National Conference on
'Role of Artificial Intelligence in Power and Water Resource Sectors'

24-25 April 2025, New Delhi

(L-R) Shri A.K. Srivastava, Advisor (Energy), CBIP; Shri Sanjeev Singh, Director (Energy), CBIP; Shri Niraj Kumar Singh, GM, NHPC Ltd.; Shri Balaji Venketeshwar, Eminent Expert, Cyber Defence, Researcher & Chief Mentor, Cyber Vidyapeeth Foundation; Shri Gaurav Kumar, IAS, Executive Director, Chennai Metropolitan Water Supply and Sewerage Board; Shri A. Balan, Member (Planning), CEA, GoI; Shri A.K. Dinkar, Secretary, CBIP and Shri K.K. Singh, Director (Water Resources) CBIP

Brief Report

A two-day National Conference on the "Role of Artificial Intelligence (AI) in the Power and Water Resources Sectors" was held on 24-25 April 2025 at the CBIP Conference Hall, New Delhi. Organized by CBIP and CIGRE India, under the aegis of CIGRE NSC D2 on Information Systems, Telecommunications, and Cyber Security, the event aimed to explore the transformative role of AI in critical infrastructure sectors. The event was supported by Central Electricity Authority. M/s. Pump Academy Private Limited – iPUMPNET was the sponsor this National Conference.

The conference was part of CBIP's ongoing commitment to knowledge dissemination and capacity building. It aimed to foster meaningful discussions, promote collaboration, and generate actionable insights for the effective adoption and integration of AI in the power and water resources sectors.

DAY 1 – 24TH APRIL 2025: INAUGURAL SESSION

The conference began with the Inaugural Session. The following distinguished speakers graced the dais:

1. Shri A. Balan, Member (Planning), CEA, GoI
2. Shri Gaurav Kumar, IAS, Executive Director, Chennai Metropolitan Water Supply and Sewerage Board
3. Shri Balaji Venketeshwar, Eminent Expert, Cyber Defence, Researcher & Chief Mentor, Cyber Vidyapeeth Foundation,
4. Shri A.K. Dinkar, Secretary, Central Board of Irrigation and Power

Auspicious Start: Lighting of the Traditional Lamp

5. Shri K.K. Singh, Director – Water Resources, Central Board of Irrigation and Power

6. Shri Niraj Kumar Singh, General Manager, NHPC Ltd.

In his welcome address, Shri A.K. Dinkar, Secretary CBIP, emphasized the critical importance of Artificial Intelligence in shaping the future of both the power and water resources sectors. "Artificial Intelligence is no longer a futuristic concept but a transformative force, already impacting operations. In the power sector, AI contributes to better grid management, demand forecasting, predictive maintenance, and energy efficiency. Similarly, in water management, AI facilitates enhanced forecasting, optimized distribution, water conservation, and early warning systems. These applications are crucial in addressing the significant challenges faced by these sectors."

Representing NHPC, one of India's leading Central Public Sector Undertakings (CPSUs) in renewable energy, Shri Niraj Kumar Singh, General Manager, outlined the growing relevance of AI in the organization's diversified operation and the transformative potential in the power and water sectors—two critical components of national infrastructure. These include hydropower, solar, wind, floating solar, and green hydrogen—sectors that are vital for India's energy transition.

He emphasized the country's ambitious target of achieving 500 GW of non-fossil fuel capacity by 2030, noting that AI is a crucial tool to navigate the challenges posed by climate variability, particularly in water resource management. He highlighted AI's far-reaching contributions to the power sector, touching on several key innovations such as AI-driven predictive maintenance for smarter operation and maintenance; enhanced renewable energy forecasting for better grid integration; and real-time optimization of smart grids to support load balancing and fault detection. He discussed the accelerating role of AI in green hydrogen, especially in optimizing electrolyzer performance and managing supply intermittency.

In the hydropower space, he detailed various AI applications such as predictive maintenance using SCADA and sensor data, inflow forecasting by integrating satellite and meteorological data, and turbine optimization via reinforcement learning and digital twins. He also introduced AI-based sediment monitoring using drone and image recognition technologies and demonstrated how these advancements are improving grid integration and operational efficiency, citing global leaders like GE, Siemens, and ABB, alongside Indian innovators such as Tata Power-DDL, NTPC, and ReNew Power.

