Narrowband IoT, Connectivity Choices Pivotal for India's Smart Grid Mission

Nikhil Batra
Senior Research Director,
IDC Asia/Pacific

Swathi Arunaa
Senior Research Analyst, Telecom and IoT Practice,
IDC Asia/Pacific

India's utilities sector is undergoing a revolution. But the country's utilities companies face hurdles such as operational inefficiency and inadequate metering infrastructure. The solution lies in digitalization, for which dependable connectivity is critical.

KEY STATS

India's utilities sector is projected to increase its annual technology spend to INR 32,500 crore (US$3.9 billion) by 2027 (CAGR of 17.7% for 2022–27), underscoring the nation's commitment to digital transformation. (Source: IDC's Worldwide Digital Technology Spending Guide, 2024)

WHAT'S IMPORTANT

India's Smart Meter National Programme aims to replace 25 crore (250 million) conventional electricity meters with advanced metering infrastructure to improve financial and operational efficiencies of DISCOMs and reduce aggregate technical and commercial losses to 12–15% by 2025.[1] The choice of connectivity will be crucial to its success.

KEY TAKEAWAYS

- **Advanced metering infrastructure service providers (AMI SPs) and smart meters play an integral role for efficient management of energy, reducing energy costs, and helping to automate operations.**
- **Narrowband IoT is particularly well-suited for India, especially in the context of the National Smart Grid Mission, due to the country's diverse geographic spread and need for cost-effective, wide-coverage connectivity solutions.**

Introduction

India's electricity industry is undergoing significant changes as the government works to meet its ambitious renewable energy goals: to grow non-fossil energy capacity to 500GW by 2030, fulfill 50% of energy needs with renewables, and achieve net-zero emissions by 2070.[2] The increased use of distributed energy resources (DERs) and integration of real-time data for better demand forecasting is pushing power sector reforms. These changes include the privatization of distribution businesses and the formation of distribution system operators (DSOs) to improve system performance and reliability. However, the revolution in India's energy industry demands the digitalization of this traditional utility sector.

Urgent Need for Digitalization of Indian Utilities Companies

India's energy sector is at a pivotal juncture, necessitating a rapid shift toward digitalization:

- **Inefficiencies in billing and collection.** Efforts to enhance billing and collection efficiency have yielded positive outcomes, with India's overall aggregate technical and commercial (AT&C) losses reduced to 15.4% in FY2023, according to the Ministry of Power, India.[1] However, these losses remain disproportionately high compared to IDC's global average benchmark estimate of 8–9% (Source: IDC's Worldwide Digital Technology Spending Guide, 2024). Addressing the remaining gap in billing and collection processes is crucial to further optimize operational efficiency and minimize revenue leakage.
- **Power purchase agreements (PPAs) dominance impedes market innovation.** Distribution companies (DISCOMs) in India rely heavily on long-term PPAs to meet consumer energy demands, locking up a significant portion of generation capacities. This rigid procurement model, accounting for 70% of electricity costs, restricts DISCOMs' ability to explore competitive alternatives, thereby impeding market efficiency and innovation.[3]
- **Financial stress and operational inefficiency.** Financially strained DISCOMs, burdened by high AT&C losses and non-cost reflective tariff structures, face significant hurdles in upgrading networks to accommodate distributed energy resources integration and meet evolving consumer demands.[4] Addressing these financial challenges is imperative to ensure the long-term sustainability and resilience of India's energy infrastructure.
- **Need for metering infrastructure and data management for accurate consumption usage.** Insufficient investment in metering infrastructure at distribution transformer and consumer levels, coupled with manual data collection processes, poses significant challenges for energy auditing and revenue management. In rural areas, maintaining accurate customer records becomes particularly challenging, leading to revenue leakage and operational inefficiencies. Manual meter reading and bill delivery further exacerbate errors and delays, eroding customer trust and satisfaction.
- **Lack of asset monitoring and network security.** Effective monitoring of critical assets like 11kV and 415V feeders and transformers is paramount for ensuring reliable power supply. However, the

absence of real-time monitoring systems forces DISCOMs to rely on outdated communication methods, jeopardizing network security and resilience. This inefficiency not only increases operational risks but also undermines consumer confidence in the reliability of the power supply.

- **Distributed energy source (DER) integration challenges**. The anticipated rapid integration of DERs into the distribution network necessitates robust digital infrastructure and strategic planning. Without dedicated distribution-level system operators and supervisory control and data acquisition (SCADA) systems, DISCOMs struggle to manage power flow, congestion, and load shedding efficiently. Inadequate management of DER integration risks destabilizing the grid and compromising service reliability.

