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Smart meter as the foundation for Smart Grid and Digitized Power sector

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Indian Power sector has been conventionally recognized as a monopolistic, highly regulated & capex-intensive business with geographically widespread asset base. Historically, the sector's business model, especially that of the distribution space, has remained majorly unchanged for years now. With the advent of digitization slowly penetrating its way into the power landscape, the sector is observing a once-in-a-decade shift across every aspect of its business processes, from network/ asset planning to O&M to consumer services.

The power distribution sector in India stands out as the weakest link in the power value chain, posing a significant challenge to the success of ongoing energy transition efforts. The sector's ability to achieve financial and operational efficiency improvements will be crucial for realizing these transitions. While technology has been instrumental in transforming various segments of the power industry, the distribution sector has lagged in leveraging technology for transformative purposes. However, with the implementation of policies and regulations aimed at enhancing systemic efficiency, coupled with financial commitments from the central government, there is now a widespread recognition within the sector that modernizing the power distribution system is essential.

Smart metering – a critical digital initiative that is shaping the future of the power distribution landscape, will play as a catalyst for pacing up the digital transformation

journey across the power value chain. Distribution utilities traditionally considered the consumer as the 'meter' itself and had little incentive to understand the individual or business behind it. However, Smart metering opens an ambit of opportunities as well as service offerings for the utilities to tap into the Behind-the-meter segment and also has the potential to disrupt the traditional business model, thereby paving the way for innovative revenue streams for the utilities as well as provide an avenue for consumers to play a greater role in shaping sectoral trends.

To leverage this untapped potential that comes along with Smart metering, Government of India through Ministry of Power has launched the Revamped Distribution Sector Scheme (RDSS), a results-oriented outcome-based initiative. It is noteworthy that nearly 50% of the investments planned under RDSS, i.e., approx. INR 1.5 Lakh Crs, is earmarked towards driving large-scale adoption of consumer smart metering across the Indian electricity landscape over next 3-5 years. As on date, ~10.84 million smart meters have been installed across states like Bihar, Uttar Pradesh, Haryana, Delhi, Rajasthan, Assam etc.

Further, Power sector's long-term path is being overhauled by 3 key trends/disruptions:

- I. Decarbonization** – Greater penetration of Distributed energy sources in the power ecosystem to align with the India's net-zero vision.

II. Decentralization - Greater adoption of self-sustainable energy systems like battery storage, off-grids, solar rooftops etc. to meet the growing energy demand in a sustainable manner, and,

III. Digitization - Shifting focus towards real-time data-driven insights by interconnecting network assets / nodes through smart grid technologies.

To navigate through this disruption and achieve the Nation's net-zero vision, it is imperative for utilities to pace up the implementation of smart metering, which indeed serves as a linchpin in the sector's energy transition and digitization pathway. Additionally, Smart metering opens a bouquet of use cases for utilities, which would in turn help in establishing the foundation for sector's transformational journey towards building robust smart grid network and ultimately digitizing the entire power value chain. Some critical and priority use cases of smart metering are:

» **Granular Data Collection:** Smart meters provide detailed, real-time data on energy consumption at the individual consumer level across various time-blocks. This data granularity is crucial for utilities to understand usage patterns, identify inefficiencies, and optimize energy supply across the grid.

» **Two-way communication:** Unlike traditional meters, smart meters enable two-way communication between consumers and utilities. This facilitates real-time monitoring of outage detection, electricity thefts, and enables more efficient resource allocation.

» **Enhanced Billing and Customer Services:** Smart meters enable accurate and automated meter readings, eliminating the need for manual readings and estimated bills. This leads to improved billing accuracy and customer satisfaction. Additionally,

smart meters provide consumers with access to detailed energy usage data, empowering them to manage their consumption more effectively. Further, with the focus of the government on installation of smart meters in prepaid mode, this would help ease the working capital burden on utilities and help eradicate the concept of electricity dues in the long run.

» **Remote Monitoring and Management:** Smart meters enable utilities to remotely monitor energy usage and manage the grid more efficiently. They can detect outages, meter tampering, or irregularities in consumption patterns, allowing for faster response times and improved service reliability.

» **Demand Response Programs:** With smart meters, utilities can implement demand response programs that incentivize consumers to reduce or shift their electricity usage during peak demand periods. By providing real-time pricing information, smart meters empower consumers to make more informed decisions about their energy usage.

» **Integration of Distributed Energy Resources and Net Metering:** Smart meters facilitate the integration of DERs into the grid. They enable utilities to monitor and manage distributed energy resources effectively, ensuring grid stability and reliability as the share of intermittent energy sources grows in the overall generation mix. Further, the success of implementation strategies such as gross metering, net metering, and net billing heavily relies on widespread adoption of smart meters and robust supportive infrastructure systems. Also, smart meters shall play a crucial role in facilitating the integration of solar power by enabling monitoring of generation, balancing consumption, and

grid integration, particularly in initiatives like the Pradhan Mantri Surya Ghar Muft Bijli Yojana which aims to install 1 Cr rooftop solar in India.

» **Grid Optimization and Resilience:** By providing real-time data on energy flows and consumption patterns, smart meters help utilities optimize grid operations and improve overall system resilience. They enable better load balancing, voltage regulation, and fault detection, leading to a more reliable and efficient grid.

» **Drive adoption of Electric Vehicles (EVs):** Smart meters play a crucial role in supporting the integration of electric vehicles into the grid. They enable utilities to manage EV charging loads, implement time-of-use pricing for charging, and coordinate charging schedules with renewable energy generation, promoting sustainability and grid stability.

Challenges and Future Prospects

While smart meters offer numerous benefits/ use cases, there are also challenges to overcome, such as data privacy and security concerns, the high cost of infrastructure

upgrades, interoperability and the need for standardization across the industry. However, with ongoing technological advancements and increasing demand for sustainable energy solutions, the adoption of smart meters is growing continuously.

India's imperative for smart metering and digitalizing its grid network extends beyond mere operational efficiency. As a responsible nation, India is actively pursuing measures to diminish its carbon footprint and foster sustainable development in the fight against global climate change. With commitments to achieve net-zero emissions by 2070 and 50% of energy from renewable sources, the grid must attain demand-side flexibility. Effective demand-side management of the grid, facilitated by granular data collection and the establishment of digital infrastructure components, stands as the sole means to address these challenges, and fulfill decarbonization objectives.

In the future, smart meters will play an even more integral role in shaping the power sector. As more homes and businesses adopt smart meters, the vision of a fully digitalized and resilient power sector becomes increasingly achievable. By serving as the foundation for smart grids and digitalized energy management, smart meters are key to a more sustainable and efficient energy future.