AI's pivotal role in water resources management, including its use in reservoir operation, smart water distribution, and climate resilience–particularly through flood and drought simulations to aid in disaster preparedness was also explored, wherein Shri Niraj Kumar Singh stressed the need for India to leverage AI in its hydropower sector to

Welcome Address by Shri A.K. Dinkar, Secretary, CBIP

Shri A. Balan, Member (Planning), CEA, GoI, addressing the participants during inaugural session

Shri Gaurav Kumar, IAS, ED, Chennai Metropolitan Water Supply and Sewerage Board, addressing the participants during inaugural session

address regional challenges, especially in the Himalayan region. He called for the deployment of digital twins in older plants; establishment of AI labs for localized problem-solving; and the creation of Early Warning Systems by integrating data from the Central Water Commission (CWC) and the Indian Meteorological Department (IMD).

While highlighting the immense potential of AI, he also acknowledged the hurdles ahead, including legacy infrastructure, cybersecurity concerns, regulatory challenges, and the need for skill development in AI technologies. He urged industry stakeholders to invest in India-specific AI R&D, promote pilot projects, foster data sharing across sectors, and equip engineers and decision-makers to effectively deploy AI solutions.

He described AI as an imperative, and not a luxury. He reinforced its role in realizing the vision of "Viksit Bharat @2047," aiming for a smarter, more resilient hydropower and water management system that will drive India toward its net-zero goals. He ended with a call for collective action: to innovate, collaborate, and work together to build a sustainable and intelligent future for India's power and water sectors.

Guest of Honour Shri Gaurav Kumar, IAS, Executive Director, Chennai Metropolitan Water Supply and Sewerage Board, shared valuable insights into the department's ongoing initiatives in smart water management and urban governance, further enriching the discussion on the integration of technology in India's water infrastructure.

Shri Balaji Venketeshwar, Cyber Defense, Researcher & Chief Mentor, Cyber Vidyapeeth Foundation, highlighted AI's growing role in predictive modeling, threat detection, and system resilience across critical infrastructure sectors. He urged caution in integrating AI into operational systems and stressed that while AI is a powerful tool, there is a need to safeguard data and ensure it is not shared too prematurely, as AI systems are still learning and could misuse data in the future.

He emphasized the importance of developing indigenous AI solutions, encouraging partnerships with institutions such as IIT Bombay, which is already training models that consider income, religion, and regional variations. According to him, India has the potential to lead globally in AI applications, particularly in smart housing and AI-powered profiling tools, which could eventually surpass commercial solutions like Gemini.

Addressing the growing reliance on AI in the power sector, Balaji highlighted a critical issue—the shortage of engineering talent in AI security. With the rise of AI adoption, he noted that the associated security risks are often underestimated. He stressed that AI systems, particularly those accessed through APIs, are increasingly becoming targets for cyberattacks, with vulnerabilities like token manipulation and data poisoning being exploited by

Shri Balaji Venketeshwar, addressing the participants during inaugural session

Shri Niraj Kumar Singh, GM, NHPC Ltd., addressing the participants during inaugural session

Shri K.K. Singh, Director (Water Resources), CBIP, proposing vote of thanks

Shri Krishnanand Menon, Head of Sales at iPUMPNET

Shri Vivek Tiwari, Founder & CEO, Audixi India, Mumbai

attackers. He advised users to always cross-verify AI outputs with other models, citing the example of SCADA systems in the power sector, where attackers could manipulate operational data extracted through AI-driven insights.

Balaji also introduced the concept of the "Kill Chain," emphasizing that attackers often operate gradually, studying systems to find subtle entry points. He urged stakeholders to familiarize themselves with the MITRE ATT&CK framework, a resource that maps out over 250 cyberattack techniques and provides effective mitigation steps. A key concern was model poisoning, where attackers subtly alter training data or introduce bugs that AI systems fail to detect. He cited a real-world example of a blast furnace explosion triggered by poisoned AI training data, underscoring the devastating potential consequences of security vulnerabilities in AI.

