

AI-Powered Distributed Renewable Energy (DRE) - Building India's Citizen-Centric Energy Future

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AI-Powered Distributed Renewable Energy (DRE) Latest News

- At the **India AI Impact Summit** held at Bharat Mandapam, senior policymakers and global experts deliberated on the theme 'Global Mission on AI for Energy Scaling through citizen-centric India Energy Stack'.
- Reflecting the global interest in India's AI-energy convergence model, the Indian government highlighted how Artificial Intelligence (AI) can become a game changer for India's rapidly expanding Distributed Renewable Energy (DRE) sector.

Understanding Distributed Renewable Energy (DRE)

- DRE refers to small-scale, decentralised renewable power systems (few kW to MW scale) located near the **point of consumption** — such as rooftop solar systems, small wind turbines, biomass-based units, and solar pumps.

- Unlike conventional centralised grids, DRE promotes energy **decentralisation**, local generation, and consumer participation.

India's Renewable Energy Landscape

- **Key data points:**
 - 52% (about 272 GW) of India's total installed power capacity is now from non-fossil fuel sources.
 - Solar capacity: ~140 GW.
 - DRE: 38 GW. Nearly 18 GW was added in the DRE segment in the last 15 months.
- **Public expenditure:** Approximately \$9 billion on rooftop solarisation, and \$4 billion on PM-KUSUM.
- **Major schemes driving DRE expansion:** Pradhan Mantri Surya Ghar Muft Bijli Yojana, and Pradhan Mantri KUSUM Yojana.
- **Enabling factors:** This rapid scale-up was enabled through technology integration benefiting consumers, vendors, banks, field workers, and DISCOMs.

Why AI is Crucial for the Next Phase of Energy Transition

- **Structural challenges in the grid:**
 - Transformers designed for unidirectional power flow. Emergence of 'prosumers' (consumers who also generate electricity). Increased stress on distribution networks.
 - Need for demand response management and predictive maintenance.
- **AI applications in DRE:**
 - AI can enable –
 - Weather forecasting and predictive analytics for solar generation.
 - Asset performance monitoring across geographies.
 - Peer benchmarking for rooftop systems.
 - B2B electricity trading enablement.
 - Predictive load management.
 - Grid stability management.
 - **Government's emphasis:** AI will move the system from reactive governance to predictive governance — enabling India to “act, not react”.

AI as Development Infrastructure

- AI should be viewed as core development infrastructure, similar to power grids, DISCOMs, and smart meters.
- This aligns with India's digital public infrastructure (**DPI**) approach — suggesting the creation of an India Energy Stack, analogous to India Stack in fintech.
- **Strategic vision:**
 - Scale AI deployment — not treat it as pilot projects.
 - Position India as the “Google of AI for Energy” globally.
 - Build interoperable digital architecture for energy markets.

Governance and Regulation

- **Concerns:**
 - Energy transition increases system complexity.
 - AI innovation does not automatically equal progress.
 - Poor digital regulation (e.g., social media concentration) led to Big Tech dominance.
- **Key governance principles:**
 - Open standards (like TCP/IP model).
 - Open-source AI systems.
 - Prevent monopolisation by global AI giants.
 - Promote local solutions tailored to farms, grids, and decentralised energy systems.
- This raises critical questions about data sovereignty, digital regulation, energy security, and technological self-reliance (Atmanirbhar Bharat).

Defining Success - What Will AI-RE Convergence Achieve in the Next 2-3 Years?

- Reduction in overall cost of power to consumers.
- Increased industrial competitiveness.
- Transition from consumer empowerment to prosumer empowerment.
- Grid readiness for high renewable penetration.
- Improved energy access and reliability.

Key Challenges and Way Forward

- **Legacy grid infrastructure constraints:** Build an India Energy Stack – interoperable digital layers for generation, distribution, trading.
- **DISCOM financial stress:** Promote open-source AI ecosystem – encourage startups, enable local innovation, avoid concentration risks.
- **Data governance, cybersecurity risks and risk of AI monopolisation:** Strengthen regulatory frameworks – open standards, anti-monopoly safeguards, data privacy protections.
- **AI-energy integration:**
 - Invest in AI-driven grid modernisation – smart transformers, real-time load balancing, AI-based forecasting.
 - Integrate AI with climate goals – support India's Net Zero 2070 target, align with Nationally Determined Contributions (NDCs).

Conclusion

- India stands at the **intersection** of energy transition and digital transformation.
- With over half its installed capacity already non-fossil, and rapid growth in distributed renewable energy, the next phase will depend not just on adding capacity but on **intelligently managing** complexity.
- The **convergence** of AI and DRE may well determine whether India becomes a passive technology adopter — or a global leader shaping the future of sustainable, citizen-centric energy systems.

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