OF ENERGY INTERNET

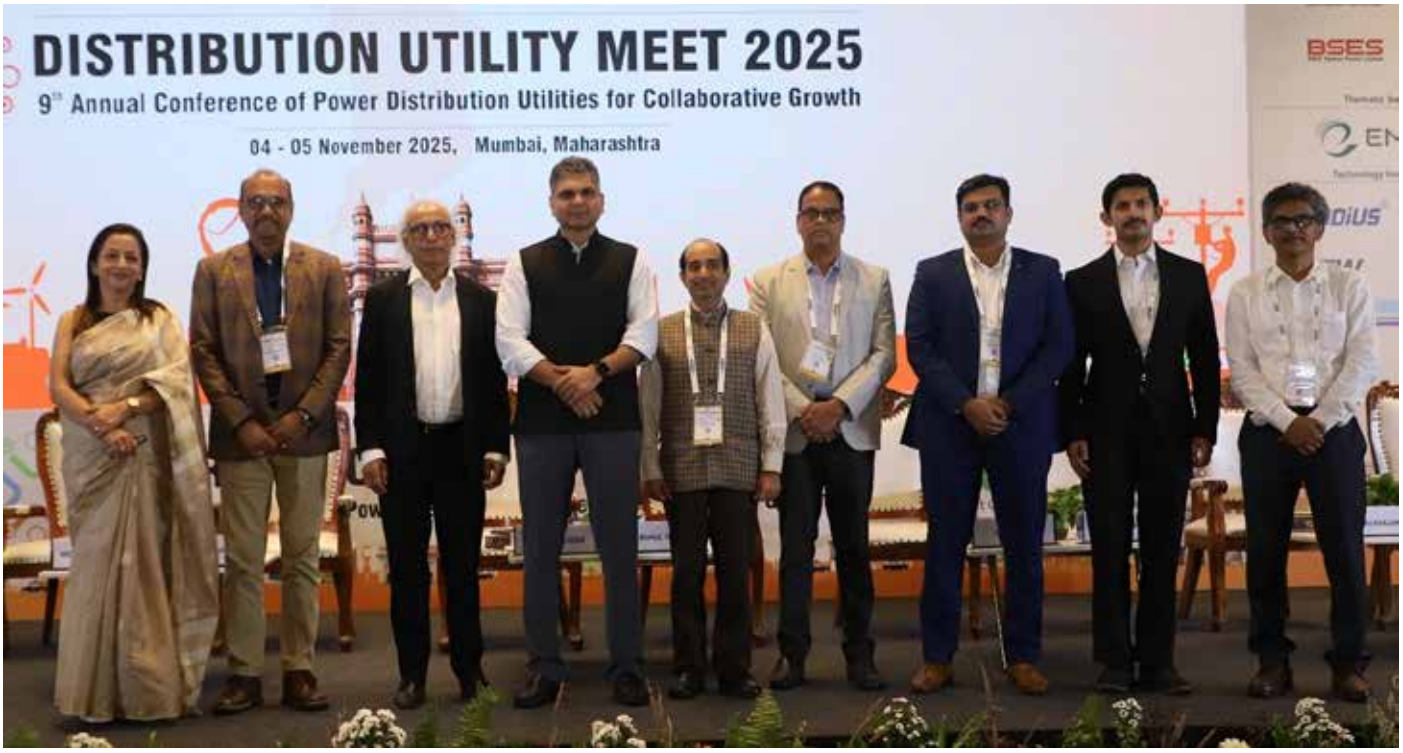
INTRODUCTION

The global power sector is undergoing rapid transformation, driven by decarbonization, decentralization, and digitalization. Traditional grids are evolving as Digital Energy Grids — intelligent, highly automated networks capable of integrating distributed energy resources (DERs), electric vehicles (EVs), and advanced storage systems. The Energy Internet represents the next stage in this evolution, where energy systems are seamlessly interconnected through high-speed communication, IoT sensors, AI-ML tools, blockchain, and big data analytics. This transformation enables real-time monitoring of power flows, peer-to-peer (P2P) energy trading, predictive maintenance, demand-response optimization, and enhanced grid resilience. Ministry of Power (MOP) has recently constituted a task force to prepare the framework for India Energy Stack (IES) and the Utility Intelligence Platform (UIP). The IES will be a Digital Public Infrastructure (DPI) to create a unified, secure, and interoperable digital backbone for India's energy sector.

ISGF along with their technology partners have implemented the Proof of Concept (POC) of a Digital Energy Grid on Unified Energy Interface (UEI) architecture in Uttar Pradesh Power Corporation Ltd (UPPCL) which is presently functional. Globally, this is the first demonstration of a Digital Energy Grid on which P2P energy transactions are being carried out and payments settled on digital platforms. This session illustrated how policy, technology, and market design can converge to make this vision a reality.

PARTICIPANTS

Pankaj Kumar, MD, UPPCL; **Rahul Tongia**, Founding Advisor, ISGF and Senior Fellow, CSEP; **Sujith Nair**, Co-Founder and CEO, FIDE; **Vishakha Chavan**, Associate Product Manager, Impresa.ai; **Shashi Bala**, Senor Engineer, ISGF; **Samanta Santadyuti**, Chief – Digital Transformation and IT, Tata Power Company Ltd; **Adarsh Nagarajan**, Consultant, BRPL; **Manoj Muthyala**, Senior Director - Sales, Impresa.ai; **Senthamil Selvam**, VP-R&D, Stelmec; **Ravi Jagannathan**, MD, KrypC; **Mohit Bhargava**, Country Director, India Energy and Climate Center, UC Berkeley



1. Rahul Tongia, Founding Advisor, ISGF and Senior Fellow, CSEP

- Framed the session as moving from "**making things faster**" to "**making things fundamentally different and better**" using platforms and systems thinking
- Used UPI as a marker: Nobody predicted its full impact, but **simple, open, population-scale rails enabled massive innovation**
- Repeatedly grounded discussion in **use-cases and value propositions**: Technology is an enabler; each actor must ask, "**What do I want from this?**"
- Emphasized:
  - Incentivising **behaviour at the margin** (when/where we charge EVs, consume energy) rather than only, say, using average tariffs)
  - Designing solutions that **scale, stay reliable in real-time grids**, and learn from global experience without repeating others' mistakes

2. Pankaj Kumar, MD, UPPCL: Session Chair

- Appreciated innovation but reminded that **DISCOM economics and grid stability are non-negotiable**:
  - **Fixed costs must be recovered**, or the burden shifts to government
  - **Rural areas** remain the biggest challenge despite urban profitability
- Clarified how **P2P works in UP** in simple terms:
  - Seller gets better price than normal export to grid under net-metring
  - Buyer gets cheaper energy than standard tariff from the grid
  - DISCOM receives a fee for using its network, and platform service providers gets their fee
- Highlighted pending challenges for regulators and DISCOMs:
  - How to convert P2P into **cost-reflective tariffs** and long-term regulatory frameworks
  - How to ensure predictability, grid stability, and DSM compliance in a world of variable renewables
- Technology is ready; the art now is designing usable, beneficial, and grid-safe use-cases for consumers and utilities

3. Sujit Nair, Co-creator, Beckn Protocol, CEO - FIDE and Member, India Energy Stack Task Force

- The **electric grid** and the internet are the two biggest "humanity-scale infrastructures" – now we're at the point where **they must intersect**
- Today's digital systems in energy are like "**one road for each car**" – siloed solutions for smart metering, EV, DER, etc. India, instead need **shared "digital rails"** for energy, like UPI/Aadhaar for finance and identity
- Proposed idea of a "**Digital Energy Grid (DEG)**", a set of **simple, open, population-scale** building blocks (protocols, APIs) that anyone can use to build applications on top of the power system
- Emphasised unbundling and building blocks, don't attempt "open-heart surgery" on utilities; add small, interoperable layers that can scale (like Aadhaar/UPI did)
- Vision: a kind of "HTTPS for energy" where every energy asset is addressable, observable, and transactable, enabling EV management, DER orchestration, P2P transactions, demand flexibility, etc.
- This becomes a platform instead of a solution

4. Vishakha Chavan, Impressa.ai

- Positioned **digital energy grids** as the glue that connects the 3 Ds: Decarbonization, Decentralization, Digitalization.
- Explained a **four-layer "Energy Internet"**:
  - Physical layer (Generation, DER, EVs)
  - Digital backbone (Smart meters, SCADA, legacy systems)
  - D**ata and intelligence fabric** (AI/ML turning data into decisions)
  - Market layer (Apps, platforms, customer interfaces)
- Presented **Impresa's "utility intelligence"** stack that mirrors the physical layer, data layer, cognitive (AI/ML) layer, and the operational interfaces
- **65–70% of digital grid projects may fail** globally if data remains siloed, cloud-only, and non-interoperable
- Proposed a "new utility intelligence checklist": unified data fabric, edge + cloud co-processing, cost-aware design, explainable AI, open standards, and very high reliability

