VIEW POINT

THE 5G EFFECT ON ENERGY UTILTIES

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Abstract

5G networks promise to deliver a superior end-user experience. Utilities face a spike in data volume driven by innumerable devices on the electrical network. 5G can help utilities cope up by supporting 100x more connected devices and transmitting 1,000x more data at a much faster speed. It is imperative for mission-critical services in utility operations. Our point of view explores opportunities for utilities to adopt 5G and address key issues in day-to-day operations. Efficient asset management, increased used of drones and a digitally enabled workforce are some examples of how utility companies can capitalize on 5G.

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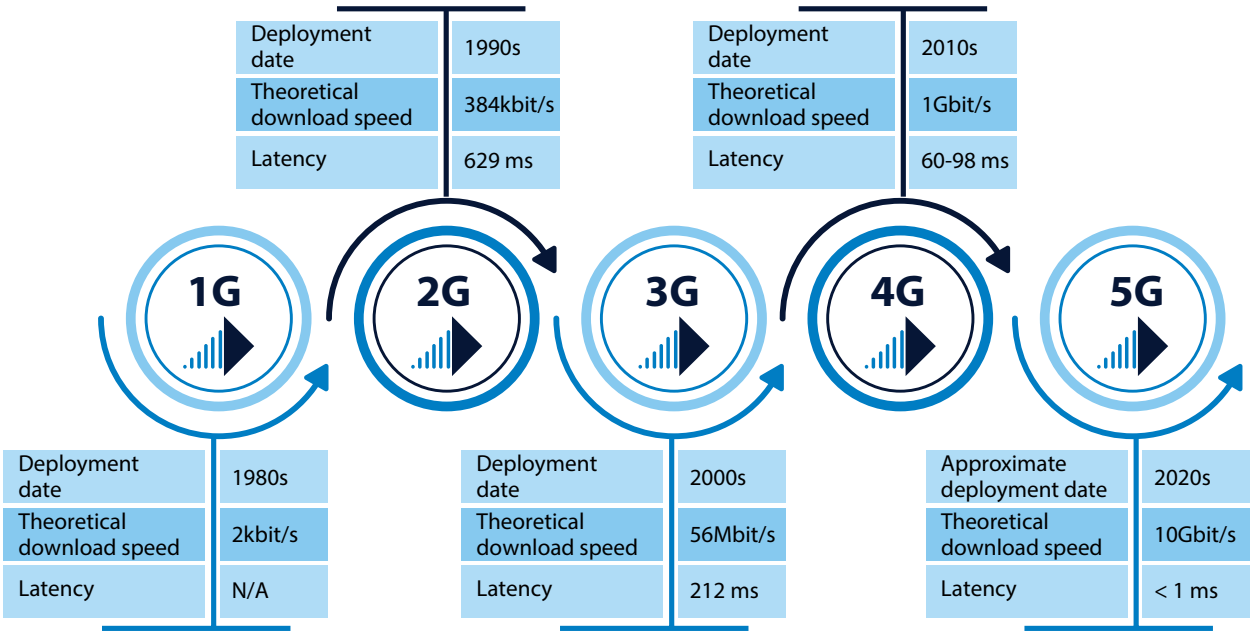
What is 5G?

5G encapsulates new-generation wireless communications technology offering much faster data download and upload speeds. It promises to deliver an improved end-user experience by offering new applications and services through exponentially faster speeds, significantly improved performance and reliability, and massive connection density resulting in dramatically enhancing day-to-day user experiences and transforming industries [Figures 1 & 2].

Figure 1: Evolution of 5G networks



Source: GSMA: Mobile Broadband: The path to 5G

Impact of 5G on energy utilities

Vertically integrated energy utilities are challenged by legacy systems, with unbundling and deregulations resulting in highly competitive, more efficient, technologically advanced, and customer centric utilities. Progressive utilities are front runners in adopting new technologies to improve their core business processes, operations and customer services. Digital technologies harness a huge volume of data that requires utilities to invest in data analytics capabilities for data analysis, planning and diagnostics. Utilities that seized the early mover advantage of adopting technology to achieve business goals reaped benefits while utilities that did not assimilate technology were left behind.

In the past decade, new and emerging technologies have had a profound effect on how utilities conduct business, disrupting their operating business models and presenting new opportunities and challenges. Utilities underwent a digital transformation on many fronts: replacement of electro-mechanical meters by smart meters, transformation of traditional electric grids to smart grids, and a renewed focus on core business process automation, digital workforce, and digital customer service delivery. These technology-enabled changes are now the new normal for electric utilities.

