Empowering utilities:

Overcoming challenges with private networks and 5G technology.

Empowering utilities.

Sponsored by

T-MOBILE FOR BUSINESS

T&DWorld™

Executive summary.

Utilities face a host of challenges as they strive to meet decarbonization goals in the face of rising demand for energy. These include transitioning their operations to accommodate a two-way power flow, managing the proliferation of distributed assets, coping with more frequent and severe weather events, and navigating the increasing variability in customer demand, among others. To effectively address these challenges and ensure efficient grid operations, utilities require a robust telecommunication network. This network must offer low latency and high bandwidth communication capabilities to facilitate seamless connection, data transmission, and control. However, current networks fall short of meeting these critical needs.

In this ebook, we look at the challenges that utilities face in achieving the energy transition and how the grid can evolve with the help of private networks and 5G. The first article addresses a crucial issue plaguing the energy system: the lack of interoperability standards. As new technologies emerge and old ones are updated, compatibility may become an issue, leading to inefficiencies, security vulnerabilities, and increased costs. Another issue for utilities is connectivity. The second article, “Extending Connectivity to the Grid Edge,” explains that utilities need better connectivity at the edge of the grid where renewables, smart meters, and EV charging connect.

This ebook also includes a report from IDC Energy Insights that asserts the importance of integrating advanced communications technologies in utilities’ operations. Operations are one major internal component that can be controlled and managed to improve the bottom line. Connectivity is the backbone of optimizing assets and overall operations.

Next, we dive into how private and 5G networks can handle increasing demand and address many challenges, which future-proofs our energy infrastructure. “Private Networks: Powering the Industry Energy Transition” discusses how private networks powered by 5G can be tailored specifically for the energy industry, providing reliable connectivity. This is where utility operations can be optimized, and various applications like smart metering, distributed energy resources (DERs), and grid automation can be supported.

5G technology is certainly shaking up the world of DERs, as shown in our final piece. 5G can transform how DERs operate, allowing the systems to communicate more efficiently and in real time, which means they can respond faster to changes in energy demand and supply. This isn’t just good for energy companies; it’s good for consumers too, because it means a more stable and reliable energy supply.

Empowering utilities.

Sponsored by

T-MOBILE FOR BUSINESS

T&DWorld

Lack of interoperability standards is putting the global energy system in jeopardy.

Disabling our energy infrastructure no longer requires on-site access, leaving it vulnerable to hackers worldwide.

Florian Kolb

A noted cybersecurity expert recently warned of cyberattacks on critical systems intended to “induce societal panic,” noting that the 2021 East Coast gasoline pipeline shutdown was merely foreshadowing what would happen if such an attack were executed on a massive scale. She painted a chaotic scenario in which Americans would be unable to perform daily activities, and in which critical systems—even the water supply—cease to function.

If this language sounds extreme, consider that it came from Congressional testimony given by Jen Easterly, Director of the U.S. Cybersecurity and Infrastructure Security Agency (CISA).

The truth is that AI is increasingly driving the systems that tie together our decentralized energy grids. These systems are also forming the backbone of new business models such as virtual power plants (VPPs), demand-side management, and Energy-as-a-Service (EaaS). AI has the potential to bring numerous benefits to a broad range of energy stakeholders. In fact, without the use of AI it’s unlikely

that we'll make meaningful strides in reducing greenhouse gas emissions or expanding the benefits of energy to underprivileged communities and countries.

On the flip side, reliance on AI and connected IoT networks means that these systems are increasingly under attack by sophisticated fraudsters, pranksters, or nation-state actors. While in a past era, disabling our energy infrastructure would have required physical sabotage carried out on-site, internet-based operations mean that if proper precautions aren't taken, energy systems could be disabled with a few keystrokes by hackers from anywhere in the world.

Challenges in data and device connectivity.

Today, energy companies leverage connected devices and software from a variety of vendors. To appreciate the scope of platforms and solutions involved, consider that in 2020, the utility software market was valued at USD 5.4 billion globally, and it is forecast to grow to USD 5.8 billion by 2025. A study from Guidehouse Insights indicates that by 2032 the electric utility software market may reach USD 37 billion. While the exact number of providers is unclear, a 2016 report identified thousands of vendors related to energy distribution.

This explosion in technology options has clear benefits, such as keeping individual components down through competition, and, in some cases, meeting specialized needs. However, without the benefit of universally agreed-upon security standards, it also carries the unintended consequence of creating siloed systems. Additionally, energy companies may find themselves restricted by integration-related obstacles and vendor lock-in, which makes it difficult to upgrade or acquire better technologies.

Organizations that find themselves hamstrung by vendor lock-in, silos, and integration challenges often have to sacrifice on numerous fronts. One of which is the ability to successfully implement AI, which must be able to access a wide range of systems.