5. Shashi Bala, Senior Engineer, India Smart Grid Forum (ISGF)

- Presented **world's first implementation** of peer-to-peer (P2P) rooftop solar energy trading using the **Unified Energy Interface (UEI) Architecture** in UPPCL/Uttar Pradesh
- ISGF has already done **three pilots** (UPPCL-Lucknow, TPDDL-Delhi, CESC - West Bengal) proving P2P is technically feasible and commercially viable
- Explained the UEI "digital marketplace": prosumers and consumers use buyer (BAP) and seller (BPP) Apps; smart meters + blockchain record all trades with **transparency and auditability**
- Described the T-1 / T / T+1 flow:
  - **Day-1**: Buyers and sellers submit quantities and prices for next day's trade on their BPP and BAP Apps; smart contract is created by 5pm; money from buyers is transferred to the escrow account.
  - **Day 0**: Energy flows over the existing DISCOM grid and smart meters record the energy transfers.
  - **Day+1**: UPPCL MDM sends the meter data of previous days export by sellers and imports by buyers to the blockchain platform from where it is shared with BAP and BPP platforms which reconciles metered data with respect to the contracts entered on the Day-1; and the **escrow account** settles payments to prosumer, DISCOM (network charges), and the Platform Service Providers as per regulations.
- At month-end, adjustments are integrated into DISCOM billing:
  - For consumers: P2P energy purchased is deducted from total consumption
  - For prosumers: P2P energy sold is deducted from their solar energy export to DISCOM

6. Ravi Jaganathan, MD, Krypc

- Highlighted why **blockchain is a good fit** for P2P:
  - **Immutable Data**: Once meter data and trades are recorded, they can't be altered.
  - **Verifiability**: Any authorised party can independently verify each transaction.
- **Smart contracts** embed regulatory rules (wheeling charges, penalties, tariffs) so compliance is **automatic and scalable**, not manual
- Emphasised **dual-ledger need**:
  - A ledger for P2P trades
  - A ledger for monthly DISCOM billing adjustments – both must be consistent and tamper-proof
- Main value: Creates a **"trust layer" for energy transactions,** reducing disputes, ensuring correct settlement, and providing clean data for AI/ML Analytics.

7. Adarsh Nagarajan, Advisor, BRPL

- **Peer-to-peer (P2P) in practice is usually run by aggregators**, not individual consumers manually bidding every day
- Most consumers **don't track their kWh** or have time to trade; **aggregators/virtual power plants (VPPs)** will be critical to make P2P work at scale
- Strong Caution: Any new scheme must simplify life for DISCOM engineers, not add complexity, their primary duty is reliability, not pilots
- Urged policymakers to:
  - **Encourage aggregators,** don't scare them away with over-complex contracts
  - Design innovations so they **reduce operational burden on DISCOMs**
- Innovation + practicality + reliability must go together, otherwise projects will remain on paper

8. Manoj Mutyala, Senior Director – Sales, Impressa.ai

- Reinforced the need for an "**intelligent grid**", not just a "stable grid":
  - Grid must **think and respond** to solar, EVs, batteries, drones, etc. in real time
- The I**ndia Energy Stack + digital backbone** as a leveller: Even small and remote utilities can leverage the same national rails to modernize and optimize their operations.

9. Samanta Santadyuti, Chief – Digital Transformation and IT, Tata Power Company Ltd

- **Generation, transmission, distribution**, and customer layers are all merging at multiple voltage levels due to DERs
- Existing protection/SCADA systems (e.g., unidirectional fault passage indicators) are not fully suited to bi-directional, distributed grids

- Noted huge **untapped flexibility**: e.g. hundreds of GW of household batteries/inverters that are currently invisible to system operators
- Consumers lack visibility and choice – e.g. EV apps show only their own chargers, not cheapest/greenest chargers across all networks
- Argued for solving the "**missing data exchange piece**" between private clouds (OEMs, apps) and utilities, so demand flexibility and new services can actually happen

10. Senthamil Selvam, VP-R&D, Stelmec

- Focused on low-cost digitalization of rural substations using IoT devices rather than full **SCADA (which is expensive)**
- One IoT gateway per substation can connect to existing numerical relays, meters, transformers, chargers via **RS-485/Ethernet/DI/AI and send data to cloud**
- **Key benefits:**
  - Real-time visibility of current, voltage, trips, transformer health
  - Historical logs for fault analysis and preventive maintenance
  - Remote monitoring and control without visiting remote yards
- Importantly, this solution can retrofit old panels supplied **5–10 years back,** helping to digitize legacy rural assets cost-effectively

11. Mohit Bhargava, Country Director, India Energy and Climate Center, UC Berkeley

- Saw strong synergy between **UEI and UPI**, real-time financial settlement for energy is feasible by integrating the two
- Suggested moving from T+1 settlement to much faster (5- or 15-minute) markets as frameworks mature
- Linked **UEI with new AC efficiency standards** and dynamic pricing: Consumers could use their phone to control Air Conditioners and appliance usage when tariffs/greenness are favourable.
- Highlighted that UEI can give control back to DISCOMs as well: With enrolled consumers and consent, DISCOMs can orchestrate demand response and flexibility in a structured way.

SESSION 4 KEY TAKEAWAYS

- India is transitioning from digitalizing old processes to re-architecting the energy sector, moving from "making things faster" to "making things fundamentally different and better" through platforms, interoperability, and systems thinking.
- A "**Digital Energy Grid (DEG)**" or "Unified Energy Interface (UEI)" is emerging as the equivalent of UPI for electricity, simple, open, population-scale digital rails enabling any application to be built on top of the power system (EV charging, DER orchestration, P2P, demand flexibility, VPPs, etc.).
- Interoperability is the biggest bottleneck and biggest success factor. Smart meters, EVs, DERs, OEM apps, SCADA, and billing systems must exchange data securely and in real time; otherwise, 65–70% of digital grid investments risk failing.
- P2P solar trading can work at scale and is already demonstrated in India - UPPCL, TPDDL, West Bengal. The UEI pilots in UPPCL proved technical feasibility, commercial viability, and regulator-compatible settlement through smart contracts and blockchain.
- The future grid must be "intelligent", not just "stable". Millions of behind-the-meter assets (solar, EVs, batteries, inverters, smart appliances) need to be visible, controllable with consent, and coordinated in real time through AI/ML and edge + cloud computing.
- Rural digitalization is equally critical. Low-cost IoT retrofits (instead of full SCADA) can modernize legacy substations and transformers, giving DISCOMs real-time visibility and improving reliability in underserved regions.
- Technology is ready the next leap is regulatory and economic design. Frameworks are required to protect DISCOMs cost recovery, maintain grid stability, incentivize participation, allow faster settlements, and support long-term flexibility markets

Video Link:

https://www.youtube.com/watch?v=L7ccVJi5kpY&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=5

SPECIAL CEO ROUNDTABLE (BREAKFAST SESSION)

INTRODUCTION

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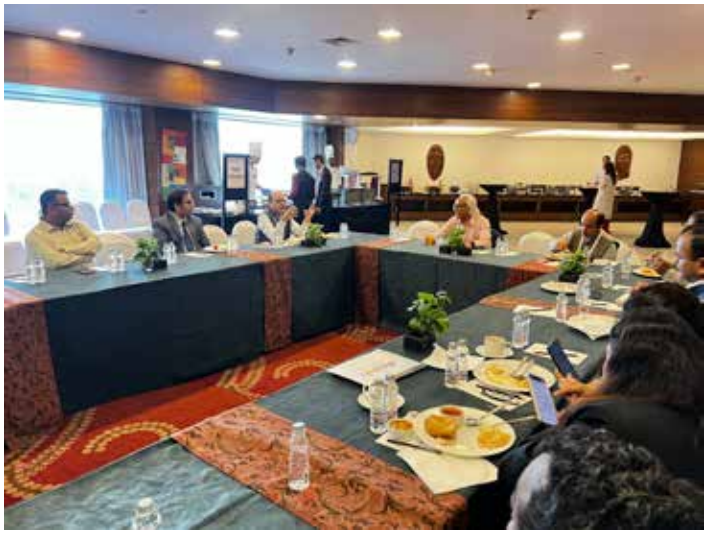
PARTICIPANTS

Reji Kumar Pillai, President, India Smart Grid Forum; **Reena Suri**, Executive Director, India Smart Grid Forum; **Rahul Tongia**, Founding Advisor, ISGF and Senior Fellow, CSEP; **Anil Rawal**, MD, IntelliSmart and Chair of ISGF Working Group on AMISPs; **Atul Bali**, Director, NSGM; **Ketan P Joshi**, MD, PGVCL; **Gaurav Sharma**, General Manager, NPCL; Abhishek Ranjan, CEO, BRPL



CEO ROUNDTABLE KEY TAKEAWAYS

- **The Imperative for Institutionalised Digitalisation Roadmaps:**
  - Continuity Beyond Leadership Changes: The roundtable acknowledged that while smart metering is underway, a holistic digitalisation roadmap is absent in most utilities. A major concern raised was that priorities currently shift with the frequent transfer of leadership. It was agreed that DISCOMs must adopt approved, long-term roadmaps that survive leadership transitions.
  - Collaborative Support: The leadership agreed to explore collaboration with ISGF and AIDA to draft utility-specific roadmaps based on their current "digital maturity" levels to ensure consistent implementation.
- **Addressing the "Safety Crisis" in the Distribution Sector**
  - High Mortality Rate: The forum noted with grave concern that the distribution sector is the most vulnerable link in the power value chain. Approximately 60% to 70% of total electrical accidents occur in the distribution sector (at voltages of 11 kV, 415 V, or 240 V) rather than in generation or transmission.
  - Daily Human Cost: The discussion highlighted the urgency of the situation, noting that on average, 47 people die every day in India due to electricity-related accidents. Of these, the majority (35 deaths daily) are caused specifically by electric shocks.
  - New User Risks: Leaders pointed out that the influx of millions of new customers through schemes like SAU BHAGYA has introduced electricity to households unfamiliar with safe handling practices, necessitating a stronger focus on consumer education.
- **Data Integrity and The EADMS Portal**
  - Launch of EADMS: The CEOs discussed the recent launch of the EADMS by the CEA. The consensus was that this tool must be used to drive accountability rather than just reporting.
  - Reporting Discrepancies: Significant disparities in state-level reporting were analysed. For instance, while Maharashtra reported 3427 accidents and Uttar Pradesh 3058, equally large states like Rajasthan reported only 55.
  - Correlation with Safety Norms: It was noted that 10 states account for 80% of total deaths. The discussion emphasised the need to audit whether low numbers in certain states reflect better safety norms or simply under-reporting of accidents.
- **Benchmarking Against Global Standards**
  - The Fatality Rate Gap: The leadership compared India’s safety performance against global benchmarks. It was highlighted that India’s fatality rate is approximately 1.04 death per 100,000 population.
  - Targeting Improvement: This statistic was contrasted with developed nations like the USA and UK, where the rate is 0.03, and developing nations like Brazil (0.3). The goal set for DISCOMs is to bridge this massive gap through better infrastructure and safety protocols.
  - State-Level Variance: The discussion utilised the fatality rate metric to identify underperformers. For example, Madhya Pradesh has a fatality rate of 2.43, significantly higher than the national average of 1.04, whereas Uttarakhand is at 0.29.