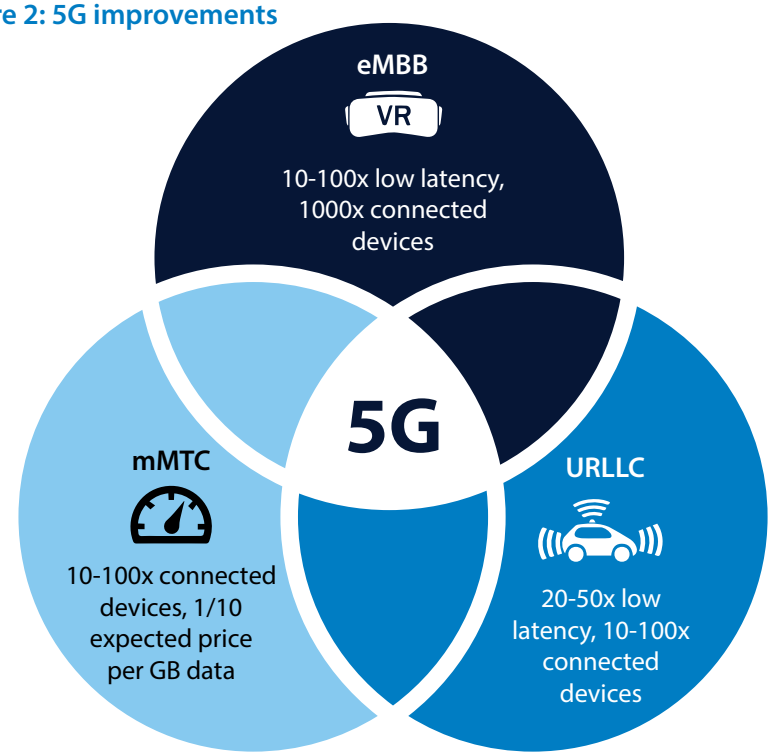
The emergence of 5th generation (5G) mobile communication technology will further accelerate digital transformation of utilities. 5G is a catalyst for mission-critical services in utility operations where data is time-sensitive and reliability is paramount. For example, 5G's ultra-reliable and low-latency communications (URLLC) feature allows monitoring of electrical transmission lines for routine inspections, and discovery and assessment of storm damage.

Despite a dynamic industry landscape, energy utilities continue to be highly regulated. Due to regulatory and commercial demands, monitoring and controlling energy generation and consumption are business imperatives. It makes utilities, ideal candidates for 5G applications. with potential use cases leveraging enhanced mobile broadband (eMBB), massive machine type communications (mMTC) and ultra-reliable low-latency communications (URLLC).

- eMBB enables extreme capacity, enhanced data rates, and extended coverage in crowded areas; to improve various functions such as indoor and outdoor broadband and augmented and virtual reality (AR/VR) applications for segments such as the digital workforce.
- mMTC involves the automatic generation, transmission, and processing of data among numerous machines with minimal human intervention. It supports ultra-high density, ultra-low energy and wide area coverage. It lends itself to IoT, smart cities, asset tracking, and energy monitoring capabilities.
- URLLC supports ultra-high reliability, very low latency (fast downloading and improved responsiveness), robust security and extreme user mobility. It is a catalyst to enhance smart grids, autonomous vehicles, remote healthcare, industrial automation capabilities and critical functions such as controlling robots and drones.

While these potential use cases benefit utilities, Infosys believes that utilities will adopt URLLC and mMTC in the near-term followed by eMBB.

Figure 2: 5G improvements



Source: Feedback insights

Opportunities for energy utilities

Energy utilities can leverage 5G's enhanced capabilities to address daily operational issues; be it mission-critical inspection of the electrical network in rough terrain, modernizing existing smart grids, or capacity building of its field workforce.

Boosting smart metering capabilities and advanced AMI

Smart meters offer cost savings in homes allowing users to monitor their usage and moderate their power consumption . Currently, we are witnessing a movement of installing smart meters in the homes of consumers. For instance, in the United Kingdom, utilities are installing smart meters as part of a national government program to replace legacy energy meters. With enhanced capabilities of 5G, smart meters will become ubiquitous. Consumers can benefit from granular analysis of energy consuming devices at their homes. After implementing 5G, utilities can deploy Advanced Metering Infrastructure (AMI) resulting in faster data access, consolidated insights about customer usage, and faster reconnection following outages, thereby enhancing customer service delivery.

Smart grid modernization

A smart grid uses information and communication technology to collect data from the electrical network and transmit it to energy utilities. It helps utilities optimize electricity generation and distribution, adjust electricity consumption, manage losses, and ensure predictability. In a smart grid, millions of devices communicate with each other and share data every millisecond. Managing demand in real time strains the capability of the energy management system. 4G networks cannot support these devices at scale due to data transfer rate and bandwidth limitations. 5G capabilities of large bandwidth and ultra-low latency accelerates grid modernization and enables real-time collection and analysis of data from power plants, transmission lines, and smart meters. Significantly, smart grid monitoring will become more accurate, generate more useful data and optimize demand management – making the smart grid smarter.