Access to a full range of information, as well as the ability to facilitate collaboration between systems, is what makes it possible to make the kind of fully informed decisions required to optimize energy production, distribution, and other key elements of an efficient grid. Such access, however, requires consistent security and authentication between hardware and software systems. And there is a new risk emerging of getting locked in to a particular AI from vendors as well.

Lack of standardization leads to security gaps.

Lack of standardization for these systems creates massive operational burdens by increasing development and operating costs. While it is not clear exactly how much burden it puts on the energy industry specifically, we do know that in general the U.S.'s "technical debt"—or financial loss associated with relying on systems that no longer work due to the problems we've been discussing—is estimated at $2.41 trillion by the Consortium for Information & Software Quality (CISQ).

The problem areas discussed in the CISQ report, such as supply chain issues with underlying third-party components, are direct results of the lack of standardization that is endemic to the energy industry. These problems, in turn, may increase energy prices and complicate efforts to meet decarbonization goals and data-related regulatory requirements for data privacy and storage.

However, higher prices and regulatory hurdles may represent a best-case scenario for lack of standardization. The worst-case scenario involves complete disablement by hackers. If this sounds far-fetched, consider that at the same Congressional hearing referenced earlier, FBI Director Christopher Wray described recent discoveries regarding a state-sponsored hacking group, Volt Typhoon, that had taken control of hundreds of routers in pre-operational information gathering. According to Wray, these were conducted with the express purpose of preparing to destroy or degrade critical infrastructure, including the energy grid.

Benefits of standardization.

Granted, the conversation around security threats to energy infrastructure tends to be dark when one considers the stakes. There's a bright spot in this discussion, however. The same procedures required to standardize security and interoperability will also provide a host of benefits, each of which is necessary to achieve many important objectives for the energy industry, such as pollution reduction.

For example, standardization will facilitate collaboration in the energy value chain by allowing authorized humans and algorithms to freely exchange information. As Penn State professor of engineering Jacqueline O'Connor notes, collaboration across all aspects of the energy supply chain is a necessary step in increasing energy efficiency.

It will allow energy organizations to avoid many of the pitfalls and efficiency roadblocks common to all IT organizations, such as steep integration costs and vendor lock-in.

Additionally, standardization may drive cost reduction by spurring supplier competition. If standards can be agreed upon, a wider range of vendors will have the opportunity to create hardware and software solutions that meet the needs of a wide range of organizations.

Conclusion.

Energy companies are entering an era of both greater danger and greater

opportunity. As digital standards and interoperability are increasingly adopted and emphasized, the energy ecosystem will be positioned to maintain secure operating environments and achieve new levels of efficiency and flexibility.

About the author.

Florian Kolb

Florian Kolb is Chief Commercial Officer and General Manager at Intertrust. He has a 15-year career in a series of business leadership roles within the European energy industry. He is responsible for all of Intertrust's product sales and business development activities, as well as the company's initiatives in the energy and related industries. Kolb spent five years as CEO/Managing Director of Innogy's (formerly known as RWE) Silicon Valley innovation group. In that role, he led U.S. strategic investments and innovation activities, including building and managing a strategic investment portfolio aimed at assembling technology assets for data-driven business models for the energy industry.

He also helped incubate internal start-ups at Innogy, which led to the creation of DigiKoo and Livisi. In 2016, he founded Free Electrons, a global accelerator program now operated by a consortium of 10 leading international utilities. Florian holds a master's degree in political economics from the University of Passau, Germany, and has participated in executive programs at INSEAD and IMD Lausanne.

Empowering utilities.

Sponsored by

T&DWorld

Extending connectivity to the grid edge: Importance of private LTE and 5G.

As power and utilities companies strive to modernize, many will extend their connectivity to the grid edge through secure, wireless means.

Ricardo F. Rodriguez

The electric power sector is transforming rapidly. U.S. utilities contend with a growing portfolio of decentralized and intermittent energy resources. They also face challenges with stagnant demand, a range of new technologies, consumers whose interactions with other industries have accustomed them to a higher level of service and responsiveness, and competition from outside firms.

This new market context requires utilities to depart from the traditional focus of energy asset ownership and commodity electricity sales toward a “beyond energy” integrated services and technology-based business model. Industry 4.0 applications will be vital for utilities to remain secure and competitive. Such applications depend significantly on advanced communications networks and include:

- Advanced analytics
- Intelligent automated devices
- Real-time control
- Ubiquitous sensing
- Cloud connectivity
- Edge computing

So, where do power and utility companies, striving to modernize, focus their attention? The answer for many involves extending their connectivity to the grid edge through secure wireless means.

5G and advances in future connectivity.

For future connectivity, network advances are an ongoing endeavor. 5G mobile broadband services are the latest hype. This high-speed, low-latency wireless cellular network will play a crucial role in connecting large quantities of sensors

T&DWorld

and smart devices. It will also enable leading-edge technologies such as Ultra-HD (4K) streaming, self-driving car connectivity, and virtual/augmented reality (VR/AR) enhancements.