SESSION 5:
GRID INTEGRATION OF DISTRIBUTED RE (DRE)

INTRODUCTION

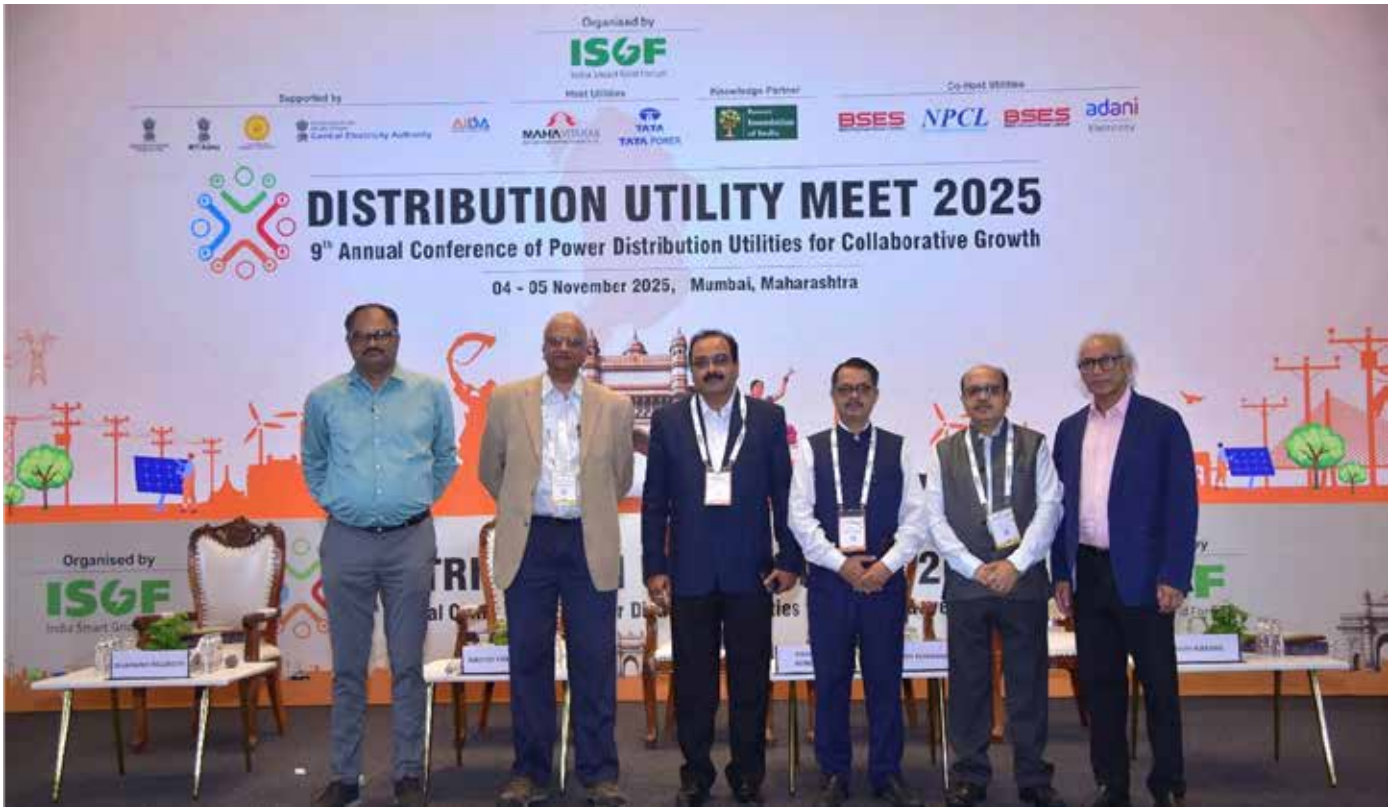
The fast growth of Distributed Renewable Energy (DRE) resources is transforming the electricity distribution landscape in India. Ambitious national targets for renewable energy and programs such as PM-KUSUM and PMSG: MBY are creating millions of power generation sources connected to the DISCOM grid – medium voltage (MV) and low voltage (LV) segments of the grid. This power injections to the distribution grid from numerous points is leading to reverse power flows, voltage fluctuations beyond permissible limits, huge variations in power flows patterns between the day and the night.

MSEDCL has successfully installed a record number of solar agriculture pumps across Maharashtra — the highest in the country. To recognize and showcase this large-scale achievement at a global level, MSEDCL, in association with Guinness World Records (GWR), proposes to attempt a new world record titled: “Most Solar Agriculture Pumps Installed in One Month.” For this challenge MSEDCL is targeting to install 35,000 Solar Agriculture Pumps in One Month across all districts in Maharashtra.

Emerging technologies such as AI and ML can significantly help in grid management to integrate DRE, improve demand and generation forecasting, help plan the most optimal grid upgrades and outage response. Exploring strategies for harmonizing DRE integration and grid resilience, will ensure reliable, sustainable, and customer-centric power distribution for the energy transition.

PARTICIPANTS

Ravi Seethapathy, Chairman, Biosirus, Inc; and ISGF WG Chair; **Dnyanesh Kulkarni**, C.E. (Renewable Energy), MSEDCL; **Dhananjay Aundhekar**, Executive Director – SP Projects, MSEDCL; **Reji Kumar Pillai, President**, ISGF; **Nidhi Narang**, Former Director – Finance, UPPCL; **Devanand Pallikuth**, Chief – Tech Services and PSCC, TPREL



1. Ravi Seethapathy, Chairman, Biosirus, Inc; and ISGF WG Chair: Session Chair and Moderator

- Highlighted four critical system issues:
  - Falling grid inertia as thermal plants back down during daytime solar dominance
  - Large intra-day solar swings (Example: 7,000 MW ramp event recently in Rajasthan) and the need for spinning reserves
  - Urgent need for grid-forming inverters as DRE increases
  - Congestion + shadow pricing: With more DRE, distribution congestion must be priced like a supply chain problem.
- Stressed that India must rethink grid stability fundamentals as DRE proliferates
- Without a structured approach to hosting capacity, local spinning reserves, and inverter standards, distribution networks may face dynamic instability

2. Dhananjay Aundhekar, Executive Director – SP Projects, MSEDCL

- Explained Maharashtra's massive DC solar irrigation pump program under PM-KUSUM-B and Mahatma Jyotiba Phule Solar Pump Yojana
- Showed how DC solar pumps significantly reduce grid burden, lower power purchase costs, and eliminate agricultural hooking thefts
- Maharashtra has installed 6.64 lakh pumps, contributing 60% of India's total; targeted to reach ~21 lakh by 2026
- Demonstrated feeder-level benefits:
  - Input energy reduces 12–27% after solar pump penetration
  - Transformer failures fall sharply where solar pumps exceed 30–40%
  - Interruptions reduce drastically as illegal connections disappear
- Shared Maharashtra's Guinness World Record attempt: installing 35,000 solar pumps in 30 days
- DC pumps directly improve operational health of rural feeders by lowering demand, reducing subsidy burden, and cutting CO_2 emissions

3. Dnyanesh Kulkarni, C.E. (Renewable Energy), MSEDCL

- DRE is now an architectural shift—not an add-on—and will define future distribution planning
- Maharashtra has already:
  - Installed 4,151 MW rooftop solar (4.8 lakh systems)
  - Contracted 15,444 MW under feeder-solarization (PM-KUSUM-C)
  - Solarized 6.6 lakh agriculture pumps under feeder mode
- Highlighted operational challenges from rising rooftop solar:
  - Reverse power flow, voltage rise, and high variation in day-night load curve
  - Residential consumers installing 3–10 kW systems under PM Surya Ghar, leading to sudden evening over loads
  - Called for grid connection charges for rooftop solar, since consumers with net-metering reduce DISCOM revenue while DISCOM must still invest in capex upgrades
- AI/ML based forecasting integrating weather, special events, and demand history for scheduling solar and agricultural load
- MSEDCL's real-time AG load control room, monitoring 3,000+ substations for feeder-wise solar and load patterns
- Proposed Battery Energy Storage Systems (BESS) as the only reliable long-term solution for smooth DRE integration:
  - 750 MW/1500 MWh BESS tender awarded
  - 10 MW already commissioned
  - New 2000 MW/4000 MWh tender issued under PSDF

4. Reji Kumar Pillai, President, India Smart Grid Forum

- Explained why DRE integration fails today: System operators don't know where rooftop solar is connected
- Current 2 million rooftop solar (RTS) systems with cumulative capacity of 16 GW produces >50 GWh energy that isn't included in daily scheduling because their grid location is unknown

- Introduced the National Solar Rooftop Registry, developed with ISGF:
  - Maps each system to its exact pole, DT, feeder, and substation
  - Built on a massively scalable IT architecture similar to Aadhar
  - Uploaded 2.5 lakhs RTS data from PGVCL, Gujarat and the Indore DISCOM as pilots
  - Registry is being handed over to CEA for national adoption and integration with PM Surya Ghar 2.0 Portal
- Warned of voltage overshoot + inverter tripping in high-penetration areas (e.g., Gujarat cities with >20% rooftop solar).
- Advocated mandatory Smart Inverters (IEEE 1547-2018) to manage reactive power, voltage, and remote curtailment. BIS has adopted IEEE 1547-2018 as IS-18968:2025; testing currently in progress at NISE.
- Shifting subsidy from rooftop panels to BESS, enabling consumers to store excess solar and reduce grid stress.
- Called Vehicle-to-Grid (V2G) a coming revolution: EVs idle for 18+ hours can arbitrage energy from ₹1–2/kWh from the grid during high solar hours to ₹7–12/kWh during peak hours.

