Telecommunications: The Cornerstone of Grid Modernization

by **Kathy Nelson**

The utility industry is undergoing a significant transformation, with telecommunications emerging as a critical enabler of grid modernization. As electric grids evolve to become smarter, more efficient, and more resilient, the importance of robust, reliable, and versatile telecommunications infrastructure cannot be overstated. This article explores the pivotal role telecommunications play in shaping the electric grids of the future and the paradigm shift occurring in utility telecommunications strategies.

Evolution of Telecommunications in Utilities

Utilities have used private telecommunications networks, both wired and wireless, since the 1960s for communications needs such as field crew communications using Land Mobile Radio (LMR) networks and Supervisory Control and Data Acquistion (SCADA) communications

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for generation and transmission grid monitoring and control.

These narrow-channel, purpose-built networks were designed to meet specific utility needs and served as their communications systems for several decades. As additional utility capabilities increased over time, networks to support use cases such as Automated Meter Reading (AMR) and then Advanced Metering Infrastructure (AMI), Distribution Automation (DA) on distribution feeders, physical security of facilities and a myriad of other use cases emerged resulting in a patchwork of siloed systems. While these purpose-built networks served their purpose for decades, new technologies now offer greater capabilities.

As these purpose-built networks age and approach end of life, coupled with the demands of grid modernization, they are driving a fundamental change in this approach. Modern grids require real-time data exchange, advanced control systems, and seamless integration of distributed energy resources - all of which depend on sophisticated telecommunications infrastructure.

Modernizing Utility Telecommunications

Utilities are shifting from legacy systems to advanced telecommunications infrastructure, which supports multiple use cases on a single network. Technologies such as private LTE (PLTE) and other wideband solutions are replacing the single-purpose networks of the past. This consolidation improves operational efficiency, provides flexibility, and allows utilities to scale their networks to meet future grid requirements.

The Critical Role of Spectrum Selection

One of the most crucial aspects of implementing modern utility telecommunications networks is the selection of appropriate radio frequency (RF) spectrum. The choice of spectrum directly impacts the capabilities, performance, coverage, and capacity of the network. Utilities must carefully weigh factors such as propagation characteristics, interference potential, and regulatory constraints when choosing their spectrum.

Low-band spectrum (below 1 GHz) offers excellent coverage and building penetration, making it ideal for wide-area networks in rural areas. Mid-band spectrum (1-6 GHz) provides a balance of coverage and capacity, suitable for suburban and urban deployments. High-band spectrum (above 6 GHz) offers increased capacity but limited range, making it appropriate for specific high-density applications.

The shift to broadband or wideband spectrum marks a significant change for many utilities that are used to operating within licensed narrowband spectrum.

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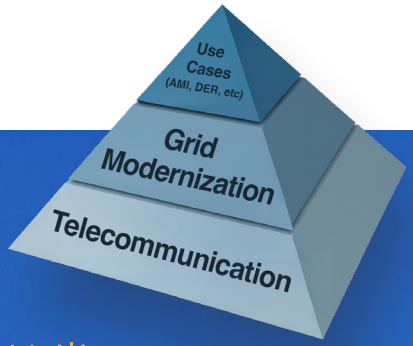

Although this transition often requires substantial investment, it offers greater capacity and enables utilities to support multiple use cases on a single telecommunications network.

Educating Stakeholders on Telecommunications Importance

Traditionally, telecommunications expertise within utilities was concentrated in the Information Technology (IT) department, with the Chief Information Officer (CIO) often being the sole executive aware of its importance. As telecommunications become central to utility operations, there is a growing need to educate other C-suite executives and regulators on its critical role.

Utility leaders must recognize that modern telecommunications networks are operational assets that directly impact grid reliability, efficiency, and resilience. Similarly, regulators need to be educated about the importance of these investments to ensure the implementation of appropriate cost recovery mechanisms.

Spectrum acquisition is a critical area for stakeholder education. Narrowband spectrum for purpose-built utility networks is generally low-cost, but modern wideband or broadband systems often require regulatory petitions and detailed technical justifications. In the United States, these licenses are frequently obtained through the secondary market at much higher cost, making clear communication of the investment imperative to both internal and external stakeholders.

Tailored Solutions for Unique Utility Needs

While the trend towards advanced telecommunications networks is clear, it's crucial to recognize that there's no one-size-fits-all solution. Each utility must conduct a thorough analysis of its unique needs, considering factors such as:

- Geographic service area and terrain
- Device density and distribution
- Existing infrastructure
- Regulatory environment
- Long-term grid modernization goals
- Budget constraints

A solution that works for a large urban utility may not be suitable for a rural cooperative. Some utilities may adopt a hybrid approach, combining private LTE in urban areas with narrowband solutions for remote locations, while others may opt for a fully private solution or partner with commercial carriers.

Challenges and Opportunities

The transition to advanced telecommunications networks presents both challenges and opportunities. One of the primary challenges is keeping pace with rapid technological advancements. Utilities must make informed decisions about which technologies to invest in, balancing the risk of obsolescence with the potential benefits.

Another challenge is integrating new telecommunications systems with existing infrastructure. Many utilities have a mix of legacy systems and modern technology, and ensuring smooth interoperability can be complex and time-consuming.

Despite these challenges, advanced telecommunications networks offer considerable opportunities, including:

- Real-time monitoring and control of distributed energy resources
- Advanced outage management and self-healing grid capabilities
- Enhanced customer engagement platforms
- Improved cybersecurity measures for increasingly connected grids
- Multiple use cases served by one telecommunications network

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The Future Landscape of Utility Telecommunications

Looking ahead, telecommunications will become fully integrated into every aspect of utility operations. The traditional boundaries between Information Technology (IT) and Operational Technology (OT) will continue to blur, leading to more holistic and efficient grid management systems.

Utilities are likely to build private broadband or wideband networks, either independently or through partnerships. These networks will support not only basic utility operations but also emerging technologies like IoT sensors, edge computing, and augmented reality for field workers.

Collaboration between utilities on telecommunications infrastructure is also expected to increase, with shared networks helping to distribute costs and maximize benefits, especially for smaller utilities with limited resources.

Embracing the Telecommunications Revolution

As the utility industry continues to evolve, telecommunications is no longer just a support function - it's a strategic asset that will play a crucial role in shaping the future of the sector. Utility leadership must elevate telecommunications in their strategic planning, invest in building internal expertise, educate stakeholders about its importance, and make informed, forward-looking decisions about telecommunications infrastructure.

The utilities that successfully navigate this telecommunications revolution will be best positioned to thrive in the era of grid modernization. They will achieve greater efficiency, enhanced resiliency, and improved ability to integrate new technologies and energy sources that are transforming the industry.

In conclusion, embracing this telecommunications revolution is not merely about keeping pace with technology – it's about laying the foundation for reliable, efficient, and sustainable electric grids of the future. As the energy landscape continues to evolve, those utilities that prioritize robust, flexible, and forward-looking telecommunications strategies will be best equipped to meet the challenges and opportunities that lie ahead.