India's Smart Meter National Programme (SMNP), aiming to replace the nation's 25 crore (250 million) conventional meters with advanced metering infrastructure (AMI), is a pivotal step toward achieving India's Smart Grid vision.[5] This digital transformation is indispensable for enhancing grid flexibility, optimizing resource management, and advancing toward a more sustainable energy ecosystem.

Elevating Energy Operations with Smart Utility Solutions in India

India has a diverse electric utility sector, with several public and private companies involved in electricity production. Some of the major electric utilities in India include NTPC Limited, Power Grid Corporation of India Limited, and Tata Power. These utilities play a crucial role in generating, transmitting, and distributing electricity to meet the country's growing demand. Total energy generation in 2022 was estimated at 1,700 terawatt-hours (TWh) with an annual growth rate of just over 4%.[6]

However, the country faces challenges in maintaining stable and consistent power supply across all regions and in major cities. In May 2023, Mumbai experienced an all-time high peak demand of 4,000MW,[7] prompting authorities to further accelerate investments in smart grid infrastructure, transmission, and distribution to meet the growing power needs of India's large population.

Real-time tracking and demand forecasting has been a major area of innovation and investment for utilities for several years. This includes supporting edge operations for linear asset-intensive utilities, remote operations for distributed energy resource operators, energy suppliers up to customers' homes, and everything in between.

Power companies are moving to smart grids, starting with advanced metering infrastructure initiatives, and smart meters are core to this transformation. The government of India has a set of major initiatives to drive the push to smart grids:

- **The Electricity (Amendment) Bill 2022** proposed significant changes in the Indian power distribution sector to introduce competition. It allows multiple distribution companies to operate in any territory, giving consumers the choice to select their electricity supplier.[8]
- **Smart Meter National Programme** (SMNP) aims to replace 25 crore (250 million) conventional electricity meters with prepaid smart meters, upgrading infrastructure such as feeders and transformers.[5]
- **Revamped Distribution Sector Scheme** (RDSS) aims to improve the financial and operational efficiencies of distribution companies, including reducing the aggregate technical and commercial losses to 12–15% by 2025.[9]
- **Introduction of 'Time of Day' tariff structure** allows consumers to reduce their electricity bills by effective planning of their consumption during non-peak hours. This new tariff structure, announced by

the government in 2023, is also aimed at improving the management of renewable generation fluctuations, and the system load factor by reducing the demand on the system during peak hours.[10]

IDC's Worldwide Digital Transformation Spending Guide 2024 also notes an uptick in ICT investments by utilities companies in India over the last two years (See Table 1). The utilities sector in India spent INR 16,232 crore in 2023, and the spend is expected to further grow at a compound annual growth rate (CAGR) of 14.4% from 2023–2027, reflecting the sector's ongoing digital transformation efforts.

From a broader perspective, this transformation will benefit not just the utilities companies, but also the end customers as well as the regulators. Smart grid technologies and practices, including advanced metering infrastructure, peak load management, power quality management, and microgrids will allow Indian utilities companies to further increase the efficiency of grid operations, handle demand spikes, and provide redundancy in case of outages in the macro grid.

For customers, benefits include improved accessibility to reliable electricity, and better visibility of their consumption trends. *For regulators*, it will help in tracking the operational viability of utilities companies and ensuring their compliance with regulatory requirements, such as sustainability.[2]

Table 1: Technology Spending on Digital Transformation by Indian Utilities Companies

Technology Group	CAGR (2022–27)
Services	21%
Hardware	14.9%
Software	13.6%
TOTAL	17.7%

Source: Worldwide Digital Transformation Spending Guide — Use Case Forecast, 2024; April (V1 2024) Release

India is closely following global utilities companies, as they modernize their electrical grids to accommodate renewable energy integration, improve grid resilience, and enhance overall reliability. However, there's a long way to go. Under the National Smart Grid Mission (NSGM), even though over 22.24 crore (222.4 million) meters have been sanctioned to be converted to smart meters, just 3.06 crore (30.65 million, or about 14%) smart meters have been deployed across India (according to NSGM's May 2025 Metering Dashboard).[11]

By 2027, 50% of utilities will implement digital twins, improving asset optimization of power grids, decreasing unplanned outages by 30%, and supporting simulations for network expansion.

