WHITE PAPER

Leveraging the Supply Zone to Enable Broadband Deployment

Jake Adams, Product Line Manager – OSP Connectivity

ABSTRACT

Grid modernization is a vital initiative undertaken by electric utility companies to enhance the efficiency, reliability and resilience of the electricity grid, while integrating renewable energy sources and advanced technologies. As part of this transformation, the deployment of fiber optic communication networks plays a pivotal role in facilitating real-time data transmission, monitoring, and control of grid components. This white paper delves into the advantages of leveraging Fiber to the "x" (FTTx) buildouts for grid modernization and explores the benefits of All-Dielectric Self-Supporting (ADSS) fiber optic technology. The focus is on how ADSS's self-supporting capability, reliability and cost-effectiveness and FTTx buildouts can enhance communication infrastructure for grid modernization efforts.

INTRODUCTION

Electric utility companies, including both private and publicly owned energy providers, have a rich history of deploying fiber networks for both internal use with supervisory control and data acquisition systems or traditional Ethernet systems, and/or utilizing their existing right-of-way to install dark fiber then leasing to a variety of customers. As utilities often sell or lease the space below the neutral to various service providers, running fiber optic cables in the supply zone or neutral space, above the communications space, is key to these deployments to prevent clashing of cables.

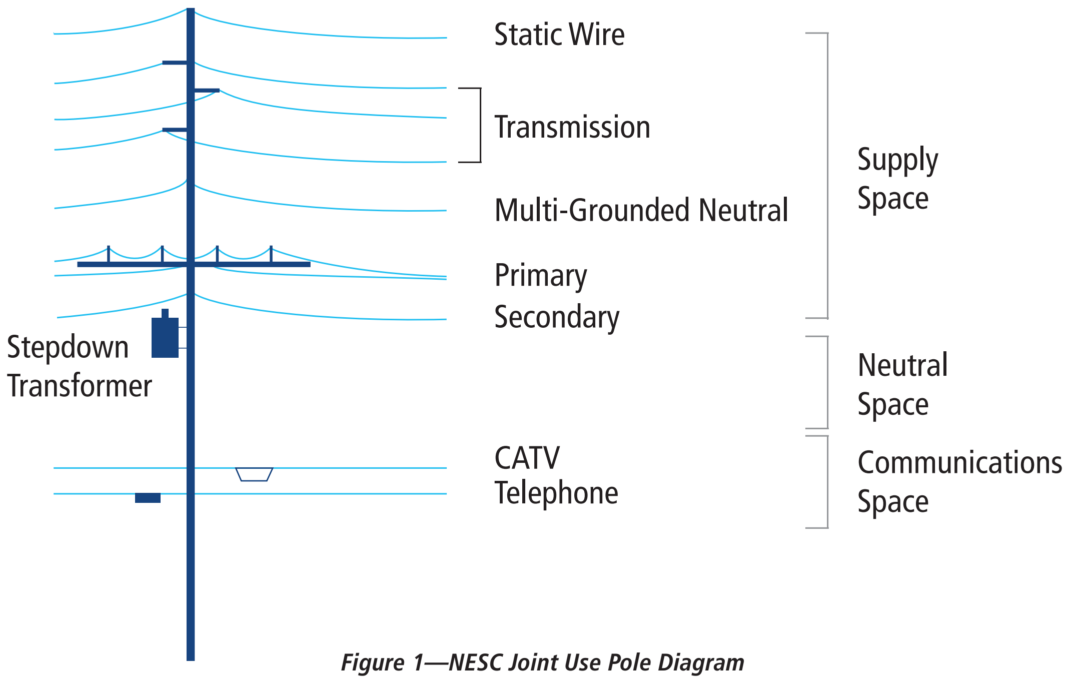

Figure 1—NESC Joint Use Pole Diagram

In recent years, electric cooperatives have also actively participated in the buildout of FTTx networks for their members. As member-owned and not-for-profit organizations, electric cooperatives have embraced FTTx deployments to deliver high-speed internet, telecommunication and smart grid services to their rural communities, empowering their members with modern communication technologies. These FTTx networks have not only improved connectivity but also paved the way for leveraging existing infrastructure for comprehensive grid modernization efforts.