5. Nidhi Narang, Former Director - Finance, UPPCL

- Focused on commercial and financial implications of DRE and raised concerns that net-metering heavily burdens DISCOMs, especially when high-income consumers install large rooftop systems
- Highlighted manipulation cases: Consumers increasing sanctioned load to install large RTS systems and then reducing sanctioned load
- The mass rooftop solar pushes up capex needs (DT upgrades, reconductoring, evening peak reinforcement)
- Called for a balanced roadmap that supports RE goals without destabilizing the DISCOM financial ecosystem

6. Devanand Pallikuth, Chief – Tech Services and PSCC, TPREL

- Distribution planning must evolve from simple load matching to power-flow-based, scenario-driven planning
- Explained NPCL/Tata Power's approach:
  - Daily resource adequacy checks
  - Scenario modelling for reactive power, reverse flows, and hosting capacity
  - Integrated control Centres with full visibility of DTs, feeders, and AMI
  - Supported Distribution System Operator (DSO) model to separate technical operation from commercial functions
- Emphasized that rising rooftop penetration requires central coordination + local intelligence, not isolated utility actions
- DRE + BESS must be embedded into distribution operations with grid-forming inverters, reactive support and local balancing features.

SESSION 5 KEY TAKEAWAYS

- DRE is now a structural transformation of India's distribution grid, not an optional add-on
- Maharashtra's DC solar irrigation pump and feeder solarization model shows clear operational improvement in rural networks and massive day-time demand reduction
- Rooftop solar growth is outpacing DISCOM preparedness, causing reverse power flows, voltage rise, and severe evening overload
- Smart inverters (IS-18968:2025) and BESS are essential to maintain stability at high rooftop penetration levels
- DISCOMs require grid connection charges, policy clarity on cost recovery, and a national estimate for DRE integration cost
- The National Rooftop Registry will be a game-changer for forecasting, scheduling, and coordinated RTS management
- Financial sustainability must flow with technical innovation; otherwise, large-scale DRE may destabilize DISCOMs
- The future lies in DSO-style operations, granular modelling, local balancing, and clear mechanisms for pricing congestion, reactive support, and flexibility

Video Link:

https://www.youtube.com/watch?v=EU4p6Kb3ZY0&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=6

SESSION 6:
ELECTRIC VEHICLES – A $200 BILLION OPPORTUNITY IN INDIA AND DISCOMs ROLE IN MAKING THIS A REALITY

INTRODUCTION

Fast growth of EVs presents unprecedented challenges as well as opportunities for DISCOMs. Global passenger EV sales annually are estimated to rise from 17.6 million in 2024 to 22 million in 2025; and to 39 million in 2030 per BNEF latest EV Outlook. EV stock (excluding 2/3-wheelers) stood at 58 million at the end of 2024 which is projected to reach 245 million by 2030 and 525 million by 2035 – nearly 10X in next 10 years! Electric 2/3-wheelers stock is already 290 million. In 2025, the LFP battery cell prices have fallen to $36/kWh, and this generation of batteries are going to make EVs cheaper than ICE vehicles in the coming years. This could further accelerate EV adoption pace.

Government of India has set an ambitious target of 30% EVs by 2030. According to NITI Aayog's latest report in August 2025, Electric Vehicles is a $200 billion opportunity in India to be unlocked. Presently there are about 7 million EVs registered in India, majority of which are 2/3-wheelers. The "Vision 2030: PM Public Transport Sewa" initiative aims to develop 600 km of electric highways and replace 800,000 diesel buses, including 50,000 school buses, with electric buses. Vehicle to Grid (V2G) technology demonstrated successfully by ISGF with 4 retrofitted Tata Nexon EVs in March 2025 has attracted the attention of various stakeholders. Millions of EVs with V2G features connected to the grid could be aggregated as virtual power plants (VPP) that could support the grid for RE integration and peak load management. There is a huge opportunity in development of bidirectional power modules and bidirectional chargers for scaling up V2G in India.

This session discussed how these challenges can be unlocked and create the $200 billion opportunity!

PARTICIPANTS

Rajendra G Ambedkar, Secretary, MERC; **Himanshu Chawla**, Head Regulatory (Senior Specialist), Power Foundation of India (PFI) and Former Joint Director (Tariff), DERC; **Anshuman Srivastava**, Executive Director, Power Foundation of India (PFI); **Anand Kumar Singh**, General Manager, ISGF; **Ramkrishna Singh**, Head of e-Mobility Business, Tata Power; **A Shrinivas Rao**, General Manager, Transport Engineering, BEST, Mumbai; **Omkar Shaligram**, GM, Tata Motors Ltd; **Pradeep Agarwal**, GM, BRPL; **Pramod Mishra**, CTO, Chandigarh Power Distribution Ltd; **Kartikey Haryani**, Founder and CEO, Charge Zone; **Chetan Pathak**, Director, IESA; **Ashok Thanikonda**, Sr Program Officer, GGGI

1. Himanshu Chawla, Head (Regulatory), Power Foundation of India: Session Moderator

- Positioned the session as one of the largest and most technically intensive panels of DUM 2025
- Divided the discussion into two logical blocks:
  - EV Ecosystem: Transport utilities, OEMs, charging companies
  - DISCOM Impact: Commercial, technical, and grid safety aspects
- Set the expectation that the panel will explore policy–industry–grid intersections, not superficial discussions

2. Rajendra G Ambedkar, Secretary, MERC, Secretary, Maharashtra Electricity Regulatory Commission (MERC): Session Chair

- Set the tone by connecting EVs to India's three big energy transitions drives:
  - Decarbonization through renewables
  - Digitization of distribution networks
  - Electrification of transport
- Emphasized that EVs are not just a technological shift but a structural change in how electricity networks must be planned, priced, and operated
- Highlighted dual impact on DISCOMs:
  - EVs increase peak loads, requiring grid strengthening and flexible pricing
  - But EVs also offer new demand, better load factor, and opportunities like V2G, RE-aligned charging, and revenue diversification
- Explained how MERC is already creating a favorable regulatory environment:
  - Dedicated EV tariff category
  - Time-of-Day (ToD) pricing to promote off-peak charging
  - Open access provisions for charging networks
  - Plans to consider bidirectional charging (V2G) regulations
- Important role for regulators in balancing affordability, financial sustainability of DISCOMs, and system reliability during the EV transition.

3. A Shrinivas Rao, General Manager, Transport Engineering, BEST, Mumbai

- Gave a powerful historical perspective: Mumbai started with electric trams in 1907 and moved to fossil-fuel buses; and now "returning home" to electrification
- Today 46% of BEST's fleet is already electric (~2,000 buses)
- By 2026, BEST will be 100% electric buses, with procurement of ~4,700 buses already underway
- Long-term vision: 8,000+ electric buses by 2030 (city requirement ~10,000).
- Highlighted the success of the Gross Cost Contract (GCC) Model:
  - Operator owns buses and charging infrastructure
  - BEST invests only in upstream 11/33 kV infrastructure
  - Allows fast scale-up without CAPEX burden on transport utilities
- Metro cities must embrace electric transit not as a choice but a climate responsibility aligned with global COP commitments

4. Omkar Shaligram, GM, Tata Motors Ltd

- India today has 4 lakh+ EV passenger cars on the road; 70–80% are privately owned
- Maharashtra subsidies played a pivotal role; EV penetration now touching 5%—the global "inflection point" after which adoption accelerates
- Highlighted three major drivers:
  - Strong government push (FAME, guidelines, open charging norms)
  - Rapid expansion of public charging (now covering 91% of National Highways)
  - Customer delight — 84% EV owners use it as their primary car

5. Ramkrishna Singh, Head of e-Mobility Business, Tata Power

- Unlocking the $200B EV Opportunity
- EV opportunity (~INR 16 lakh crore) equals 6 times RDSS budget

- Identified five systemic bottlenecks:
  - Location availability
  - Reliable power infra at sites
  - Charger standardisation
  - Slow DISCOM processes (ROW, energization)
  - Limited awareness/social infrastructure.
- Suggested actionable reforms:
  - EV charging infrastructure must be integrated at design stage of highways, townships, ULB plans
  - Charging hubs earmarked across expressways
  - Reduce GST on charging services from 18% to 5%
  - Mandate parking + home charging readiness in buildings
  - Standardize display, UI, error codes, safety process across all chargers
  - Dedicated project monitoring units for uniform implementation
  - Strong push for V2G, modular chargers, multilingual UI and integration of solar + BESS for green charging