Distributed Energy Resources (DERs)

With the convergence of rationalized solar photovoltaic panel pricing and the introduction of net metering, millions of residential and commercial consumers are becoming small electricity producers (prosumers) who can sell excess energy to the electricity grid or other consumers. It has led to the creation of a distributed energy resource management platform enabling electricity to flow from different renewable sources and allow bi-directional electricity flow – home to electric grid and home to home. The spike in the volume of data generated every millisecond requires distributed energy management systems to manage the load in real time. 5G enables real-time data management and analysis and supports flexible billing systems using bi-directional electricity flows. It also enables scaling of community participation and integration of DERs in seamless electricity distribution.

Digitally enabled workforce

The utilities industry is asset-intensive and demands a significant amount of time, money, and resources to maintain and manage assets. A majority of field operatives manage their functions manually, which exposes them to health and safety risks. Besides, inadequate training results in low first-time resolution of faults and a subpar customer experience.

Such operational issues can be addressed by a digitally enabled workforce leveraging 5G powered virtual reality (VR) solutions such as VR enabled safety helmets. Virtual reality helmets equipped with head-up displays and voice activation enable field operatives to summon work instructions, manuals, videos, network status information and images while working, which boosts efficiency and productivity while undertaking repair and maintenance jobs on the field. In addition, 5G can facilitate training an ageing workforce remotely using virtual reality solutions. Operatives can learn new skills or diagnose faults without visiting sites.

Drones in asset maintenance

Energy utilities are challenged to monitor and survey electrical networks spread over thousands of kilometers in harsh terrain to detect faults. Inspections are performed manually or by helicopters / drones and then analyzed offline. It may require multiple iterations to access the information needed to detect and rectify faults. In such situations, the capabilities of drones can be enhanced using 5G for asset management during routine inspections and damage assessment after storms.

The biggest leap in drone technology powered by 5G is the ability of devices to move across cells without long and complex reconnection protocols[1]. A 5G enabled drone can fly to a distant location without halting when it enters a new network area covered by a different mast. It is possible because ground-based or rooftop structures can support antennas at a height where they can send or receive radio waves. Such networks allow 5G drones to be always connected, which empowers remote operators to monitor drone data remotely and in real-time rather than from a control tower. Any internet connection allows access to the drone network. Drones equipped with high-definition cameras and sensors, and powered by 5G can relay high-resolution visuals and videos in real time for real-time analysis. For example, the video footage from a drone, computer vision and ultra-fast 5G monitor and provide real-time insights into environmental conditions in the Baltic Sea[2] .

The enhanced capabilities of 5G powered drones significantly improve routine inspections enabling prompt rectification of equipment fault. This dramatically improves equipment breakdown time (time lapse between equipment failure and restoration) and enhances the operational lifetime of assets. Utilities can benefit from reduced asset maintenance cost, fewer unplanned outages, low downtime and accelerated restoration of power following a storm.

The road ahead

The inherent capabilities of 5G such as supporting 100x more connected devices, very low latency, high data rates and reliability make a business case of 5G adoption in utilities.

In the short-term, utilities need to proactively identify 5G use cases with return on investment for pilot testing. Successful pilots can be replicated and scaled up to improve the health and safety of employees, reduce the cost of asset maintenance, and extend the lifetime of assets. Early 5G adopters will transform utility operations to become more competitive.

5G enables utility enterprises to envision new revenue streams and enhance the customer experience. Infosys combines an intimate understanding of the 5G domain with robust digital capabilities to help utility enterprises navigate the 5G journey. Infosys is a strategic partner of AT&T's 5G Innovation Program which leverages 5G and AT&T's edge computing capabilities to develop novel customer experiences[3].

Infosys was awarded the Outstanding Catalyst Award – Innovation for its 5G Patisserie at TM Forum's Digital Transformation Asia in Kuala Lumpur[4]. The award recognizes our work in 5G network slicing facilitating common shared physical infrastructure to support services with diverse requirements across parameters such as bandwidth, latency, scale, and reliability.

Infosys has established 5G Living Labs in Bangalore, Melbourne, Indianapolis, Richardson, and Frankfurt. The Labs transform organizations into Live Enterprises by creating new economies with 5G technology, while simultaneously supporting communication service providers to accelerate and monetize their 5G network deployment[5,6].

About the Authors

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Shannon has over 25 years of experience. Currently, he is working with Utility clients to effect a business transformation by adopting digital capabilities. He has been focused on data and analytics and envisions new solutions using new and emerging technologies.

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Lakshman has 20 years of experience in industry, management and IT consulting. He has led and executed multiple consulting engagements in digital technologies for energy and utilities clients in the UK, USA and India.

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