Grid modernization has become a paramount initiative in the energy sector, driven by various factors, including the Department of Energy's (DoE) Grid Modernization Initiative (GMI). The DoE's GMI is a comprehensive program aimed at transforming the nation's electricity grid to meet the evolving energy landscape's challenges and demands. A modern grid must possess several key attributes, including greater resilience to hazards of all types, improved reliability for everyday operations, enhanced security to counter an increasing and evolving number of threats, additional affordability to maintain economic prosperity, superior flexibility to respond to the variability and uncertainty of conditions and increased sustainability through the integration of energy-efficient and renewable resources.

As a foundational component of grid modernization, the deployment of robust fiber optic communication networks is essential in facilitating real-time data transmission, monitoring and control of grid components. The integration of ADSS technology has emerged as a superior solution in this context due to its self-supporting capability, reliability and cost-effectiveness. By leveraging the existing FTTx buildout, electric cooperatives and other utility companies can enhance their grid communication infrastructure, ensuring seamless data exchange and coordination among various grid elements.

UTILITY FIBER OPTIC CABLE SOLUTIONS

In the context of advancing grid modernization initiatives, the development of ADSS cables by fiber optic manufacturers has been instrumental. These cables, distinguished by their dielectric construction, enable seamless pole-to-pole spans without the need for a separate messenger wire. This innovative design mitigates concerns about induced charges from overhead lines, thereby enhancing safety measures without requiring additional grounding. While flat drop cables also possess self-support capabilities, ADSS cables stand out for their robustness, enabling longer spans of over 1,500 feet between poles, depending on the cable's specific design.

ADSS cables, such as AFL's Flex-Span® ADSS Fiber Optic Cable, offer both technical and cost advantages over self-support flat drop and lashed cables in various scenarios. When comparing ADSS and lashed cable installations in new builds where messengers are absent or unavailable, it becomes evident that the two-pass installation process of lashed cables, along with bonding and grounding requirements, adds complexity and can extend installation times by 30-35% on average.

Additionally, the maintenance demands of lashed networks warrant consideration. Common issues like loose "bug nuts" and lashing wires necessitate extra labor to prevent cable strain during adverse weather conditions. Notably, ice loading poses a challenge for lashed cables, potentially limiting span length performance. The larger cross-sections of lashed cables, including messengers and additional cables, are susceptible to increased radial ice, resulting in higher loading on strands, cables and poles.

The implications of excessive ice loading extend beyond immediate damage. It can lead to permanent stretching of metallic messengers, causing sagging over time. This issue cannot be rectified once the ice load is removed, potentially requiring strand replacement in cases of non-compliance with vertical clearance standards or excessive strain on lashed cables. ADSS technology, with its innate resilience and reliability, emerges as a paramount solution in the journey towards grid modernization.

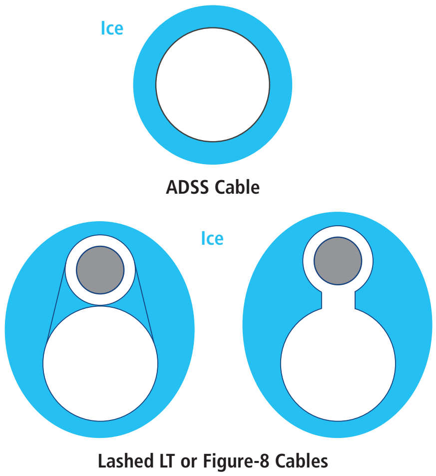

Figure 2—Comparison of Ice Loading on ADSS vs. Lashed Loose Tube or Figure-8 Cables

