

# Emerging Utility Opportunities: Middle Mile Fiber Networks

Richelle Elberg  
Principal Research Analyst

## Middle Mile Fiber Offerings Can Help Bridge the Digital Divide and Foster Economic—and Utility—Growth

Access to broadband internet service has become nearly as essential to modern life as electricity. The coronavirus pandemic in 2020 has only served to accentuate this reality. Nevertheless, access to high speed, competitively priced broadband service remains woefully low in many communities, even in developed nations. And where there is broadband service, there may be only a single internet service provider (ISP), resulting in artificially high service prices and creating further disparities between the haves and have-nots. Economically disadvantaged citizens and communities are finding it more difficult than ever to participate in the new digital economy.

This so-called digital divide is a growing priority for governments at the local, state and country levels. As a result, many are now providing grants and other forms of economic support to create adequate broadband services in underserved communities.

Widespread, robust fiber backbone, middle mile, and last mile infrastructure is foundational to delivering high speed internet access. But in economically constrained and rural communities, large legacy communications providers have generally not found a compelling business case. Utilities, with their vast and growing networks of fiber infrastructure, are uniquely positioned to provide middle mile fiber services, particularly in rural and underserved markets. In so doing, they can leverage excess capacity for new revenue opportunities and contribute to the longer-term economic health of their service territory, thereby improving the prospects for the enduring success of their core business.

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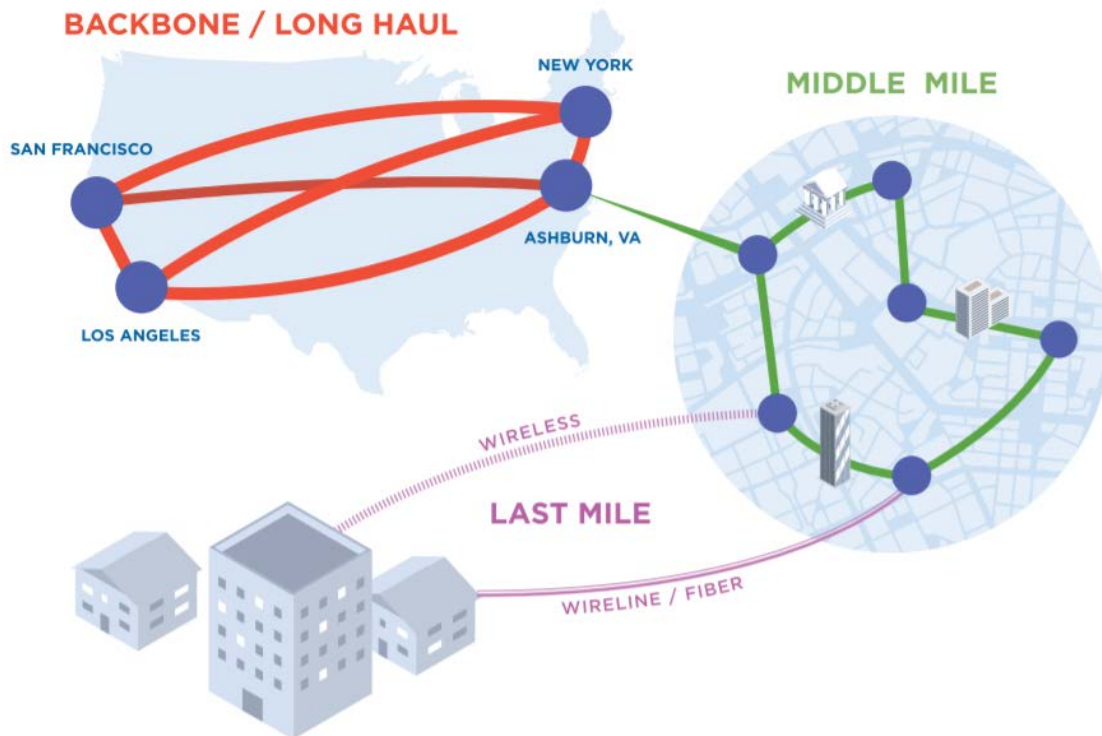
This paper describes the middle mile fiber market and discusses how utilities can participate for new revenue opportunities and community prosperity. It provides an overview of the middle mile market, its key drivers and barriers, and analysis of the financial benefits a utility might enjoy by providing middle mile fiber services.