Beyond 5G, new cellular technologies are emerging that are specifically designed to support Internet of Things (IoT). Lower power wide area (LPWA) wireless technologies, like Cat-1, LTE-M, and NB-IoT, are offering utilities the opportunity to economically connect a wide array of network devices for metering and monitoring purposes. What makes LPWA options attractive is their low price, long battery life (10-plus years) and typically better reach into buildings or basements. In addition, the incremental improvements that brought these advanced versions of LTE (like small cells, carrier aggregation, and IoT interoperability) will pave the way for a smoother introduction of 5G.

The need for private LTE.

In addition to newer LPWA technology options, utilities have a growing interest in licensed or shared spectrum options, potentially for the deployment of private 4G LTE networks. Private LTE can be viewed as a utility building its own private cellular network within its territory and using it exclusively for the backhaul communications of distribution supervisory control and data acquisition (SCADA), distribution automation, advanced metering infrastructure (AMI), distributed energy resources (DERs), and other field applications. The advantages of private LTE include:

- The ability to manage the desired reliability and security level while building coverage to meet utility needs
- More control over the product lifecycle
- Economy of scale by reducing the number of disparate networks to manage
- Selection from several standards-based LTE endpoint manufacturers, which allows for a more plug-and-play environment
- Potentially lower maintenance costs compared with a variety of other communication alternatives

Recognizing these benefits, the Federal Communications Commission (FCC) adopted a notice of proposed rulemaking in 2019 that would allow a broadband allocation at 900 MHz. The rulemaking will reconfigure the band from its current narrowband-only allocation and open up the possibility that the band could support private LTE in addition to private two-way radio systems. Currently in the final stages of approval, the rulemaking offers utilities an opportunity to optimize their wireless networks so they are both interoperable and future-proof. To achieve this, utilities should standardize on LTE technology and on the spectrum band in which it is deployed.

Combined with built-for-purpose equipment, the availability of the shared access 3.5 GHz band in the United States will enable utilities to deploy and operate a private LTE network. The 3.5 GHz shared access band, known as Citizens Broadband Radio Service (CBRS), is making 150 MHz of spectrum available on a lightly licensed, shared access basis using a three-tiered model. Tier 1 is used by incumbents such as the Navy, Department of Defense, and by military satellites. The two lower tiers are allocated for commercial use. This spectrum-sharing model will be administered by one of five companies chosen by the FCC to be Spectrum Access Systems Administrators: Federated Wireless, Google, CommScope, Amdocs, and Sony.

The CBRS band will allow a wide range of companies (including utilities) to develop, build, and operate their own wireless networks without being beholden to a wireless carrier. While companies have been able to establish their own Wi-Fi networks for years, if they wanted to use cellular networking technologies like LTE, they had to use a network owned by a mobile network operator. The FCC began auctioning CBRS licenses in June 2020 called Priority Access Licenses, which may be of interest to some utilities. Others can still secure General Authorized Access to the CBRS spectrum, enabling them to build and operate their own private LTE networks at their facilities and other locations without needing a license from the FCC, which was previously a significant barrier to entry.

The path forward.

In the past, utilities viewed communications networks as a compulsory cost of doing business. Those days are over. Utility modernization requires a communications network that is foundational to the delivery of safe and reliable service to customers, today and in the future. As an increasingly complex grid depends ever more upon data, the communications network becomes one of the utility's key strategic assets.

About the author.

Ricardo F. Rodriguez

Ricardo F. Rodriguez is a research analyst with Navigant Research, contributing to the Energy Storage service. Rodriguez, who is focused on distributed energy storage, specializes in financial and regulatory analysis, market sizing and forecasting, and business process improvement for energy storage and other distributed energy technologies.

The increasing need for advanced communication technologies in utilities operations.

Utility companies must establish a foundation of advanced communications and connectivity to realize a successful digital transformation strategy.

John Villali, Research Director, IDC Energy Insights, and **Jason Leigh,** Research Manager, Mobility

The need for advanced communications in utilities operations.

Many utility companies are rethinking the need to invest in advanced communications technologies to update their infrastructure to better capture operational intelligence and implement more comprehensive analytics functionality. The industry's path toward digital maturity will increase the demand for innovative technologies that will transform how utility companies operate by increasing operational intelligence, which will support a reduction in both costs and carbon emissions. Furthermore, changing market dynamics and economic conditions, coupled with cyclical volatility in energy commodity prices and tightening environmental regulations, have the utilities industry focusing on how best to optimize its operations.

With the exception of external factors, such as energy market conditions and environmental regulatory pressure, operations are one major internal component that can be controlled and managed to improve the bottom line of utilities companies.

Empowering utilities.

Sponsored by

T-MOBILE FOR BUSINESS

T&DWorld

A digital and strategic approach to operations can improve operating margins, improve asset performance, and extend the life cycles of assets and equipment while overall improving safety and operational productivity when effectively managing and maintaining critical assets.