— IDC FutureScape: Worldwide Utilities 2024 Predictions

Critical Role of Connectivity in Advancing India's National Smart Grid Mission

Fundamentally, while AMI deployment consists of four key components (as below), robust, adaptable, and secure connectivity is essential for ensuring the availability of an ecosystem of interconnected smart meters and flow of data through the system:

- **Smart meters**. Installed on customer premises, smart meters capture the usage data at varying intervals of 5–60 minutes,[12] enabling monitoring of consumption patterns.
- **Communication networks**. Communication networks facilitate a two-way communication channel between smart meters and smart metering applications, such as head end systems (HES), to transmit significant volumes of interval load data such as load profile, billing information, and energy audit reports.
- **Cloud infrastructure**. Cloud provides a centralized location to host a variety of smart grid applications, data, and firewalls. It also serves as a key component of the disaster recovery/business continuity plan (DR/BCP) strategy, storing copies of data and applications across sites, to ensure a reliable system.
- **Applications**. A variety of applications make up the system, such as head end systems, that collect data from smart meters and validate it before sending it to meter data management systems (MDMS) for further processing and storage. This data is then integrated with other critical systems such as billing and outage management, to ensure smooth grid operations.

Given the critical role of connectivity to the connected utilities ecosystem, several technologies have been proposed, developed, and deployed, with both wired and wireless options available. Telecom SPs in India are further investing in upgrading the underlying network infrastructure, including 4G and narrowband IoT (NB-IoT) networks. This improved connectivity will encourage the adoption of cloud platforms and services, offering greater scalability and flexibility for utilities companies. This will also lead to greater efficiency from operators, pushing them to invest in greater automation, real-time grid visibility, and asset management optimization.

Connectivity Options Allowed by NSGM in India

The connectivity technologies allowed include NBIoT, radio frequency mesh network (RF mesh), and power line communication (PLC).[13] Each of these technologies offers unique advantages in terms of coverage, power consumption, cost, and capacity. For instance, RF mesh offers wireless mesh networking capabilities with high reliability and scalability. On the other hand, NB-IoT provides cellular-based connectivity with wide coverage and low power consumption, making it ideal for large-scale smart metering deployments. The plug-and-play nature of NB-IoT also makes it suitable for both urban and remote areas, without the need for extensive network planning.

Based on the similarity of their characteristics, IDC has segmented the connectivity options allowed by the NSGM under the following access technology segmentation (see Table 2).

TABLE 2

Communication Technologies Used in Smart Utilities in India

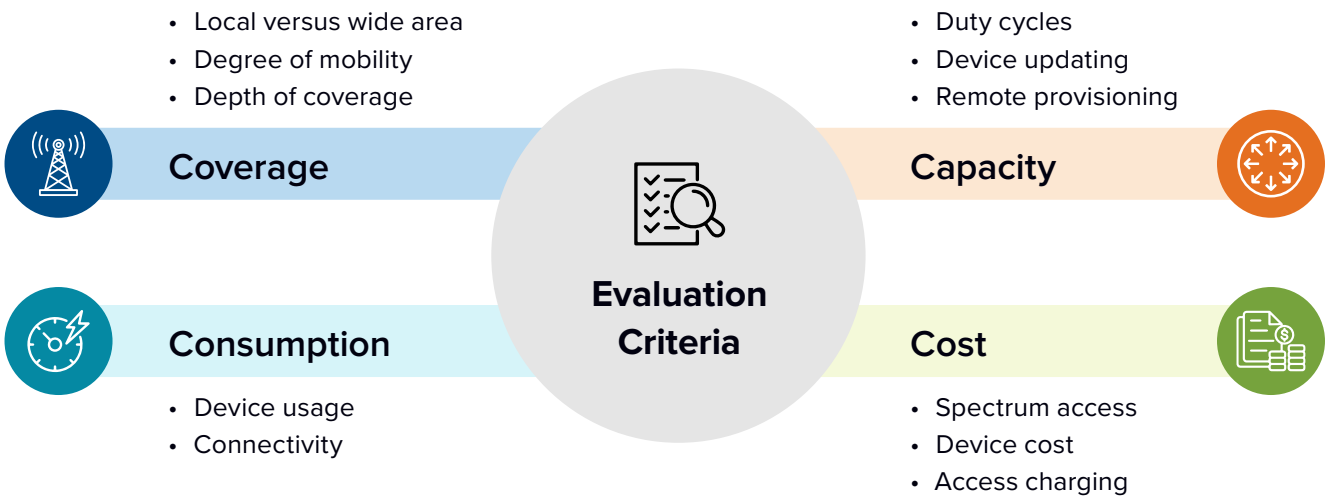
Access Technology	Description
Cellular	**NB-IoT, 2G, 4G LTE, 5G NR**
LPWAN	**RF mesh**
Radio/Other	**PLC**

Source: IDC, 2024

Selecting the right connectivity technology is crucial for the successful implementation of AMI and smart metering. Utilities companies must evaluate the pros and cons of each connectivity option based on the 4C Framework (Coverage, Consumption, Cost, and Capacity) to choose the most suitable technology that aligns with their operational requirements, geographical conditions, and budget constraints (see Figure 1). By investing in reliable connectivity solutions, utilities can ensure the seamless integration of AMI and smart metering into their operations, thereby driving the success of India's National Smart Grid Mission.