### Middle Mile Defined

In the context of a broadband communications network, the middle mile consists of lateral cables that connect the internet backbone to the last mile of the network (see Figure 1). Using a transportation system analogy, the backbone can be thought of like an interstate highway while the middle mile

represents major state roads. Local streets serving individual homes and businesses are analogous to the last mile in a broadband network.

**Figure 1 Backhaul, Middle Mile, and Last Mile Fiber Network Segments**



(Source: Benton Institute for Broadband & Society<sup>1</sup>)

Where the internet backbone is typically operated by many companies and competition exists along major routes, middle mile connectivity to a city or county might only be provided by one or two companies, sometimes only by the incumbent telephone company.

Increasingly, utilities are constructing middle mile fiber throughout their electric distribution footprint, and many are still building out new fiber for expanded visibility and automation applications at the grid edge. By partnering with local municipalities, counties, or other public or private entities in advance, plans for these fiber networks can be built or extended in a way that is mutually beneficial for utility applications and community broadband access. This requires regulatory signoff, but where broadband access is below par, most regulators encourage such alliances.

New middle mile capacity can attract ISPs to a market that might otherwise not be served, fostering competition. This competition, in turn, translates to lower service pricing for end users and makes the community more attractive to new business relocations, which also benefits the utility in terms of its power business.

<sup>1</sup> Arnold, Jordan and Sallet, John, *If We Build It, Will They Come? Lessons from Open-Access, Middle-Mile Networks*, Benton Institute for Broadband & Society, December 2020. <https://www.benton.org/publications/middle-mile>

## Middle Mile Service: A Growth Market

Many independent middle mile providers have emerged in recent years, some at a national level and others with regional- or state-level networks. Examples of this type of provider include Level 3, AboveNet, Zayo, ENA, Allied, Cogent, and Tata. These middle mile providers generally do not sell services directly to residents or business customers; rather, they target ISPs or data center operators looking to expand into a new geography.

Notably, an ISP's middle mile does not necessarily require a large number of fiber strands. For this reason, leasing excess capacity on an existing (utility) network—even where there may only be a dozen or so spare fibers—is often a feasible alternative to constructing an all-new network for an aspiring ISP.

## Open Access Preferred

A utility considering entrance into the middle mile business should understand its local regulatory requirements and restrictions. Increasingly, open access is mandated—meaning the provider generally cannot place restrictions on which ISPs have access to the infrastructure. The utility builds, owns, and maintains its fiber-optic network and leases access to private providers that then offer services directly to the public. Under the open access model, the utility can operate and maintain the fiber and the transport electronics or it can contract these tasks out to a private sector partner, but it must allow access to all interested parties.

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Access to existing middle mile fiber can mean the difference between a poor, small, or very community gaining access to competitive broadband service—or not.

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By leasing middle mile access from a utility, the third-party ISP can deliver phone, video, or internet services to local residents and businesses with a far lower cost to enter the market, enabling multiple providers to serve residents and businesses over the same infrastructure. Access to existing middle mile fiber can mean the difference between a poor, small, or rural community gaining access to competitive broadband services—or not.

The middle mile model can also be combined with a dark fiber model, whereby the utility provides dedicated broadband access to certain (typically large) institutions in a community. Hospitals, school systems, and other government facilities are often good anchor tenants for the dark fiber leasing model. Through these fiber leasing models, a utility that builds its fiber infrastructure with community involvement can simultaneously meet its internal communications needs, reduce its reliance on expensive leased lines, and support local government and citizens with high quality broadband access.

Note, however, that where open access is not required, a competitive and inefficient dynamic can result, particularly when it comes to funding access. In California, for example, open access is not required of all middle mile providers. In June 2020, Plumas-Sierra Telecommunications, the telecoms arm of the Plumas-Sierra Rural Electric Cooperative, filed an objection to Frontier Communications' request to the California Public Utilities Commission to build a middle mile fiber route to the towns of Herlong and Janesville. Notably, Plumas-Sierra did not object to spending California Advanced Services Fund (CASF) subsidies on middle mile fiber. Instead, it wanted Frontier to use the CASF funds for access to its existing middle mile network rather than using the funding to overbuild it. Plumas-Sierra said it “already provides wholesale services via its existing middle-mile fiber-optic infrastructure with high-quality and reasonable price levels.” However, it does not lease dark fiber to competitors, meaning it effectively has monopoly pricing power.