The backbone of optimizing assets and overall operations in the utilities sector is a solid connectivity foundation and strategy. Advanced communications that integrate 5G connectivity with other capabilities, such as mobile edge compute, network slicing, data analytics, and unified communication and collaboration (UC&C) solutions, can vastly improve operations throughout the utility value chain, from generation, transmission, or distribution, all the way down to field services. The use of 5G communication networks, which enable access to IoT and AI capabilities, can improve the efficiency, productivity, and security of both assets and technicians in the field. The investment in secure, low-latency 5G communications, in combination with existing private 4G/5G networks, can unleash these benefits and aid in improving a utility company's overall sustainability profile. It should be noted that many of these benefits can also be realized via LTE, the cellular generation that preceded 5G.

One area where communication technologies can provide utility companies with positive results, and an ROI in a brief period of time, is around asset management. A strategic approach to asset management is one that takes a data-driven approach to operations, which can provide real-time insight on a utility asset's health and performance while providing operational decision support. Communication technologies can enable the remote monitoring and diagnostics of equipment and assets and utility companies prevent operational and asset issues and failures before it is too late.

Digitizing assets with modernized communication technology to create digital twins of assets in the field provides utility companies the ability to predict and prevent asset failure as well as help prescribe the best practices and approaches to resolve asset issues in a timely manner through the use of AI, machine learning, and advanced analytics. The use of secure, low-latency private cellular networks or a hybrid of both private and public mobile networks in combination with fixed wireless accesses and IoT with edge compute capabilities can provide comprehensive visibility into operations. This can provide real-time, mission-critical intelligence and automation to very remote areas where many utility assets operate. This is particularly important with the expansion of utility-connected renewable resources, such as solar and wind farms, which can be located either onshore or offshore.

In addition to asset performance, the global movement of the energy transition—moving away from traditional fossil fuels, such as coal, gas, and oil, toward green energy to decrease carbon emissions—is putting sustainable operations front and center in the utilities sector. Modern communication systems, such as private and public 4G/5G networks, can enable data-driven, cloud-based digital operational platforms to collect and analyze volumes of data from devices on assets at the edge. That, in turn, allows companies to act on insights and automate responses to best account for and reduce carbon emissions within operations, leading to positive business, environmental, operational, and reputational outcomes.

This spotlight highlights some of the benefits that advanced communications can bring to utility organizations by supplementing or optimizing existing communications infrastructure, while not disrupting current operations.

Benefits of advanced communications throughout utilities value chain.

Changing market dynamics, increased environmental regulations, and cyclical volatility in energy prices have utility executives shifting priorities and making more investments to better optimize their operations. Advanced connectivity, in combination with existing communication infrastructure, can enable better optimization of operations throughout the value chain, providing utilities with the frequent collection and analysis of relevant asset and operations data to make better-informed decisions. For example, by analyzing historical data and detecting anomalies, operators can be alerted when an asset or a piece of equipment is degrading and proactively dispatch maintenance technicians to resolve the issue and avoid a major disruption in operations. Taking a proactive, condition-based approach to maintenance can be much more cost effective than a scheduled or reactive break/fix approach to asset management. Whether it is remote monitoring and diagnostics, asset automation, or granting access to timely information for field workers, secure, low-latency connectivity via private 4G/5G networks can enhance many areas and functions throughout operations. Assisting field workers and arming them with the most up-to-date and accurate data and information needed to be efficient onsite can also be achieved through 5G-enabled devices, such as laptops and tablets. 5G devices can also enable remote assistance from experienced technicians who are offsite, saving both time and costs on asset maintenance.

Utilities and power companies that own or operate generating facilities can leverage advanced communications in this core area of operations. Advanced connectivity, such as private and public cellular and microwave networks, along with fiber-optic communication networks, can be used for point-to-point communication, data transfer, navigation, and monitoring. Specific to the increase of green energy assets, communication networks can provide a robust infrastructure

for collecting, analyzing, and transmitting data from remote renewable energy sources. They enable seamless communication between various components of renewable energy systems, including sensors, inverters, and energy management systems. By establishing a reliable flow of information, these networks optimize energy production and allow for more accurate forecasting and scheduling of renewable power.

The transmission segment of the utility value chain can also benefit from advanced communications. The high-voltage transmission electric grid is a complex, interconnected, and interdependent system that is responsible for providing safe, reliable, and cost-effective electricity to customers. Communications technologies can provide congestion relief on transmission lines by leveraging strategically placed sensors in areas where power line capacity is prone to be tight. By using advanced communications transmission, owners and operators can gain insight into the best ways to actively change the way power flows through the transmission system without making changes to generator dispatch or the topology of the network. Avoiding transmission congestion and line losses can lead to significant cost savings and mitigate risks by improving transmission system reliability.