FIGURE 1

IDC's 4C Framework for Evaluating Connectivity Options



Source: IDC, 2024

Coverage

One of the most fundamental requirements is that the chosen connectivity technology should ideally be able to cover all the endpoints and address all the use cases identified by the utilities company. For example, are all or most endpoints deployed within a finite and/or closed area or are they deployed over a much wider geography?

- **Local versus wide area**. For a wider deployment of endpoints, such as in the case of smart meters, the choice of technology will veer toward cellular technologies, such as NB-IoT, which are supported by the radio infrastructure of telecom SPs' public mobile networks. As such, 4G and NB-IoT can provide coverage at a national level. However, LPWAN technologies can be considered for local area coverage requirements.
- **Degree of mobility**. Consider whether the endpoints need to be covered in a stationary manner or whether they have mobility across a wider area. In the case of utilities, smart meters deployed by the utility provider will be stationary. However, in asset tracking use cases, endpoints tend to move over a much wider area, requiring much broader, national-level coverage. It is interesting to note that NB-IoT standards were largely designed for this dual purpose.
- **Depth of coverage**. Identify if endpoints need to be deployed either deep indoors or even below ground. For example, endpoints could be deployed deep indoors and underground within railroad or subway stations in an urban area as part of a smart city initiative. Similarly, utilities companies may have assets deployed below ground, or in areas of high interference. In these situations, NB-IoT does well and benefits from the added feature of coverage enhancement as defined by the 3GPP, in which messages are repeated multiple times to overcome poor signal quality in an area.

Capacity and Throughput

The size of the message, along with the frequency of transmission, is an important consideration for the companies. Depending on the specific use case, endpoints may need to transmit/receive varying amounts of data, with changing frequency, throughout the day. Some endpoints may be set up to send messages multiple times a day, only once a month, or some other frequency. While endpoints like smart meters need data transmission throughout the day, the data packets are small, and are typically sent every 15 minutes.[14] On the other hand, a closed-circuit television (CCTV) endpoint will be transmitting nearly continuously streams of large data packets. Companies need to consider all these factors in their selection of connectivity technologies.

- **Duty cycles — limits on data transmission for unlicensed spectrum usage**. It is important to note that LPWAN technologies, such as RF mesh and LoRaWAN, have limits on the amount of transmit power and data they can transmit over an unlicensed spectrum. These limits, referred to as duty cycles, define the maximum amount of time a transmitting endpoint can occupy a given channel, and are placed to prevent any one user from using a disproportionate number of spectral resources in the unlicensed, shared spectrum. They also have the net effect of placing constraints on the data that endpoints can transmit on RF mesh and LoRaWAN.

  Meanwhile, NB-IoT and LTE-M do not have these constraints by virtue of using licensed spectrum resources. They have the advantage of repeated messaging protocol to boost their penetration, especially useful for endpoints below ground or in unfavorable conditions. Signal strength is also a major differentiator for 3GPP (cellular) technologies. RF mesh and Sigfox have signal strength limits placed by regulators because of the usage of unlicensed, shared spectrum. Cellular technologies (such as NB-IoT) have a consistent record with

minimizing packet loss when data is transmitted over large distances, while LoRaWAN is particularly vulnerable to packet loss over medium to long distances.

- **Device/firmware updates**. Utilities companies need to consider how many of their endpoints need updates and how often. This is especially relevant in the case of smart meters when endpoints are deployed across a wide geography and conditions, including some that might be inaccessible. The cost of sending out technicians and truck rolls is often prohibitive, given the large number of devices and remote locations. Here, the ability of cellular technologies, NB-IoT and LTE-M, to process larger file sizes relating to these updates is crucial.

Costs

Ultimately, companies must consider the total cost of ownership (TCO) for the IoT network to be deployed. This is one area that most organizations have struggled with, and which has held back the progress of IoT deployments overall.

- **Cost of network operations**. A key decision for enterprises is whether to deploy their own local network or access licensed spectrum through a telecom SP. While deploying their own LPWAN network might seem cost-effective initially, as it eliminates spectrum access costs by use of unlicensed spectrum, the TCO for utilities companies can be high. Managing operations over a wide area is challenging, especially since it's not their core business. On the other hand, the plug-and-play nature of NB-IoT networks owned by telecom SPs spares businesses the capital expenditure and operational challenges associated with maintaining networks.
- **Cost of IoT modules**. The second area of cost comes from individual IoT modules that go into the endpoint. This can be a module added to a legacy machine or connected tools, or even a module that goes into an automated guided vehicle (AGV). RF mesh, PLC, LoRaWAN and Sigfox modules have traditionally been cheaper because of the early scale. Moreover, these modules do not come with a secure element and other components, thereby reducing their bill of materials and overall cost. Given the rapid adoption of NB-IoT in the last 2–3 years, the price of NB-IoT components has come down to be comparable to other technologies.
- **Spectrum access cost**. The final cost area will come down to access charges per device per year. Given scale advantages, NB-IoT pricing on an annual basis is likely to be more competitive now for the requirements of enterprises.