LEVERAGING EXISTING FTTX BUILDOUTS

As FTTx installations continue to scale to meet the demands of modern connectivity, traditional drop installation methods have encountered challenges in keeping pace. For instance, the fusion splicing approach, while reliable, entails a time-consuming process that involves accessing a splice enclosure, stripping cable and fusing fibers using specialized equipment. This method is not only slower but also requires skilled technicians and specific machinery. Factory terminated hardened fiber optic connectors (HFOCs), such as those used in the AFL TITAN RTD® FTTx System, has revolutionized the speed and reliability of drop installations. HFOCs facilitate quicker and more efficient drop installations compared to traditional methods. What sets HFOCs apart is their ability to maintain a sealed interface between the drop and the terminal, regardless of the deployment environment—whether underground, on poles, aerial strands or ADSS cables. By streamlining the installation process and eliminating the need for repeated access to splice closures, HFOCs contribute to enhanced long-term reliability.

In the realm of FTTx deployments, a commonly used strategy is to overbuild the network, ensuring the capacity to serve up to 110% of potential subscribers in each area. This approach is particularly relevant for electric cooperatives, which are mandated to provide equitable services to all members. By creating this surplus capacity, utility providers can effectively address outages and accommodate future growth within the service region. The economic advantage of this approach lies in the fact that the initial installation of backbone cables incurs the most significant labor costs, while the incremental increase in fiber count has a relatively minor impact on capital expenditure.

This principle of overbuilding extends to multiport terminals used for subscriber connections. These terminals frequently result in surplus ports at each subscriber's residence, providing an intriguing avenue for grid modernization efforts. The excess fiber connectivity created by these surplus ports holds the potential to revolutionize grid operations. By harnessing these resources, utilities can seamlessly integrate crucial components such as Advanced Metering Infrastructure (AMI) and Distributed Energy Resources (DERs) into the electricity grid.

The integration of AMI is a cornerstone of grid modernization. Smart meters, a pivotal element of AMI, offer real-time data collection on electricity consumption and demand patterns at the customer level. Leveraging the surplus ports on multiport terminals, utilities can seamlessly incorporate smart meters into their communication network. These smart meters provide utilities with a wealth of real-time data, enabling accurate load forecasting, demand response capabilities and efficient peak load management.

Furthermore, the rise of DERs, including rooftop solar panels, battery storage systems and grid-connected electric vehicles (EVs), presents an opportunity to transform the energy landscape. The availability of surplus ports allows utilities to integrate these DERs into their communication infrastructure effectively. For instance, grid-connected EVs equipped with vehicle-to-grid capabilities can provide bidirectional power flow, contributing to peak load management and grid stability.

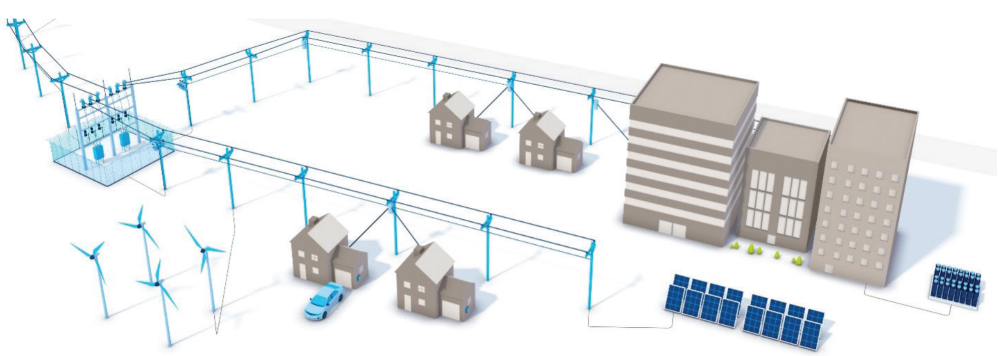

Figure 3 – Fiber-Thru-The-Grid

Even in networks with limited excess fiber, innovative solutions like the strategic deployment of splitters at premise locations emerge as viable alternatives. These splitters serve as secondary signal conduits for low bandwidth monitoring applications, exemplified by use cases such as smart meters. This approach ensures that the principles of grid modernization can be embraced, allowing utilities to tap into the benefits of real-time data-driven grid management. Overall, the integration of excess fiber resources within FTTx deployments presents a pivotal moment for utility companies to advance grid modernization, ushering in a more resilient, reliable, and sustainable energy ecosystem.