In addition, the utility distribution system can leverage advanced communications to optimize the low-voltage grid and navigate the increased complexities of the distribution system due to the steady increases in distributed energy resources (DERs) such as rooftop solar, electric vehicles, and microgrids. Wireless communications and protocols can provide distribution network operators better visibility, control, and management of behind-the-meter DERs, which can ensure optimal power flow and economic dispatch of these and other DERs.

The utility industry is ripe to produce more innovative processes faster than ever to accelerate decarbonization and accommodate the influx of new sustainable and green energy resources. Advanced communications can support operational platforms and technologies, energy management systems, advanced distribution management systems, and distributed energy resource management systems, which are all essential for advancing decarbonization efforts and producing reliable, clean, and affordable energy.

Considering T-Mobile for advanced communications in the utilities sector.

T-Mobile for Business is a leading provider of business wireless connectivity and networking solutions. The portfolio begins with the company's top-rated 5G network, which, according to various independent testing agencies, provides market-leading 5G speed, coverage, latency, and reliability. In addition to 5G mobile service, T-Mobile for Business offers nationwide fixed wireless broadband (FWB), branded as "Business Internet," that serves as either primary or failover connectivity for single-location and multilocation businesses.

All of those robust connectivity options fuel the 5G Advanced Industry Solutions (5G AIS) portfolio from T-Mobile for Business, which provides a comprehensive yet flexible suite of end-to-end 5G solutions that blend connectivity with edge compute and industry-specific solutions for the utilities sector's advanced communications needs.

With 5G Advanced Network Solutions (5G ANS) from T-Mobile, businesses can mix and match performance features to meet connectivity and compute needs of a diverse set of use cases that drive the digital transformation agenda for utility companies. T-Mobile for Business can provide end-to-end support across utilities organization's entire connectivity journey—from infrastructure implementation to mobile devices and managed network services, analytics, and unified connections. The utilities specialists at T-Mobile for Business provide insight and guidance around connectivity solutions to address carbon regulations, network security, and use case prioritization. Connected workforce safety programs, industrial automation, remote monitoring, digital twins, and video surveillance are leading IoT use cases that can be enabled by 5G ANS to deliver operational efficiency and cost management for utilities companies. With 40% of enterprises citing poor network latency levels and another 37% pointing to the cost of connectivity as significant challenges in scaling IoT network deployments, 5G ANS allows organizations to tap into low-latency 5G network performance without the significant start-up costs of deploying a dedicated private 4G/5G network. The utilities specialists at T-Mobile also provide a 360-degree approach to solution implementation, ensuring that connectivity and network solutions coalesce with disparate technologies for a frictionless management and control system. T-Mobile has a wide reach, with its 5G network covering 98% of Americans and its faster Ultra Capacity 5G covering 300 million people (as of 3Q23), coverage that is of particular importance to utility companies that have assets and operations in rural areas.

Beyond connectivity and edge compute resources, 5G ANS includes a full portfolio of voice and collaboration, IoT, security, and productivity solutions to address varying business connectivity and communications needs.

Challenges.

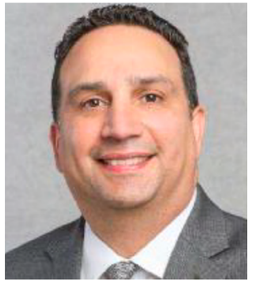
The utilities sector is not usually first in line to quickly adopt emerging technologies. Historically, the legacy communication networks supporting the industry have been a patchwork of different technologies, all at varying states of modernization, further complicating the already fragile digital transformation efforts for some utility

companies. With T-Mobile for Business being a relatively new entrant to the business wireless networking landscape, it will need to lean on established deployments in other industries and proof of concepts tailored to the utilities industry to establish its bona fides fully. Convincing utilities to leverage advanced communications approaches, such as 5G ANS, will require detailed road maps that streamline the adoption and integration of new business and operational models. Because introducing emerging communication technologies is a substantial change to the way utilities operations have been managed historically, T-Mobile for Business will need to establish close, high-touch, and highly customized partnerships with its utility clients and ensure that solutions for the industry are interoperable with existing legacy communications to avoid rip-and-replace disruptions. Understanding and accommodating the digital maturity of individual utilities companies, along with the integration and interoperability of existing communications—many utilities companies being homegrown and built internally—will be key for successfully implementing and leveraging advanced communication in the industry.

Conclusion.

As utilities companies seek to successfully navigate an uncertain economic landscape, ever-volatile energy prices, and intensifying environmental regulation, embracing digital transformation enabled by the next generation of connectivity and advanced network services is essential. With advanced connectivity and network services, utilities companies can realize the critical operational agility and resilience needed to compete and grow in a competitive and highly regulated marketplace. Linking far-flung operations via high-performing connectivity and low-latency compute resources fuels greater automation and real-time actionable insights that can improve safety, productivity, and operating margins, delivering material benefits for utilities companies, their shareholders, and the utilities industry at large.