Table 3 shows the relative cost factors to consider for the deployment of NB-IoT and other networks:

TABLE 3

Cost Factors for Network Deployment

Cost factors of deployment	NB-IoT	RF Mesh (Subscription with operator)	LoRaWAN (Own Network)	Sigfox
Devices including radio module	$	$	$	$
Subscription fees	$	$		$
Own network infrastructure		$$	$$	
Network ops and maintenance		$$	$$	
Application (server and software)	$	$	$	$

Source: IDC, 2024

Consumption

IoT devices in the field should be able to run with limited to no human interaction or intervention, with the lowest power consumption profile possible, as many of these endpoints are in remote or unfavorable areas. This is applicable for smart meters in the field, a variety of sensors in challenging industry verticals, such as oil and gas, and even for modules placed on stationary assets, such as machinery or trash cans.

- **Energy efficiency**. Depending on the use case, smart meter transmission may have significant data transmission requirements, and as a result energy efficiency becomes paramount. For message sizes up to 500 bytes, NB-IoT and LTE-M are more efficient as they can send all of the required data in one transmission. However, most of the LPWAN (Sigfox) and radio technologies such as RF mesh, need to split up data into separate packets, and each message transmission increases energy consumption.
- **Security**. The security of endpoints and their potential impact on the corporate network is not to be underestimated. LPWAN and radio devices are often available without built-in security or even an OS that can help with setting up security, making these devices an easy target for compromise by malicious actors. A mechanism for mutual authentication is crucial between the endpoint and access network. While radio and LPWAN technologies struggle with this, 3GPP technologies, such as NB-IoT and LTE-M, allow authentication to be done through the SIM card, which is secure by design and safely stores the necessary credentials for secure authentication.

The NB-IoT Advantage: Accelerating India's National Smart Grid Mission

A careful evaluation of all the technologies in **the Indian context highlights that NB-IoT is well-suited for India, especially within the framework of the NSGM,** due to several unique characteristics of the country:

- **Connectivity for diverse geographical conditions:** India encompasses a diverse range of geographical conditions, from densely populated urban areas to remote rural regions. NB-IoT offers robust connectivity leveraging cellular technology making it ideal for use in urban high-rises and basements, as well as rural areas. In comparison, the geographic spread of households in a rural deployment presents serious challenges in realizing per-unit economics for RF mesh deployments. In addition, getting right of way (RoW) and permissions for LPWAN deployments in urban landscapes is challenging, and establishing a blanket network coverage will be a costly affair. Hence, NB-IoT is an ideal candidate for diverse conditions.
- **Facilitate faster time to market**. NB-IoT networks are available pan-India, translating to readily available connectivity infrastructure as opposed to mesh networks which require network planning and deployment while catering to regulatory requirements such as right of way.
- **Ability to support high population density**: With its high population density, India has a substantial number of devices requiring connectivity. NB-IoT can support a large number of devices in a confined area, making it perfect for dense IoT deployments, which is crucial for the NSGM's objective of enhancing grid efficiency and reliability.[15, 16]
- **Low cost of ownership**: NB-IoT uses existing infrastructure, eliminating the need to deploy separate infrastructure to connect devices. As a result, the initial rollout costs are low, along with lower expenses related to operating and maintaining of infrastructure. Irrespective of the location, smart meters can be connected to the infrastructure owing to pre-existing network

availability. Moreover, the Indian market is highly cost sensitive, and the cost of NB-IoT modules is expected to decrease rapidly as demand increases. This aligns with the NSGM's goal to implement cost-effective smart grid solutions across the country.[16]