6. Pradeep Agarwal, GM, BRPL

- DISCOM Perspective: Managing EV Bus Loads
- Delhi's ~3,500 electric buses charge in two slots: afternoon and night
- Daytime charging aligns with high RE availability, but evening charging overlaps expensive peak slots
- BRPL proposes:
  - BESS at depot-level to store low-cost day RE during the day and discharge during peak
  - Green charging via open access or green tariff
- Optimising existing charger network without augmenting grid when possible

7. Pramod Mishra, CTO, Chandigarh Power Distribution Ltd

- Shared Chandigarh Electricity Department's transformation after 100% privatization in 2024 – taken over by
- RP-Sanjiv Goenka Group
- Target: Reduce AT&C losses from 14.77% to 7.6% in Year-1
- EVs seen as the only real load growth option because Chandigarh is saturated and heritage-restricted
- Chandigarh's advantages:
  - Planned city, ample parking, high per-capita vehicles (1 vehicle per citizen)
- DISCOM reforms:
  - 87% reduction in load shedding
  - GIS + ADMS rollout
  - LT feeder monitoring app (AI/ML-based prediction)
  - No outages for 3 months straight
- Strong belief that V2G will be game changing:
  - Consumers can earn monthly revenue using their car battery
  - Appeals for a structured settlement mechanism like net-metering

8. Chetan Pathak, Director, IESA

- Highlighted urgent need for BESS integration with charging infra:
  - Reduce reliance on grid augmentation
  - Provide firm, dispatchable power
  - Mitigate transformer constraints
- India still lacks:
  - Battery reuse certification
  - Second-life EV battery regulation

9. Kartikey Haryani, Founder and CEO, Charge Zone

- Challenges for Public Charging Operators:
  - 10 GWh/month energy delivery; 250,000+ EV users served at least once
  - Applauded DISCOMs for faster approvals (compared to 10–48-month delays in EU)
  - Biggest challenge: Reliability anxiety, not range anxiety
- Advocated for CPOs to become micro-grid operators: solar + BESS + fast DC
- Consumers willingly pay INR 20–22/unit at fast chargers because per-km cost is still 3–4 times lower than petrol/diesel
- EV transition will depend on scaling commercial mobility — buses, trucks, fleets — not just personal cars

10. Ashok Thanikonda, Sr Program Officer, GGGI

- Green bonds are proven instruments, but “greenium” has nearly disappeared in current global markets
- Catalytic/patient capital can help first-mover EV infrastructure
- Governments can reduce risk via:
  - Land support
  - Lower lease rates
  - Co-investment in early-stage hubs
- The need for consumer behavior modelling to size chargers correctly
- Highlighted live examples where states still publish EV charger lists as PDFs without map links → urgent need for digital transparency

11. Anshuman Srivastava, Executive Director, Power Foundation of India (PFI)

- Role of Think Tanks in EV Transition: Think tanks must provide evidence-based research to prevent systemic shocks
- Need for:
  - Feeder-level visibility of EV loads
  - Tariff modelling support
  - Long-term grid impact forecasting
  - Zero-emission vehicle mandates
  - Planning EV hubs with power availability mapping

12. Anand Kumar Singh, General Manager, ISGF

- Presented India’s First V2G and Green Charging Demonstrations
- ISGF executed India’s first real V2G pilot, in partnership with:
  - University of Delaware
  - Nuvve Holdings
  - Watt and Well
- Conducted across 3 Delhi DISCOMs and ANERT in Kerala
- Proposed Model V2G Regulation covering:
  - Eligibility, metering, interoperability, settlement, tariff framework
  - Tariff designs studied from UK, EU, USA, Japan and Netherlands

SESSION 6 KEY TAKEAWAYS

- BEST plans full electrification of its bus fleet and noted smoother transition due to its dual role as a DISCOM
- High upfront EV costs and limited charging infrastructure remain key barriers; Tata Motors highlighted lower operational costs and the need for subsidies/financing
- CPOs reported fast-growing infrastructure, but slow charging (30-45 mins/200 km) remains a major user hurdle
- DISCOMs raised concerns about EV loads overlapping with peak demand, increasing grid stress and short-term power costs; Chandigarh DISCOM sees EVs as a new revenue opportunity. But Chandigarh-type models may work for small states but cannot be generalised due to cost socialisation issues
- Grid constraints, transformer limits, lack of V2G regulations, unclear second-life battery norms, and low utilization of charging points hinder scaling; BESS-based microgrids can ease bottlenecks
- Battery leasing emerged as the most viable model to reduce upfront cost and improve EV affordability
- Effective grid planning, demand management, and BESS deployment are essential to integrate rising EV loads efficiently
- Business models may vary by state; manufacturers must cut costs and enhance efficiency to drive mass adoption, and transport agencies need sustainable fare and operational structures
- EVs present a major economic opportunity but require coordinated action across all stakeholders to build an affordable and scalable ecosystem

Video Link:

https://www.youtube.com/watch?v=EBMY0b4ZIvk&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=7

SESSION 7: EMERGING CHALLENGES FOR DISCOMS: GW-SCALE AI DATA CENTERS, MW-SCALE EV CHARGING STATIONS, AND GRID-LEVEL POWER QUALITY CHALLENGES

INTRODUCTION

The rapid advancement of artificial intelligence (AI) and electric mobility is reshaping electricity demand dynamics across the world including India, which is posing complex and unprecedented operational challenges to DISCOMs. Power requirements of AI infrastructure are quickly scaling to gigawatt levels, with global investments expected to reach US$ 624 billion by 2029. Modern AI data centers, powered by thousands of GPUs (and TPUs), require exceptionally high energy inputs, ultra-low latency connectivity, and sophisticated cooling systems, placing immense pressure on existing grid infrastructure. India has emerged as a very competitive location offering US$ 80 per kWh for data center usage compared with US$ 200 per kWh in Indonesia, and much higher in developed countries. OpenAI has just announced a 1 GW capacity data center in India as part of their Stargate project; and Google announced another 1 GW data center in Visakhapatnam in Andhra Pradesh which will be bult in partnership with Adani Group. It is estimated that power requirement for data centers will exceed 12 GW by 2035 from present data center load of under 1.6 GW; and another report in June 2025 estimated that annual electricity demand of data centers in India will be about 300 TWh by 2035.

Globally 1282 companies have set Net Zero targets of which about 100 are targeting Net Zero by 2030. Several leading data center players such as Apple, Alphabet, Microsoft, Meta, Nvidia, IBM, TCS etc. have pledged to go Net Zero by 2030. It is important to build special zones where Carbon Free Energy (CFE) can be provided in GW-scale for attracting prospective hyper scaler data centers in India.

The session explored the technical, regulatory, operational and financial implications of these emerging trends, and outlined actionable pathways to future-proof India's distribution networks.

PARTICIPANTS

Ashish Kumar Goel, Chairman – UPPCL and Gen Secretary – AIDA; **Reena Suri**, Executive Director, ISGF; **Anil Kumar Prasanna**, Director, Enspar Energy Solutions; **Saurav Shah**, ED, PFC; **Ketan P Joshi**, MD, PGVCL; **Santosh Kumar Singh**, AVP, BYPL; **Manish Wath**, Chief Engineer, MSEDCL; **Chintamani Chitnis**, Chief - Distribution Services, Tata Power Company Ltd; **Manish Patel**, BD and Product Head for Covered Conductor, APAR; **Kishor Narang**, Founder, Principal Design Strategist and Architect, Narnix Technolabs; **Gaurav Sharma**, General Manager, NPCL

1. Ms. Reena Suri, Executive Director, ISGF; Session Moderator

- Explained why AI data centers and MW-scale EV bus depots are fundamentally different from traditional industrial loads:
  - Faster ramp up
  - Higher switching frequencies
  - Zero power-factor tolerance
  - Power quality sensitivity
  - Huge reactive swings
- India's last five years of load profile cannot be used as reference anymore, everything is changing simultaneously: AI, EVs, digital infra, DERs, and RE displacement of inertia in the power systems

2. Ashish Kumar Goel, Chairman, UPPCL and General Secretary, AIDA; Session Chair

- Set a strong, reality-check tone: India is entering a future where gigawatt-scale AI data centers and megawatt-scale EV hubs will reshape the load profile of every DISCOM and DISCOMs will earn meagre revenues from them directly yet need to create massive upstream infrastructure upgrades.
- Highlighted dual disruptive loads:
  - AI Data Centers: 24×7, dual-feeder redundancy, ultra-high power quality, massive reactive power swings, and f fast-ramp fluctuations
  - EV Public Charging's: Highly fickle, sudden spikes during bus/truck charging sessions, with very low ability to forecast
- DISCOMs must build:
  - New substations
  - Transmission corridors
  - Dedicated feeders
  - Redundancy infrastructure
- Deep Technical and Urban Planning Challenges:
  - Data centers convert 100% of input power into heat, not usable products like other industries; and it will create urban heat islands, intensifying micro-climate stresses
  - Engineers and staff will not live in remote deserts; hence "shifting data centers to far-off regions" is not feasible in India like it is in Arizona
  - Massive data center clusters in cities will lead to thermal stress + air quality issues + urban design load shocks
- India cannot avoid AI data centers or EV charging hubs. DISCOMs must embrace these challenges and plan integrated grid-readiness, power quality management, and regulatory clarity.