About the analysts.



John Villali, Research Director, IDC Energy Insights

John Villali is a research director for IDC Energy Insights, primarily responsible for thought leadership in the areas of digital strategies and smart operations in the energy and utilities sector. Villali's expansive experience within the energy industry allows him to provide superior market insight, having firsthand experience in understanding and meeting the needs of professionals in the energy industry. Villali's core research coverage includes but is not limited to asset performance management, energy policy, distributed energy management, demand response, mobile workforce management, energy trading, and the energy transition.

Jason Leigh, Research Manager, Mobility

Jason Leigh is a research manager for IDC's mobility team, responsible for 5G and mobile operator research. Leigh's research focuses on the strategic implications and market opportunities presented by the emerging 5G ecosystem, including commercial availability, installed base forecasts, regional adoption trends, content and services enablement, device impacts, 5G's role in IoT, and innovative use cases leveraging 5G.

Empowering utilities.

Sponsored by

T-MOBILE FOR BUSINESS

T&DWorld

Private networks: Powering the energy industry transition.

Natacha Baroni, Head of Energy Product Marketing at T-Mobile for Business

Digitization of utilities and oil and gas companies offers immense value potential for the energy sector. Utilities are adopting advanced metering infrastructures to incorporate an abundance of distributed energy resources and smart appliances. However, revolutionizing the energy industry also requires incumbents to implement solutions that boost data transmission and connectivity capabilities while extending them exactly where they're needed.

Networks in the energy industry currently use a patchwork of technologies at various stages of development. To transform operations, you need to connect thousands of devices spread over miles of territory with a single 5G- and LTE-powered private network that supports fast, secure, high-throughput communications—and that's easier to manage than assorted technologies.

5G and LTE technologies enable a multi-service private network that gives you

the capacity to meet customer demand for enhanced experiences, face challenges from aggressive competitors, adopt wireless solutions to upgrade operations, and improve efficiencies.

Five key benefits.

Private wireless networks segregate traffic from the public macro network. With lower latency and higher bandwidth, they promote greater efficiencies, reliability, safety, and security—and cut operating costs. Here's a closer look at the five ways private networks will revolutionize the energy industry.

Efficiencies: Private networks allow data collection, communication, and analysis in real time, supporting fast and effective decision making. By accelerating transmission of critical data, such as sensor readings, companies can better monitor equipment performance and predict maintenance needs, cutting downtime and increasing efficiency.

Reliability: In remote and challenging environments, private networks provide the dependable and robust connectivity for communication and coordination between field workers and operations centers. The dedicated and secure communication channel lowers the risk of interference and breaches. If necessary, private networks can also failover to the public commercial network, keeping critical infrastructure operating even in an outage or crisis.

Safety: Private networks support real-time environmental monitoring and video surveillance of potential hazards, such as leaks or equipment malfunctions, along with instantaneous alerts. In an emergency, the ability to communicate rapidly helps shorten response time. And by supporting drones and autonomous equipment, private networks let machines take over jobs too dangerous for humans, minimizing accidents and injuries.

Data security: Separation from public networks lets private networks provide more secure communication and data storage, protecting sensitive information from cyber threats and keeping data contained on-site. You can also configure private networks with advanced security protocols for an extra layer of protection and design them with specific requirements to control network access and user privilege.

Reduced operating costs: Using private networks optimizes operations and reduces downtime. By supporting automation and autonomous systems, private networks reduce the need for manual monitoring, inspections, and maintenance. In addition, private networks move operations away from costly copper lease lines and satellite links.

T-Mobile for Business can guide your transition.

T-Mobile's experts will work with you from beginning to end to help you select a network solution and achieve your modernization goals.

T-Mobile for Business is helping energy companies improve connected customer experiences with the country's largest and fastest 5G network. At T-Mobile for Business, we're focused on providing your business with connectivity solutions and dedicated, exceptional service you need to help you stay ahead. To learn more about how T-Mobile is architecting integrated solutions for energy providers that revolutionize digital transformation by leveraging the power and capabilities of 5G, or to connect with a T-Mobile Business Expert to get started, visit our Energy industry page.

About the author.

Natacha Baroni

Natacha Baroni is the Head of Energy Product Marketing at T-Mobile for Business, with more than a decade of experience enabling customers in the energy industry to improve efficiency, digital transformation, and safety. Specializing in marketing and product management, Natacha uses her experience to bring industry and customer perspectives into the development of business initiatives and go-to-market strategies to best meet industry needs.

Natacha holds a B.Sc. in chemistry from the University of Wisconsin, Milwaukee, and an MBA from Olin Business School, Washington University in St. Louis.

Fastest: Based on median, overall combined 5G speeds according to analysis by Ookla® of Speedtest Intelligence® data 5G download speeds for Q4 2023. See 5G device, coverage, & access details at T-Mobile.com.