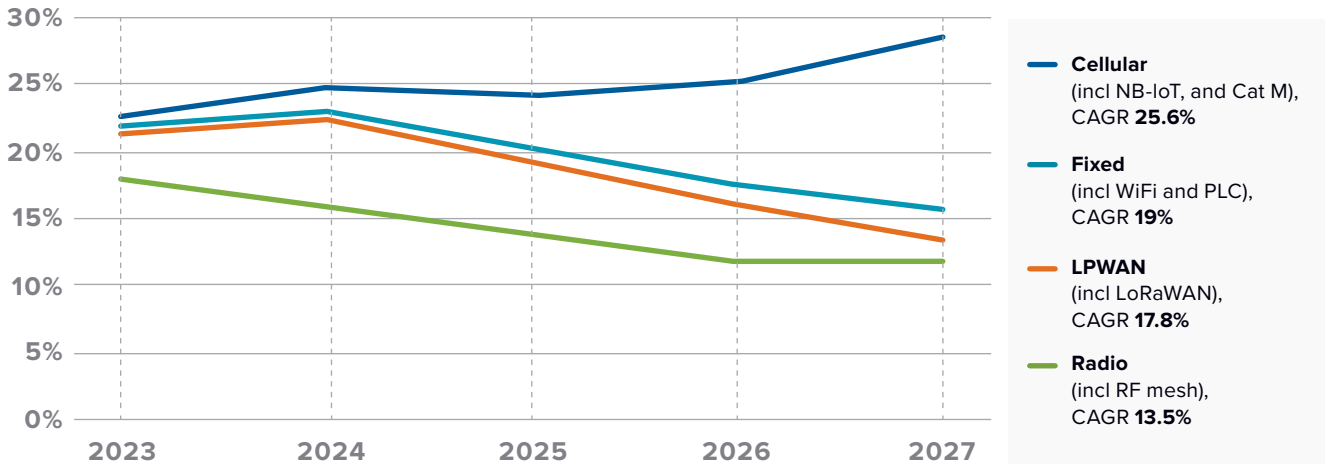
- **Reliability and availability**: Leveraging the underlying robust telecom infrastructure, NB-IoT provides reliable connectivity with high network availability, ensuring consistent and uninterrupted communication between devices and the central system. Higher data quality is achieved through higher reliability and better quality of service (QoS). This is crucial for the NSGM's aim to create a resilient and robust smart grid infrastructure.[16]
- **Security**: NB-IoT offers enhanced security features, including end-to-end encryption and authentication, to protect data transmission and ensure the integrity of the smart grid system. This aligns with the NSGM's focus on implementing secure and trustworthy smart grid solutions.[16]
- **Standardization**: NB-IoT is a standard developed by 3GPP for cellular IoT connectivity, encompassing an extensive global community of equipment manufacturers, telecom SPs, and suppliers of communication modules and chipsets, and is widely adopted across the world.

IDC's IoT Access and Connections Tracker also highlights that the cellular segment, led by NB-IoT, will be a strong contender for connectivity for utilities in India over the next four years, outpacing the growth of other LPWAN and radio technologies due to the reasons mentioned above. The rate of growth of cellular connections (including NB-IoT) for the utilities segment is expected to grow at a CAGR of 25.6% over the 2023–2027 period, while the LPWAN (including LoRaWAN and Sigfox) and radio (including RF mesh) segments are expected to grow at annualized rates of 17.8% and 13.5%, respectively, over the same period (see Figure 2).

> Cellular connections (including NB-IoT) for utilities are expected to grow at a CAGR of 25.6% between 2023 and 2027.

FIGURE 2

IoT Connections for Utilities in India — YoY Growth Rates 2023-27

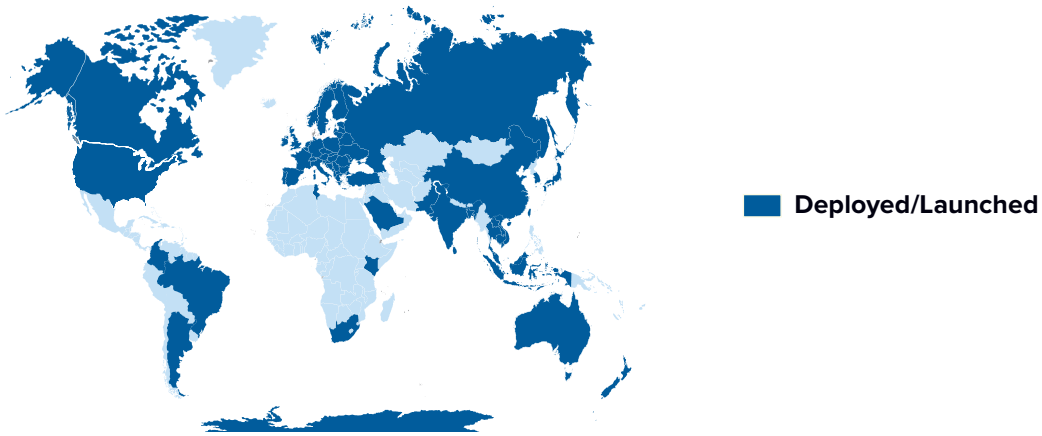


Source: IDC, 2024

NB-IoT is rapidly emerging as a prominent connectivity option across the globe as well, showcasing its transformative potential for digital initiatives. Figure 3 highlights the global traction behind cellular IoT networks, specifically NB-IoT and LTE-M. These networks are operational in over 95 countries worldwide, supporting all kinds of IoT use cases including smart metering and AMI initiatives.