3. Anil Kumar Prasanna, Director, Enspar Energy Solutions

- Demonstrated why smart meters alone cannot detect power quality (PQ) disturbances, they lack:
  - High sampling rate
  - High bandwidth
  - Microsecond-level waveform capture
  - Transients, harmonics, sags/swell detection
  - Core PQ Challenges with New-Age Loads
- Real Global Example: Spain's grid oscillation (~1 Hz) was recorded by PQ monitors early, but no automated trigger which led to a large-scale grid disturbance.
- Multi device integration: PQ meters + fault recorders + IEDs + SCADA + AMI should feed in to a central PQ Data Management System.
- IEC-61850 based unified PQ platform should capture:
  - Waveforms
  - Harmonics
  - Transients
  - Voltage flicker
  - Frequency drift

4. Ketan P Joshi, MD, PGVCL

- Gujarat entering a new phase where digital loads + EV loads dominate the load curve, replacing traditional agricultural and residential load patterns
- Data centers require:
  - 24×7 uptime
  - Dual redundant feeders
  - Zero tolerance for voltage dips
  - Near-perfect power quality
  - Require massive Grid Upgrades
  - Multi-source substations
  - Real-time reliability monitoring
  - Looped 66 kV corridors for AI hubs
  - Advanced GIS-based grid planning
  - AI/ML forecasting integrating RE + EV + Weather Data
- Megawatt-scale fast charging creates instantaneous load jumps impacting 11/22 kV urban networks. It needs:
  - Transformer upgrades
  - RMU strengthening
  - BESS at Bus Depots
  - Advanced harmonic filters

5. Santosh Kumar Singh, AVP, BYPL

- Over 3,000 public EV chargers already integrated in Delhi
- Challenges:
  - Sudden 0–5 MW spikes at electric bus depots
  - Large-scale harmonics from DC fast chargers
  - Voltage dips affecting nearby consumers
- Implementing:
  - Network strengthening
  - Rooftop RE balancing
  - Transformer capacity augmentation

6. Saurav Shah, ED, PFC

- Two kinds of challenges:
  - Technical: harmonics, voltage flicker and transient impulses
  - Commercial: tariff structures not aligned with high PQ-sensitive loads
- Emphasized that:
  - EV chargers must include standards for reactive compensation and harmonic mitigation
  - PQ meters must be deployed between DT → feeder → consumer

7. Manish Wath, Chief Engineer, MSEDCL

- Maharashtra has:
  - 4 GW rooftop solar
  - 2.7 GW feeder solar (Krishi Yojanas)
  - 3,800+ public chargers
  - 8.5 lakh EVs on road
- Key Challenge: Night-time EV charging to reverse power flows during day time from high solar generation
- Solutions Adopted:
  - Mandatory PQ metering across 6,791 substations
- Monitoring PQ via central platform for:
  - Flicker
  - Voltage sags
  - Harmonics
- Indicated that there is difficulty in meeting IS-17036's strict PQ norms, especially flicker limits.

8. Chintamani Chitnis, Chief - Distribution Services, Tata Power Company Ltd

- No space for new substations in Mumbai. So, Tata Power created:
  - Fully submersible underground 22 kV substations (IP-68, RMUs + hermetically sealed esther-oil filled
  - transformers)

9. Manish Patel, BD and Product Head for Covered Conductor, APAR

- Conventional ACSR/AAAC cannot handle:
  - Higher temperatures
  - Overloads due to EV clusters
  - Cumulative harmonic heating
- New AL59/ACS-based covered conductors support:
  - Higher thermal rating (95°C)
  - Higher ampacity
  - Lower technical losses
  - Ideal for urban densification + EV corridors

10. Kishor Narang, Founder, Principal Design Strategist and Architect, Narnix Technolabs

- Current DISCOM digital infra is siloed:
  - AMI SCADA OMS DERMS EVMS GIS
- Submitted a detailed presentation how these systems can be brought on a unified digital architecture.

11. Gaurav Sharma, General Manager, NPCL

- AI Loads are dangerous for the Grid: AI data centers consume 10–150× more than traditional Data Centers.
- Load ramps at 290 milliseconds from baseline to peak
- Forecasting failure (existing models not trained on AI+EV composite loads)
  - Long-Term Impact
  - Capacity bottlenecks
  - Transformer thermal stress
  - DT/Feeder overloads
  - Mitigation Architecture
  - On-site BESS to flatten 200 MW-scale load spikes (30–50% sizing recommended)
  - STATCOM to counter reactive swings.
  - PQ monitoring via IEC-61850 based unified PQ platform
  - AI-based load forecasting to integrate weather + EV behavior + AI cycles

SESSION 7 KEY TAKEAWAYS

- GW-scale AI data centers and MW-scale EV charging depots represent the fastest-growing, highest-risk, lowest -forecastability loads ever seen in the Indian grid
- DISCOMs must treat power quality as a first-class reliability parameter such as harmonics, flicker, voltage dips, resonance, DC injection, and EMI will define future outages
- BESS (30–50%) and STATCOMs are non-negotiable for stabilizing AI/EV node behavior
- PQ meters must be deployed at all critical nodes, not just substations
- Distribution networks require multi-source substations, redundant corridors, and GIS-based planning for AI clusters
- Covered conductors, submersible substations, and high-rise substations will become mainstream urban solutions
- Digital transformation must shift from isolated IT/OT systems to a Unified Digital Architecture integrating IoT, AI, sensors, SCADA, PQ, DERMS, EVMS

Video Link:

https://www.youtube.com/watch?v=GE2kCNgxmVI&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=8

SESSION 8: EXTREME WEATHER EVENTS AND THE URGENT NEED FOR REVISION OF STANDARDS AND SPECIFICATIONS OF GRID EQUIPMENT

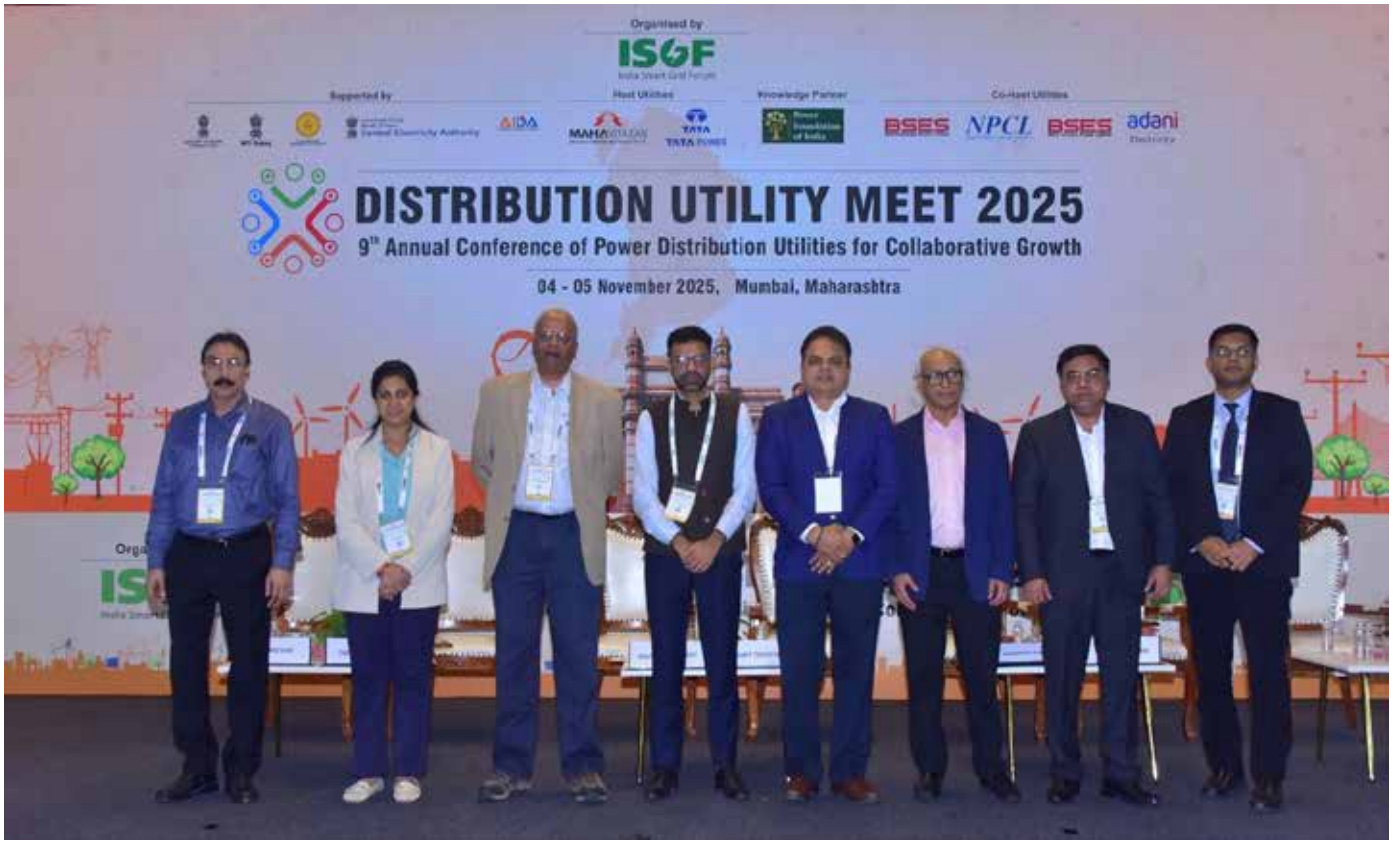
INTRODUCTION

The frequency and intensity of extreme weather events including cyclones, floods, heatwaves, landslides and heavy storms have increased significantly in recent years. It is posing severe threats to India's power distribution infrastructure. Climate change is accelerating the rate of such events, exposing vulnerabilities in grid equipment, overhead lines, substations, and associated assets. According to a study report by the Centre for Earth Sciences (CES), in 2024, out of 366 days, 322 days recorded extreme weather events in some or the other part of India that resulted in the death of 3472 people and hundreds of billions of dollars of damages to properties including power grids assets. Many existing standards and specifications for distribution network equipment were developed under historical climatic conditions of the 20th century that are not adequate to ensure power system resilience anymore.