How 5G will support the evolution of distributed energy resources.

The utility space is transitioning from traditional centralized grids with one-way power flows to modern distributed energy resource (DER) systems with bi-directional flows. Customers are becoming small electricity producers through emerging solar, wind, and battery storage technologies that can push power back onto the grid and reduce overall volume and peak demands when needed.

To achieve the potential of DERs, millions of devices must be connected in a network that satisfies strict requirements for performance and reliability. Utilities will need communications with higher speeds, greater bandwidth, and lower latency to transmit massive amounts of critical data in real time to support distributed energy.

How 5G networks will lend a helping hand to DERs.

Managing DER energy supply in real time for grid balancing.

The global DER generation market is growing rapidly, with a compound annual growth rate (CAGR) of 10.6% anticipated through 2027.[1] Utilities can use these new generation assets to meet growing electricity demand—and avoid building additional and expensive power plants or peaking plants that may also emit greenhouse gases.

Deloitte notes that some providers are even combining DER systems into "suites" that include solar photovoltaics plus battery storage, along with energy

Empowering utilities.

Sponsored by

T-MOBILE FOR BUSINESS

T&DWorld

management applications and smart inverters.[2]

At the same time, residential smart thermostats, appliances, and water heaters are replacing direct load controls as a primary source of demand response. Using these smart utility technologies to reduce or shift demand, customers help balance utility-generated variable energy resources (VER), like solar and wind power.

Taking advantage of DER requires a Smart Grid that integrates emerging digital technologies and provides the data utilities that customers need.[3] A robust and reliable 5G network, such as T-Mobile's 5G network that covers 320 million people across 1.8 million square miles, can deliver the connectivity advantages needed by both utilities and consumers alike.

Pricing to influence electric vehicle charging times.
Another opportunity for demand response comes from electric vehicle (EV) charging. Utilities can influence charging times by reducing rates when electricity is abundant and raising them when demand peaks. Through grid intelligence, utilities can also encourage customers to use inexpensive renewable energy for EV charging when it's available.

Some EV batteries also provide the option to push energy back into the grid. This serves a dual purpose—rewarding owners with payments when possible and minimizing the need to construct more generation facilities. To support near-real-time communications and rapid changes in grid power, these advanced capabilities will require the high data transfer speed and low latency that 5G networks can provide.

Delivering information for better consumer energy decisions.
Whether they're making decisions on energy or EV charging, customers want more choice, convenience, and control.

But they need up-to-date rate information to help them make informed decisions and incentivize behavior that supports the utility's priorities. For example, smart meters can let customers see how much electricity they use, when they use it, and what it costs while letting utilities monitor systems and bill customers without a meter reader.

5G connectivity can provide the instantaneous data consumers need. By combining this data with real-time pricing, customers can save money by scheduling their power use—and utilities benefit from reduced demand during peak periods.

Scaling up renewable resource integration and community participation.
Governments worldwide are encouraging citizens to use and generate renewable energy. Many consumers and enterprises would like to share the excess energy they produce with the grid or each other. In some markets, system operators are already working to let DER providers aggregate resources for sale into wholesale markets.

Smart grid technology allows better integration of customer-owned power generation, including renewable energy systems. When electricity isn't available from utilities, the grid can tap customer-generated power. Analytical tools also let utilities predict energy demand, detect outages, and respond immediately to problems to improve customer experience.

With real-time collection and analysis of massive data from many and varied devices, 5G will play an essential role in integrating renewable resources in seamless energy distribution and promoting community involvement.

Connectivity empowers DERs.
The evolution of DERs requires robust, consistent connectivity to deliver the performance, latency, and reliability utilities and consumers need. The network must be built to support emerging technologies and encompass the utility's entire service area.