Legislation is pending in the state that would require open access for any CASF-subsidized middle mile project, although whether or when it might be passed remains unclear. Longer term, open access is likely to become the norm, particularly for projects that receive any type of government funding. Utilities should expect to work within an open access framework if they decide to enter the middle mile market.

## Middle Mile Equals Minimized Risk

A middle mile model has much lower risk than a last mile fiber project. In a last mile fiber project, the utility directly enters the retail market, providing some combination of voice, video, and internet services—the so-called triple play model. While certain municipal and cooperative utilities, along with numerous large European utilities, have made that leap, last mile service can be a far riskier strategy. In markets where a

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large, established provider already offers triple play service, it can be difficult for a new entrant to gain enough share to make the last mile fiber build economically viable.

The middle mile model also has widespread and growing support from governmental and regulatory bodies. For example, in 2019, Virginia passed legislation that would enable its two largest electric

utilities, Dominion Power and Appalachian Power, to build extra fiber to rural substations as they modernize their electrical networks. Appalachian Power partnered with Grayson County in rural Virginia, where many people had no broadband access at all, to create a middle mile network open to all broadband providers. The pilot project is deploying 238 miles of fiber on Appalachian Power utility poles in the county. As one Appalachian Power executive noted, the utility has a powerful motivation to see the region succeed economically: if the economy of the service area is shrinking, then the utility will shrink, too.

## Middle Mile Market Drivers and Barriers

### Drivers

Economic growth, monopoly pricing dynamics, burgeoning data centers and government support among the drivers for the middle mile market. Key drivers are described more fully below.

### Economic Growth

In a report published in December 2020, the Benton Institute for Broadband & Society argued for more federal US government support for open access, middle mile networks. Arguably, the points it makes apply to any region globally:

- An open access, middle mile network allows any ISP to connect to the network on nondiscriminatory terms and conditions to provide last mile solutions to homes and businesses.
- Open access, middle mile networks can provide the savings that spur last mile providers to build further and faster to reach residences.
- An open access, middle mile model promotes private investment and competition in last mile service by reducing the CAPEX required to build last mile connections.

The report highlights numerous case studies demonstrating the benefits of open access, middle mile networks. One, the Illinois Century Network (ICN), originally began as a research and education network built to serve government and community anchor institutions. But then:

*...starting in 2013, the network [ICN] began selling service to commercial providers, lowering the cost of entry in rural and underserved regions of Illinois. Forty providers [now] use ICN to deliver last-mile service. For the Illinois Electric Cooperative, operating in a low-population-density part of Illinois — and serving some towns with populations numbering just in the hundreds — the ability to connect to ICN made it financially feasible to deploy fiber to the home, even as its rival, the local incumbent provider, continued to operate slow Internet service over a traditional copper network.*

The Benton report also points out that these networks can have substantial economic impacts. For instance, the Medina County Fiber Network in Ohio has led to “1,000 new jobs and half of the investment” in the county. The Medina County Fiber Network serves nearly a dozen service providers and offers data transport, internet, dark fiber, and, most recently, fiber to the home service.

### **Eliminate Monopoly Pricing Dynamics**

Ready access to affordable middle mile fiber can reduce the very real problem of monopoly broadband provision by giving more ISPs an opportunity to serve different customer bases. In the US—whether urban, rural, or tribal—at least one-third of residents only have one broadband option. According to multiple sources, middle mile service in a single provider market can cost from twice as much as 6 times the costs in a competitive market.

Limited competition also harms consumers in the form of lower quality service, slower innovation, and reduced customer service. As noted in the Benton Institute report, “Because fixed broadband is a widely subscribed service that, especially in light of the COVID-19 crisis, is now an essential pathway to participation in our democracy, society, and economy, any artificially higher prices will tend to disproportionately harm those subscribers who have lower incomes.”

### **Government Support**

In recent years, governmental support for equal access to adequate broadband service has grown markedly and new funding programs have been developed. In both mature and emerging economies, governments at the country, regional, and local levels have all recognized the importance of broadband service to their citizens. As noted in the introduction, the coronavirus pandemic has amplified this need.