For DISCOMs, the damages caused by extreme weather events leads to prolonged outages, high restoration costs, and severe impacts on customer trust. There is an urgent need to review, upgrade, and harmonize equipment standards to withstand new environmental realities. Advanced materials, robust engineering designs, and predictive asset management can help improve preparedness. Revising grid equipment specifications in line with future climatic challenges requires a revision of technical standards, and operational strategies, across DISCOMs.

PARTICIPANTS

Ravi Seethapathy, Chairman, Biosirus, Inc; and ISGF WG Chair; **Amit Tripathi**, Advisor – Power Sector, Coalition for Disaster Resilient Infrastructure (CDRI); **Gajanan S Kale**, CEO, Tata Power, Odisha; **Sujit Pathak**, General Manager, CESC, Kolkata; **Aneesh Thomas**, Associate Director - National Sales MV, Eaton Power Quality; **Aakash Saxena**, COO, CESC Rajasthan; **Deepti Sharma**, Addl Vice President, BRPL



1. Ravi Seethapathy, Chairman, Biosirus, Inc; and ISGF WG Chair; Session Chair and Moderator

- Set a strong ground reality: Climate has shifted so dramatically that equipment designed 20–30 years ago no longer works to present challenges
- Extreme weather is no longer a seasonal anomaly, it is the new operating environment for every DISCOM
- Key Threats Highlighted:
  - Heat Waves: Ambient temperature rises beyond 50°C → derating of transformers, cables, switchgear
  - Cyclones: Unprecedented wind speeds (200–280 km/h possible) → tower collapses and pole failures
  - Floods and Waterlogging: Switchgear inundation, LV pillar box failures, DT failures, cable deterioration
  - Landslides: Frequent in northern states → long outages due to terrain-induced collapses
  - Lightning: Steep rise in lightning intensity in rural/semi-urban belts
- Today's grid faces:
  - Higher ramp rates
  - Higher thermal stress
  - Lower predictability
  - Higher failure frequency
  - Utilities must define their own new-normal specifications otherwise they will be "offside" every year as climate
  - severity increases

2. Amit Tripathi, Advisor – Power Sector, Coalition for Disaster Resilient Infrastructure (CDRI)

- Introduced CDRI as a multi-country, multi-agency coalition (51 countries + MDBs like World Bank, ADB, UN agencies) launched by Prime Minister of India in 2019 to work on disaster-resilient infrastructure
- Shared global context:
  - Annual global infrastructure losses due to disasters ~USD 330 billion
  - Energy sector alone ~ one-third of that (~USD 120 billion)
  - Recent Examples: Cyclone Fani in Odisha (~USD 1.2 billion loss to power sector), Cyclone Melissa wiping out
  - Jamaica's grid
- Described ongoing work with Department of Economic Affairs (DEA), Ministry of Finance on:
  - Integrating disaster resilience into project planning at National Infrastructure Pipeline (NIP) stage
  - Developing a Resilience Cost–Benefit Analysis Tool for line ministries (power, roads, railways)
- Key findings from pilot analysis (with Power Grid on a transmission project):
  - Additional "resilience capex" required is typically 5–15% of project cost
  - This yields 7x–12x economic benefit over the asset life (avoided damage, reduced outages, lower repair costs)
- Main recommendations emerging:
  - Revise standard contracts to embed resilience clauses:
  - Force majeure, defect liability period, safety audits, climate thresholds, etc.
  - Go beyond codal minimum for priority assets:
- Existing wind zone maps and standards often underestimate actual wind speeds now being witnessed
  - Mandate hazard, risk and vulnerability assessments (HRVA) for priority projects and integrate into DPRs
  - Create India Infrastructure Resilience Fund:
- To finance resilience "delta" without overburdening state DISCOM balance sheets or tariffs
  - Explore risk transfer instruments:
- Sovereign risk pools, disaster insurance, and captive risk pools formed by utilities themselves.
- Demonstrated the Resilience CBA Tool output:
  - For an old POWERGRID project, every ₹1 spent on resilience yielded ~₹12 benefit over 25 years

3. Gajanan S Kale, CEO, Tata Power, Odisha

- Presented Odisha as India's "cyclone laboratory":
  - Historically hit by multiple cyclones every decade (Fani, Hudhud, Titli, Yaas, recent storm "Michaung/Metho" etc.)

- Shared how Tata Power Odisha is preparing to live with “cyclones as routine reality”:
- Technology and Monitoring
  - Developed an in-house weather dashboard:
- Radar coverage ~200–350 km radius
- Planned deployment of weather stations at strategic locations, feeding real-time data into a central server
  - Centralised Power System Command and Control Centre at Bhubaneswar:
- Monitors all 4 Odisha DISCOMs in real time
- SCADA coverage for ~60% of substations
- GIS integration for network + weather overlays
- Disaster Management Structure
  - Detailed, formal Disaster Management hierarchy:
- From CEO to circle/division level
- Dedicated Disaster Management Cell, Core Assessment Teams and Emergency Support Teams
- Conducts two large-scale mock drills every year to test readiness
- Cyclone Specific Planning
  - Odisha DISCOM areas categorised into four vulnerability zones:
- 0–20 km from coast (highest risk)
- 20–40 km
- 40–60 km
- 60 km (normal)
- For coastal zones:
  - Developed special cyclone-resilient poles (stronger design, custom-manufactured).
  - Progressive undergrounding of networks.
- Uses GIS + cyclone track mapping to:
  - Forecast which GRIDs, feeders, divisions and sections will be impacted
  - Pre-position restoration crews, materials, and mobile teams
  - Proactively inform customers in likely affected areas
- Alignment and Funding
  - Aligned with:
- UN Sendai Framework
- Odisha State Disaster Management Authority, and national disaster management frameworks
  - Highlighted funding constraints:
- RDSS support not available due to privatisation
- State government supporting resilience works; proposals also sent to MoP for cyclone-resilient network funding
- Tata Power cannot keep rebuilding the same weak network after every cyclone and must rebuild stronger and
- smarter.

4. Sujit Pathak, General Manager, CESC, Kolkata

- Presented Kolkata’s extreme climate challenges:
  - Heat waves: 1.5–2°C higher than past 20-year baseline
  - Monsoon cloudbursts:
    - Example: 251 mm in 24 hours in 2025 (highest in 4 decades, 6th highest in 137 years)
  - Cyclones with high winds
  - Coastal proximity → saline, corrosive air → accelerated corrosion.
- Impacts of Extreme Weather on the Grid:
  - Heat waves:
    - Transformers overheat, cables derate
    - More spurious trippings and accelerated insulation aging

- Urban flooding:
  - Water ingress into RMUs, pillar boxes, DTs, LV panels
  - Underground network particularly vulnerable; longer restoration
- Cyclones and high winds:
  - Large numbers of LT poles damaged
  - Widespread treefalls on overhead lines
  - Restoration often >72 hours in affected pockets
- Lightning:
  - Increased lightning damage to rural assets

Consequences Observed

- Maintenance costs up by 25–30% due to higher failure rates
- Asset aging accelerated by ~40% (based on internal studies)
- Customer dissatisfaction due to longer outages
- System losses increase because equipment operates far from optimum point

Gaps in Existing Standards

- Thermal limits based on outdated ambient assumptions
- Flood resilience (plinth height, IP level, drainage) not adequately addressed
- Corrosion protection in coastal and humid zones poorly covered
- Lightning protection standards for rural/semi-urban networks based on legacy designs
- Wind loading in standards does not reflect the present reality; recommends ≥180 km/h design for structures

Specific Recommendations to CEA/BIS

- Transformer standards:
  - Redefine insulation class and cooling for 45°C ambient (not 35/40).
- Underground cables:
  - Use water-blocking insulation layers
  - Minimum IP68 rating
  - Better drainage at road/rail crossings and duct transitions
- Switchgear (RMUs, panels):
  - Minimum IP65/IP66 + higher installation height
  - Corrosion-resistant enclosures
- Towers and poles:
  - Design for ≥180 km/h winds
  - Improved foundations for waterlogged/saturated soil
  - Anti-corrosion coatings
- Substation civil design:
  - Plinth height based on historic rainfall + climate projections, not just past averages

Utility and Regulator Responsibilities

- Utilities:
  - Systematic post-event performance analysis (what failed, where, under what conditions)
  - Vulnerability mapping of existing assets
  - Incorporate resilience criteria into procurement and vendor evaluations
  - Move towards climate-adaptive maintenance and proactive replacement
- Regulators:
  - Allow cost recovery for resilience investments
  - Mandate climate risk reporting and mitigation plans
  - Define performance standards under extreme weather conditions
- Shared initiatives:
  - Infrastructure Resilience Fund, with Resilience Cost–Benefit Analysis (RCBA) as eligibility gate

- CESC initiatives:
  - IoT water-level sensors + automated LT CFS (combined fuse switch) at DTs
  - Ongoing resilience study with IIT Kharagpur post-Cyclone Amphan