Dr. Dharmesh Kumar Singh, DGM (Electrical) & Alternate CISO at NHPC Ltd.,

Another critical point discussed was the AI supply chain. He warned that if AI models are built using compromised third-party code, organizations inherit those vulnerabilities, especially in sectors like power, where predictive maintenance and operational analytics rely heavily on AI models trained on sensitive data. He also mentioned model inversion techniques, where attackers can reverse-engineer private data from trained AI models, leading to potential data breaches. He cautioned organizations about unknowingly agreeing to broad data-sharing clauses when using AI platforms, which could result in the exposure or sale of sensitive data.

He provided practical cybersecurity recommendations for organizations, including using multi-factor authentication (MFA), testing all code layers, conducting open-source audits, and ensuring AI models are hosted on secure servers. His message was clear: organizations must test AI codes thoroughly and not use AI models blindly. By understanding the underlying code and questioning the results, companies can mitigate risks and build more resilient systems.

The session served as a wake-up call: the future of AI must be anchored in security, transparency, and accountability to protect national infrastructure and ensure its safe integration into critical sectors.

Shri Balan, Member-Planning, Central Electricity Authority, spoke of the early days when IT infrastructure was at its nascent stage in India and the remarkable progress made since then, especially in the integration of AI into the power sector. He emphasized that the shift towards smart grids in India's power infrastructure was a result of IT innovations.

He also addressed the challenges faced during the early adoption of AI in the sector, such as overcoming resistance to change and building the necessary technical skillsets to deploy these technologies.

As he detailed the application of AI in power management, he underscored its potential to enhance efficiency, reduce operational costs, and predict outages. He cited examples where predictive models were used to prevent power grid failures and optimize maintenance schedules. He also discussed AI's role in energy forecasting and its importance in integrating renewable energy sources into the grid.

At the end of inaugural session Shri K.K. Singh, Director, CBIP, offering the Vote of Thanks, said, "It is both an honor and a privilege to thank all dignitaries for sharing their insights, our speakers and authors for their diligent contributions, and every stakeholder for their support. We look forward to translating today's discussions into actionable strategies for AI-powered, sustainable power and water infrastructure."

TECHNICAL PRESENTATIONS

The two days Conference covered a diverse set of topics, from importance of Artificial Intelligence in Power and Water Resource Sectors in, all aimed at strengthening the nation's power systems & water resources sectors.

DAY 1: 24th APRIL 2025

Shri Krishnanand Menon, Head of Sales at iPUMPNET, in his presentation on digital transformation of pumping infrastructure discussed on how emerging technologies—particularly IoT, cloud analytics, and AI—are reshaping the management of water supply systems by municipalities and utilities.

He outlined a framework that begins with advanced sensors and a Data Handling Controller (DHC) installed adjacent to each pump, enabling continuous operational data acquisition. To ensure seamless and secure transfer, a dual-mode communication protocol—combining traditional and high-reliability channels—is employed. Once in the cloud, the data is processed and analyzed to produce dynamic dashboards accessible on both mobile devices and desktops, giving stakeholders, from field operators to executives, real-time operational intelligence.

He stressed the shift from legacy "systems of record" to modern "systems of intelligence," which enables proactive, predictive maintenance. He illustrated this with a Chennai case in which leakages were detected and correlated with reservoir and output levels, as well as leak detection over a 30 km pipeline using cause-and-effect modeling. The turnkey platform tracks and analyzes over 189 parameters (including vibration, bearing temperature, flow efficiency, and energy consumption), integrates with existing SCADA via APIs or can operate standalone, and extends to treatment plants and clarifiers. Live dashboards showcased flow-vs-design comparisons, vibration/temperature heatmaps, and real-time alerts.

He urged utilities and contractors to embrace digital transformation not as a trend, but as an operational imperative for clean, stable, and efficient water distribution.