ADVANTAGES OVER CELLULAR OR RADIO COMMUNICATION

In the pursuit of grid modernization, resilience emerges as a paramount attribute, particularly when confronting natural disasters or physical damage. Fiber optic communication offers a robust solution, outshining other communication technologies in its ability to withstand disruptions and maintain essential connectivity, a crucial factor in integrating DERs effectively.

Amidst natural disasters or physical disruptions, the durability of fiber-optic communication distinguishes it from wireless alternatives. Unlike technologies like cellular networks, which are prone to signal degradation and interruptions, fiber optic communication exhibits exceptional resilience. This reliability ensures the uninterrupted flow of critical data, enabling grid control centers to uphold situational awareness, precisely monitor DERs such as rooftop solar installations or battery storage and efficiently coordinate restoration efforts.

Furthermore, the advantages of fiber optic technology extend beyond resilience. Real-time responsiveness, a hallmark feature of fiber-optic communication, empowers grid operators to seamlessly manage and optimize DERs. Rapid data transmission facilitates instant adjustments to energy generation, consumption and storage, enhancing grid stability and flexibility. Unlike conventional wireless options, fiber optic communication's negligible latency and high bandwidth capabilities enable grid operators to harness DERs' potential promptly and adapt to fluctuating grid conditions.

Incorporating fiber optic communication into grid modernization efforts not only fortifies grid resilience but also amplifies the integration and management of DERs. The technology's real-time responsiveness underscores its pivotal role in shaping modernized grids that seamlessly accommodate distributed energy sources, ultimately paving the way for a more resilient, adaptive and sustainable energy ecosystem.

SUMMARY

In the pursuit of a robust and adaptable energy landscape, grid modernization takes center stage, compelling utility companies to optimize their operations. This white paper has explored the instrumental role of existing FTTx infrastructures in this transformative journey. By harnessing the surplus fiber resources inherent in FTTx buildouts, electric cooperatives and utility providers can elevate grid modernization efforts to new heights of resilience, reliability and sustainability.

The integration of ADSS fiber optic technology emerges as a cornerstone of this advancement, offering self-supporting capabilities, unwavering reliability and cost-effectiveness. This innovation aligns seamlessly with the DoE's GMI, a comprehensive program that champions attributes such as resilience, security and flexibility. By leveraging the unique advantages of ADSS technology, utility companies position themselves to create a dynamic energy ecosystem, capable of weathering challenges and embracing DERs with real-time responsiveness.

Incorporating fiber optic communication networks, particularly ADSS technology, into grid modernization strategies not only empowers utility providers but also paves the way for a sustainable energy future. By enabling precise data transmission, seamless monitoring and adaptive control, these advancements lay the foundation for grids that are resilient in the face of adversity, responsive to dynamic conditions and equipped to integrate DERs effectively.

In closing, the synergy between FTTx buildouts and ADSS technology offers a transformative pathway for utility companies to fulfill their grid modernization aspirations. As we navigate an evolving energy landscape, this integration promises a future-proof solution where grids stand strong, adaptive and sustainable, ready to power the needs of communities and industries with unwavering efficiency and reliability.

BIO

Jake Adams is a Product Line Manager for outside plant connectivity products within AFL's Cable and Connectivity division. Jake's product focus is on FTTH deployments such as multiport terminals, outside plant cable assemblies, fiber demarcation boxes and node service cables. Jake has more than two years of experience in fiber optic connectivity and cable with a background in mechanical engineering.

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