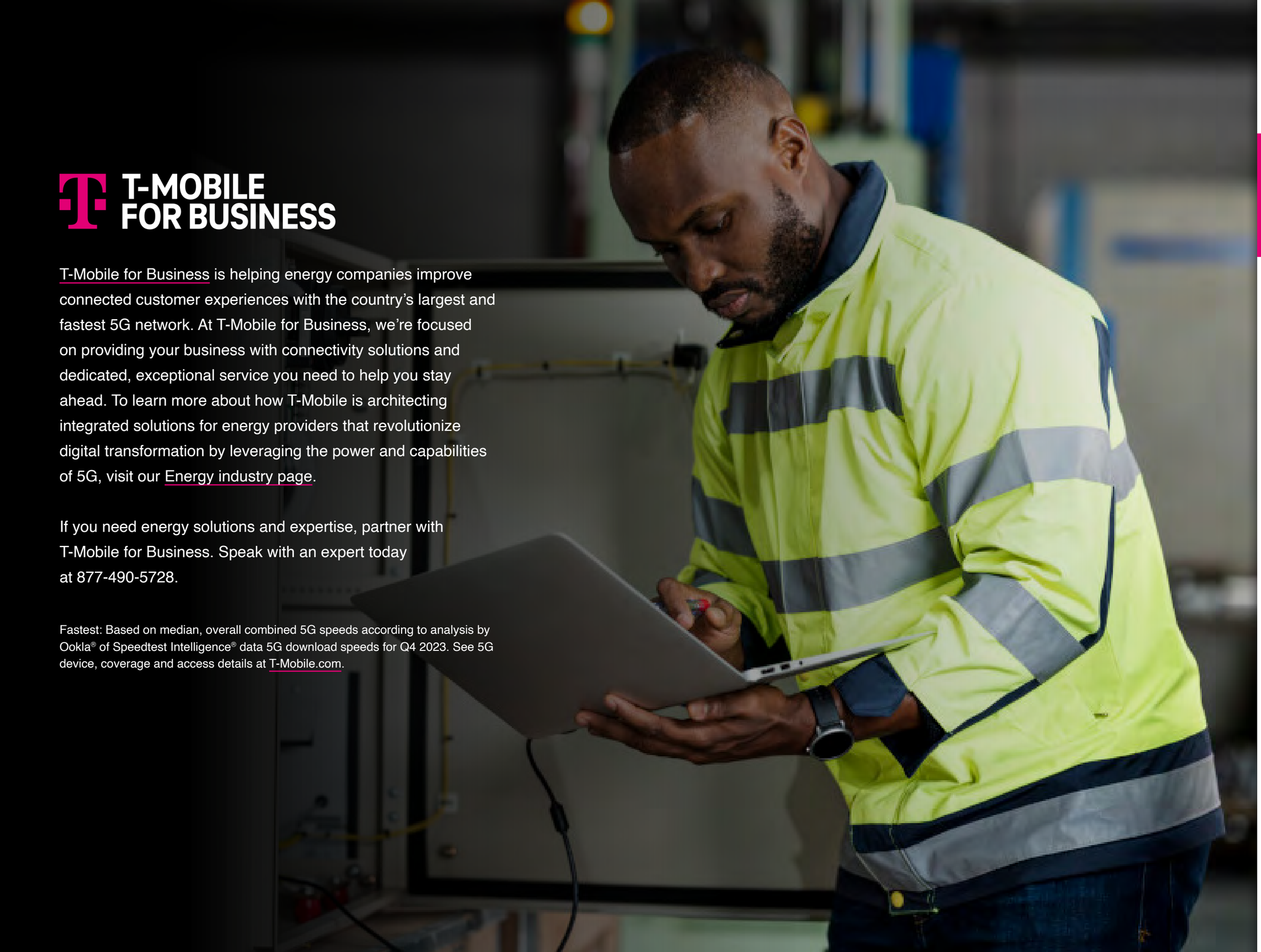
With America's largest 5G network, covering more than 330 million people across 2 million square miles, T-Mobile can support almost any utility in the country. For more information, contact a T-Mobile Business Expert.

5G: Capable device required; coverage not available in some areas. Some uses may require a certain plan or feature; see T-Mobile.com.5G use cases are still emerging and new devices being created; see details on current 5G capabilities & services.

[1]"Worldwide Distributed Energy Generation Market Is Expected to Reach USD 532.3 Bn by 2027 -ResearchCMFE." ResearchCMFE, ResearchCMFE, November 30, 2021, https://www.globenewswire.com/news-release/2021/11/30/2343346/0/en/Worldwide-Distributed-Energy-Generation-Market-is-Expected-to-Reach-USD-532-3-Bn-by-2027-ResearchCMFE.html. Accessed September 15, 2022.

[2]Deloitte Center for Energy Solutions, "Managing Variable and Distributed Energy Resources: A New Era for the Grid." Accessed September 15, 2022.

[3]"The Smart Grid." Smart Grid: The Smart Grid | SmartGrid.gov, SmartGrid.gov, December 16, 2019, https://www.smartgrid.gov/the_smart_grid/smart_grid.html. Accessed September 15, 2022.



T-MOBILE FOR BUSINESS

T-Mobile for Business is helping energy companies improve connected customer experiences with the country's largest and fastest 5G network. At T-Mobile for Business, we're focused on providing your business with connectivity solutions and dedicated, exceptional service you need to help you stay ahead. To learn more about how T-Mobile is architecting integrated solutions for energy providers that revolutionize digital transformation by leveraging the power and capabilities of 5G, visit our Energy industry page.

If you need energy solutions and expertise, partner with T-Mobile for Business. Speak with an expert today at 877-490-5728.

Fastest: Based on median, overall combined 5G speeds according to analysis by Ookla® of Speedtest Intelligence® data 5G download speeds for Q4 2023. See 5G device, coverage and access details at T-Mobile.com.

Empowering utilities.

Sponsored by

T-MOBILE FOR BUSINESS

T&DWorld™