FIGURE 3

Global Footprint of NB-IoT and LTE-M Networks



Source: GSA, 2024

Leveraging these NB-IoT implementations, below are some real-life case studies of utilities companies partnering with service providers and technology vendors to modernize their operations and customer experience.

Case Studies

Secure Meters, in collaboration with Airtel, deploys 1.7 million NB-IoT smart meters in Bihar, India (2024) and counting[17]

Secure Meters, in partnership with Airtel, has successfully deployed 1.7 million NB-IoT smart meters across Bihar, providing a reliable and robust connectivity solution for electricity consumers in the region. Secure has developed its own smart meters **with NB IoT communication module,** head end system, and meter data management system, which have been integrated with Airtel's IoT platform to ensure seamless cellular connectivity. This large-scale deployment is supported by Airtel's (NB-IoT/GPRS) network, ensuring consistent services. It also includes a network feasibility tool and a SIM services management portal to assist Secure in effectively planning and implementing smart meter installations.

China Telecom, Shenzhen Water Group deploy NB-IoT smart meters in Shenzhen, China (2022)[18]

China Telecom has collaborated with Shenzhen Water Group, Huawei, and Ningbo Water Meter Company to introduce an innovative IoT water management platform, connecting over one million NB-IoT-powered water meters throughout Shenzhen. Additionally, Shenzhen Gas, along with China Telecom, Huawei, and Goldcard, conducted joint trials on NB-IoT gas meters to address industry challenges in smart gas metering.

Aqualia and Vodafone partner to scale NB-IoT connectivity for water system digitalization in Spain (2022)[19]

Aqualia collaborated with Vodafone in Spain to implement NB-IoT connectivity for enhancing its metering systems as part of water system digitalization efforts. Since the deployment commenced in October 2022, Vodafone Spain has connected over 250,000 water meters to its NB-IoT network, with a target of connecting over one million meters by 2026. Aqualia aims to provide remote meter reading and advanced customer

services to its three million customers, showcasing the scalability and efficiency of NB-IoT in large scale utility deployments.

EON partners with Telia for advancing sustainable energy with NB-IoT enabled smart meters in Sweden (2020)[20]

To enable the electrical grid to adapt better to sustainable energy sources, EON selected Telia's NB-IoT network to connect smart meters in one million homes in Sweden. Telia has also signed an agreement with ONE Nordic and Ellevio to connect close to one million of their customers with the same technology.

These case studies underscore the increasing recognition of NB-IoT's advantages, including wide coverage, low power consumption, and cost-effectiveness, making it an ideal solution for smart metering initiatives globally. As utilities companies continue to prioritize digital transformation and the modernization of their infrastructure, NB-IoT is expected to play a pivotal role in driving the adoption of smart utilities and advancing the objectives of initiatives like India's National Smart Grid Mission.

In conclusion, the technical advantages of NB-IoT, combined with its alignment with India's specific characteristics and the objectives of the NSGM, make it an excellent choice for the implementation of smart utilities in the country.

NB-IoT is expected to play a pivotal role in driving the adoption of smart utilities and advancing initiatives like India's National Smart Grid Mission.

Airtel Business' NB-IoT Portfolio

Airtel Business' IoT portfolio is future ready, offering solutions that cater to diverse industry needs, with a focus on NB-IoT. By leveraging its extensive nationwide network, Airtel Business supports the utilities sector with advanced IoT solutions, driving enhanced connectivity, efficiency, and operational reliability.

Airtel Business provides a scalable foundation for connected devices, including various IoT connectivity options such as NB-IoT, 5G, 4G, and 2G, coupled with applications such as head end systems, meter data management, and prepaid billing hosted on Airtel Cloud. Airtel Business' offerings include the following key components:

- **Network infrastructure**: Airtel Business has a nationwide network infrastructure that provides connectivity across urban and rural areas, ensuring reliable communication for IoT devices. Leveraging this nationwide network, Airtel Business facilitates the deployment of NB-IoT-enabled smart meters and other utility-focused IoT solutions, enabling real-time data transmission and monitoring.
- **Airtel IoTHub**: This is Airtel Business' central platform for managing IoT deployments. It provides features such as meter life-cycle management, data visualization, and analytics. Utilities companies can use IoTHub to efficiently provision and manage NB-IoT devices, monitor performance metrics, and gain actionable insights to optimize their operations for large scale deployments.
- **Advanced analytics**: Airtel IoTHub enables advanced data analysis and predictive modeling. The IoT platform enables AMI SPs to track communication uptimes and SLAs whilst integrating field data of smart meters from head end systems to resolve connectivity issues and performance issues that lead to system downtime, thereby improving efficiency and reducing downtime.
- **Network planning tools**: Airtel provides custom-built tools that allow AMI SPs to test the feasibility of deployments ranging to large-scale implementations without requiring critical human resources to be sent for an on-field survey.