5. Aneesh Thomas, Associate Director - National Sales MV, Eaton Power Quality

- Spoke from the manufacturer's perspective on extreme weather events and equipment design
- Key Observations:
  - Indian grid has grown from fragmented islands (1960s) to a large synchronized system, but climate risks have grown faster
  - In 2024, India had extreme weather on ~93% of days in first 9 months and total 200+ days with extreme temperatures - >50°C in some regions
  - World Bank estimates USD 25 billion per year climate-related disruptions for South Asia's power sector by 2030
- Implications for standards and design
  - BIS and CEA standards have historically focused on reliability, now must embed climate resilience:
    - Revise CEA (Safety and Electric Supply) Regulations 2023 periodically (e.g., every 5 years) to keep up
    - with climate data
- Proposed changes:
  - Update wind loading and cyclone design using latest IMD 30-year wind data
  - Incorporate high-temperature conductors, advanced insulation and derating rules for >50°C ambient
  - Mandate flood-proof enclosures (higher IP ratings), especially GIS/RMUs in flood-prone areas
  - Promote undergrounding in coastal zones, with proper corrosion protection
  - Require anti-corrosive coatings and composite materials in saline environments
- Global examples:
  - Japan: Typhoon-grade poles and stricter design for seismic + wind risk
  - Australia: Revised transformer specs post bushfires
  - US: National Electrical Safety Code now includes robust grid hardening rules

6. Deepti Sharma, Addl Vice President, BRPL

- Added the Delhi metro perspective, which faces all extremes in one city:
  - 50°C heat, intense dust
  - Heavy monsoon waterlogging in several areas
  - Near-zero winter temperatures with dense fog
  - Episodes of severe air pollution
- Impact on equipment:
  - Transformers and cables face peak stress in summers (high load + high ambient)
  - In monsoons, moisture ingress leads to cable and RMU failures
  - Overhead lines suffer dangerous sag under high temperature and loading, requiring enforced load limitation on
  - some corridors
  - Dust and pollution lead to flashovers on insulators
- Actions and approach
  - Moving from reactive restoration to predictive resilience:
    - Drone surveys to detect weak spans, tilted poles, vegetation threats
    - Adoption of digital twins, DMS, and fault passage indicators (FPI) to reduce fault-location time and restoration time
  - Equipment changes:
    - Gradual shift from conventional transformer oil to ester oil (higher fire point and thermal withstand)
    - More underground cabling, though recognizing its own challenges (flooding, joint failures)
- Proposed stronger collaboration with manufacturers, BIS and CEA:
  - To co-develop equipment with better coatings, enclosure designs, and insulation suitable for Delhi's multi-extre-

- Proposed stronger collaboration with manufacturers, BIS and CEA:
  - To co-develop equipment with better coatings, enclosure designs, and insulation suitable for Delhi's multi-extreme climate
- Key message:
  - Weather will continue to worsen due to climate change; consumers will still expect high reliability and short outages Thus, technology, predictive tools and updated standards must move together

SESSION 8 KEY TAKEAWAYS

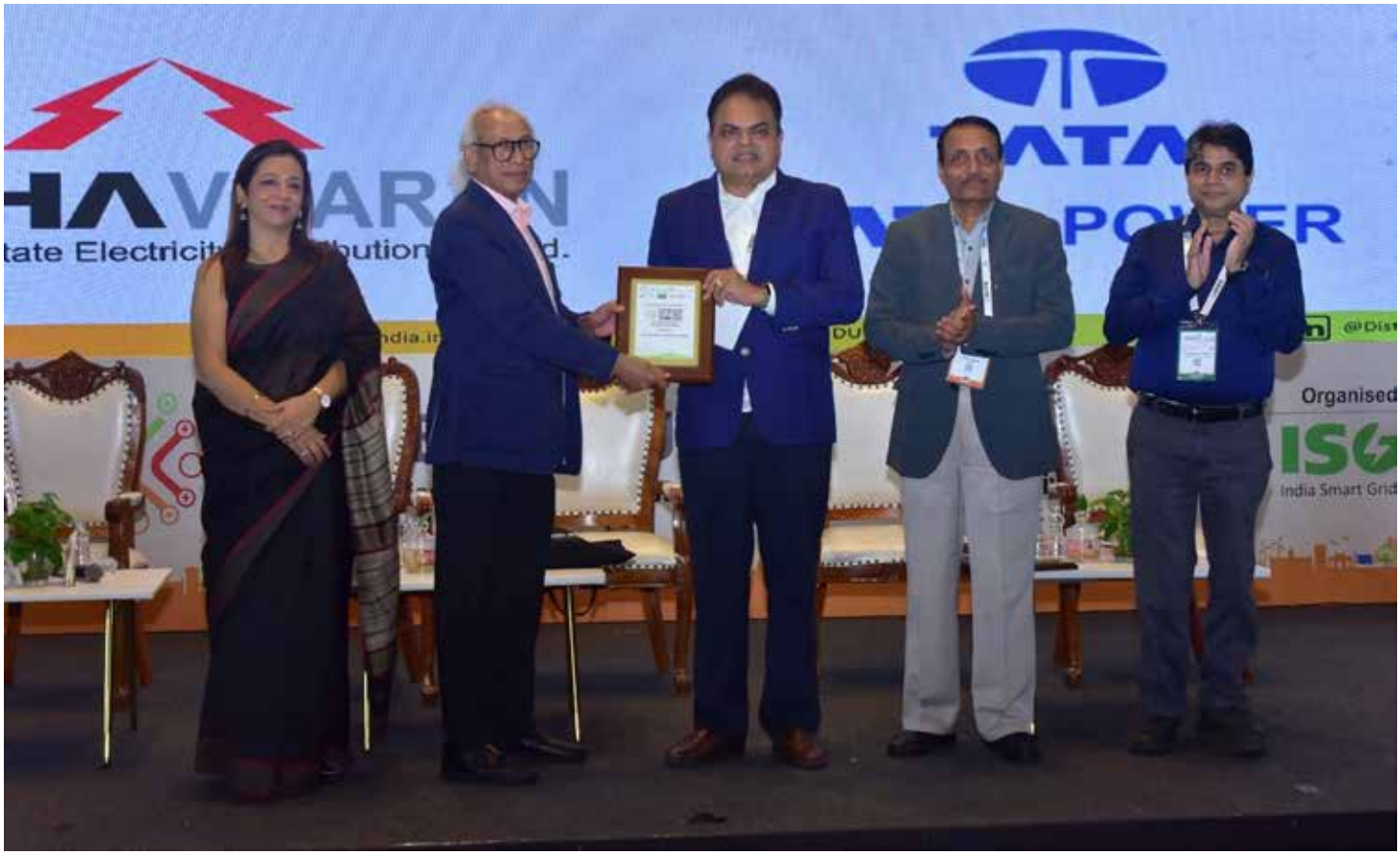
- Extreme weather (heat waves, cyclones, floods, lightning) is now a structural feature, not a one-off risk
- Existing BIS/CEA equipment standards are inadequate for the new climate reality—urgent revisions needed for:
  - Ambient temperature, wind loading, flood resilience, corrosion protection, lightning levels
- Resilience is affordable: 5–25% higher capex today can yield 7–12x benefits over the life cycle through fewer failures and outages
- Utilities must map vulnerability and criticality, and prioritise investments, rather than trying to harden everything
- Disaster-heavy states like Odisha and West Bengal are already demonstrating:
  - Advanced weather–GIS–SCADA integration
  - Formal disaster structures
  - Cyclone-resilient designs and SOP-driven restoration
- Metro utilities (Delhi, Kolkata, Mumbai) need highly specialised designs for:
  - Multi-extreme conditions
  - Space constraints
  - Underground flooding and corrosion
- Planning criteria must be revisited so recurring events like tower collapse in cyclones are treated as credible contingencies
- Manufacturers, DISCOMs, planners, regulators, BIS and CEA must jointly create climate-zone-specific standards and certified resilient designs
- A dedicated Infrastructure Resilience Fund, backed by Resilience Cost–Benefit Analysis, is essential so that financially stressed DISCOMs and franchisees can still invest in resilience
- The grid must shift from reactive repair to predictive, data-driven resilience, using:
  - IoT sensors
  - AI analytics
  - Digital twins
  - And climate risk modelling as standard practices

Video Link:

https://www.youtube.com/watch?v=JTJoVwAWvcY&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=9

VALEDICTORY SESSION

- During the Valedictory Session all key stakeholders were facilitated and recognized their valuable support for making DUM 2025 a very successful event
- The key takeaways listed above were summarized in the valedictory session



Video Link:

https://www.youtube.com/watch?v=LRI4Tz1e7VI&list=PLgSiPGd4Nrcj70ts6LIkU02aratmxVkxq&index=11

TECHNICAL TOURS

03 NOVEMBER 2025

Underground Submersible Substation at Tata Power, Mumbai

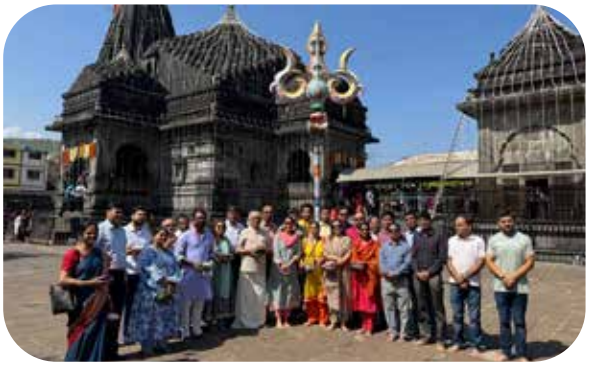
Cyber Physical Lab at VJTI

Distribution Command Centre at MSEDCL

06 NOVEMBER 2025

Distributed Solar Plants and Solar Irrigation Pumps in Nashik

Trambakeshwar Jyotirling Mandir in Nashik



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