Shri Vivek Tiwari, Founder & CEO, Audixi India, Mumbai, delivered a presentation on "Artificial Intelligence in Cyber-security for Power & Water Resources Sector". He emphasized the growing importance of AI-driven cyber-security tools in protecting critical infrastructure from evolving cyber threats. The talk highlighted real-time threat detection, automated incident response, and anomaly detection as key areas where AI is enhancing security frameworks. He also underscored the role of predictive analytics in preempting attacks and safeguarding data integrity.

Group Photograph

Dr. Dharmesh Kumar Singh, DGM (Electrical) & Alternate CISO at NHPC Ltd., examined how AI, cybersecurity, and renewables converge to reshape India's 422 GW power sector (including 102 GW solar). He stressed the need to innovate across solar, wind, hydro, nuclear, and green hydrogen to meet rising demand with resilience.

Showcasing AI tools for precise load and renewable forecasting, real-time fault detection, distributed energy-flow optimization, and predictive maintenance via digital twins and smart sensors, he highlighted case studies that boosted asset utilization and control-room decision-making.

Pointing out that decades-old transmission networks incur up to 25% technical losses, he informed that AI analytics can identify bottlenecks and enhance grid performance. He warned that interconnected OT systems demand layered defenses—intrusion detection, encryption, role-based access—aligned with IEC 62443 standards, and that ongoing operator training is vital given that 80% of breaches stem from human error.

To manage renewable intermittency, he recommended AI-assisted frequency control and real-time analytics. He noted hydroelectric advances such as upgraded turbines, vibration-resistant stators, and improved insulation, and urged deployment of digital twins, synchronized phasors, and AI-enabled control centers to drive real-time awareness and India's decarbonized energy future.

DAY 2 - 25th APRIL 2025

The second day of the National Conference on 'Role of Artificial Intelligence in Power and Water Resource Sectors' witnessed another round of insightful and thought-provoking sessions led by distinguished experts and professionals from the energy, water, and technology sectors. The sessions underscored the growing impact of AI across domains, offering practical case studies, emerging trends, and strategic approaches.

Key presentations included:

- **Dr. Hemlata Vyas, Group Head (Contracts & Procurement), Services & IT, GMR Group**, delivered a presentation on "Artificial Intelligence in Project Management – Types, Risks and Future Trends", highlighting how AI tools are transforming risk assessment, scheduling, and resource allocation in large-scale infrastructure projects.

- **Shri Santosh Kumar Jain, DGM, GRID-INDIA (formerly POSOCO)**, spoke on "Use of AI in Power Sector", detailing applications of AI in grid stability, predictive maintenance, and demand forecasting, enabling a more resilient and efficient power system.

- **Shri Vijay Barthwal from Chlorofyl Eco Ventures Pvt. Ltd.** presented on "Applications of Digital Twin-Based Solution for Transmission Line", demonstrating the use of virtual replicas for monitoring and optimizing the performance of power transmission infrastructure in real-time.

- **Dr. M. Selva Balan, Scientist E & Joint Director, CWPRS**, presented an insightful talk on "Role of AI/ML with Special Emphasis on DNN Architecture in Integrated Reservoir Operation", incorporating a case study on satellite-derived bathymetry to showcase the potential of deep learning in optimizing water resource management.

- **Shri Jayant Sinha, Senior Principal Consultant (Energy & Utilities), EnTruist Power**, delivered a joint presentation titled "Artificial Intelligence & Machine Learning: Revolutionizing Utilities in the Modern Era", focusing on how AI-driven solutions are reshaping customer engagement, operational efficiency, and sustainability practices in utility services.

- **Shri Hillol Biswas, Advisor, WAPCOS Ltd.** spoke on "Operational Data Analytics of a Wind Farm", illustrating the use of AI for performance benchmarking, fault detection, and energy yield optimization in renewable energy projects.

The day concluded with an interactive Q&A session and a summary by the conference chair, emphasizing the need for cross-sector collaboration and continuous innovation to harness AI's full potential in both the power and water resource sectors.

The event concluded with a call to action for policymakers, industry leaders, and technology innovators to collaborate and ensure that AI is leveraged safely and effectively in India's critical infrastructure sectors.