- **Partnerships and ecosystem**: In the smart utilities space, Airtel provides solutions beyond connectivity that allow AMI SPs to track and monitor end-to-end system uptimes and SLAs effectively. For instance, through its partnership with IntelliSmart Infrastructure Pvt. Ltd. (IntelliSmart Infra), Airtel Business provides connectivity and cloud services that host the HES application. This makes it easier for IntelliSmart Infra to deploy smart meter stacks. Airtel Business' bundled services make it an attractive partner for AMI SPs.

By integrating its network infrastructure, an innovative IoTHub platform, smart metering applications, and advanced analytics capabilities, Airtel Business empowers the utilities sector with IoT solutions, driving digital transformation and operational excellence.

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Essential Guidance

As utilities companies in India embark on their journey toward implementing AMI and smart meters, it is crucial to understand the importance of choosing the right connectivity technology. NB-IoT has emerged as a promising solution, offering a host of benefits such as long battery life, cost-effectiveness, and excellent coverage. The transition to NB-IoT requires careful planning and consideration. Here are eight key points to guide utilities companies on this journey:

- Familiarize yourself with NB-IoT, its specifications, and how it applies to your scenario. Work with a strategic partner to evaluate and understand how it can facilitate real-time energy usage monitoring, dynamic pricing, and outage management.
- Evaluate your existing infrastructure's capacity to support NB-IoT. This includes assessing the compatibility of your current systems and the readiness of your grid to handle two-way communication and real-time data transmission, including broader data management.
- Collaborate with vendors who have proven expertise from a connectivity point of view and a deep understanding of the energy sector. Look for end-to-end solutions, from hardware to software, and ongoing monitoring and management support that caters to your specific needs.
- Consider the TCO. While NB-IoT modules might be cost-effective, consider the total cost of operations including installation, maintenance, and data transmission costs, while factoring in cost savings from improved efficiency and reduced energy theft.
- Consider a provider that has reliable connectivity in remote as well as densely populated areas to cater to India's diverse geographical conditions. This is crucial for effective energy management across your entire footprint.
- Ensure that your implementation is future proof by ensuring compatibility with future advancements in the energy sector.
- Train your workforce to manage the massive number of connections and familiarize yourself with the connectivity management platform provided by your service provider. This includes technical training for installation and maintenance of these remote modules, as well as training for data analysis and decision-making based on insights derived from data from the smart meters.
- Ensure your implementation aligns with the Standard Bidding Document (SBD)[21] objectives of the NSGM to ensure compliance with national policies. Leverage government support and contribute to the national goal of energy efficiency and sustainability.

Remember, the goal is to create a more efficient, reliable, and sustainable utility infrastructure.

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About the IDC Analysts

Nikhil Batra
Senior Research Director,
IDC Asia/Pacific

Based in Australia, Nikhil focuses on telecom service provider and tech vendor strategies, along with enterprise connectivity and IoT services across the Asia/Pacific region. In his role, Nikhil works with the regional telecom teams to produce intelligence reports, market insights, and contributes to various consulting projects for leading regional telcos and tech vendors. With about 19 years of experience in the telecom and technology Industry, Nikhil has worked with some of the industry giants like Verizon, IBM, and most recently, YTL Communications.

More about Nikhil Batra

Swathi Arunaa
Senior Research Analyst
IDC Asia/Pacific

In her role, Swathi works with the regional telecom team to produce syndicated research around industry developments, technology buying patterns, and market sizing and segmentation. She develops intelligence reports, market insights, and contributes to various consulting engagements. Swathi is also responsible for the Telecommunication Services Tracker program, which includes market forecasting and analysis of telecom vendor and communications SP offerings.

More about Swathi Arunaa

Message from the Sponsor

Airtel Business is a provider of integrated communication solutions in India, offering a wide range of services like cellular IoT, cloud, datacenters, cybersecurity, and more. Their solutions provide high-speed connectivity, broad coverage, and scalable bandwidth to enterprises, governments, carriers, and small and medium businesses (SMBs).

This white paper by IDC focuses on how digital transformation is reshaping India's utilities sector, with a spotlight on the National Smart Grid Mission.

It explains the key role of Narrowband IoT (NB-IoT) in enabling smart meters, improving deployment efficiency, creating a positive RoI for DISCOMs, and helping India achieve its energy goals.

Airtel is proud to present this IDC white paper, which helps our customers better understand the ongoing transformation in the utilities sector and the innovative solutions driving India's Smart Grid Mission.

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