In many countries and locales, utilities may be direct beneficiaries of these new funding sources. For example, in December 2020, Kansas announced a new, \$85 million 10-year broadband grant program designed to drive network expansion in unserved and economically depressed areas. The state noted that 3.5% of its population, almost 100,000 people, have no internet access options at all.

The Broadband Acceleration Grant Program prioritizes low-income, economically distressed areas, as well as those without access to speeds of at least 25/3 Megabits per second (Mbps, download/upload). The grant also urges applicants to engage local stakeholders in their communities and build relationships with community anchor institutions, businesses, and nonprofits to maximize impact. Each project is eligible for awards of up to \$1 million, requiring a 50% match. The program is open to existing ISPs, counties, municipalities, nonprofits, and cooperatives, including electric utilities. Also of note: most broadband advocates believe the 25/3 Mbps standard is inadequate for modern needs.

## Data Centers Also Drive Demand

Digitalization of the economy is a growing trend worldwide, and much of that economic growth is supported by cloud-based (i.e., data center) infrastructure. Data centers, in turn, must be connected by high capacity fiber. Indeed, the location for a new data center is often selected based on access to nearby fiber infrastructure.

In fact, access to fiber for data centers is so important that Facebook has entered the market through its subsidiary Middle Mile Infrastructure. In a blog post from March 2019, the company wrote:

*To provide the 2.7 billion people using our products with the best possible experience, we have designed more efficient servers and data centers, and we have strengthened the long-haul fiber networks that connect our data centers to one another and to the rest of the world. As we bring more data centers online, we will continue to partner and invest in core backbone network infrastructure. We take a pragmatic approach to investing in network infrastructure and utilize whatever method is most efficient for the task at hand. Those options include leveraging long-established partnerships to access existing fiber-optic cable infrastructure; partnering on mutually beneficial investments in new infrastructure; or, in situations where we have a specific need, leading the investment in new fiber-optic cable routes.*

Facebook went on to say that it will allow third parties to purchase excess capacity on its fiber, particularly in underserved rural areas. The company noted that when it built its data center in New Mexico, it built a 200-mile cable to connect the facility to one in Texas. “The resulting cable is more efficient than other high-capacity cables, and our New Mexico data center now has another redundant path to our network.”

**Figure 2** Facebook Data Center in New Mexico



*(Source: Facebook)*

Facebook has effectively entered the middle mile fiber market, but as noted in the quote above, there could be partnership opportunities. Utilities with advantageous existing infrastructure—poles for above-ground fiber networks, conduit for underground infrastructure—could attract economically attractive data centers to their markets for any major cloud-based business. However, if they wait too long to plan their entrance into the market, a company like Facebook just might beat them to it.







### **Public Goodwill**

A utility that brings robust, competitive broadband service to its community will not only benefit financially but also via improved public goodwill. Broadband access in a rural community can support remote telehealth and distance learning services for otherwise unsupported communities. As the pandemic has demonstrated, remote access to health and education services is more important than ever. Additionally, attracting new businesses to a remote community depends heavily on the availability of competitively priced, high speed broadband service.

### **Diversification**

Provision of wholesale fiber services has been embraced by numerous large European utilities. In some cases, government funding is a driver, but for several, diversification of revenue streams and market opportunity are key drivers (see Table 1).

**Table 1** Electric Utility Fiber Ventures across Europe

Metric	Germany	Italy	Ireland	France	Switzerland	Poland
Utility						
Fiber Company	M-Net	Open Fiber	SIRO	@rteria	IWB Net	Tauron
Drivers	<ul style="list-style-type: none"> <li>• Diversification</li> </ul>	<ul style="list-style-type: none"> <li>• National policy</li> <li>• Public funding</li> </ul>	<ul style="list-style-type: none"> <li>• Market opportunity</li> <li>• National policy</li> </ul>	<ul style="list-style-type: none"> <li>• National policy</li> </ul>	<ul style="list-style-type: none"> <li>• Market opportunity</li> <li>• National policy</li> </ul>	<ul style="list-style-type: none"> <li>• Public funding</li> </ul>
Business Model	<ul style="list-style-type: none"> <li>• Retail</li> <li>• Wholesale</li> </ul>	<ul style="list-style-type: none"> <li>• Wholesale</li> </ul>	<ul style="list-style-type: none"> <li>• Wholesale</li> </ul>	<ul style="list-style-type: none"> <li>• Wholesale</li> </ul>	<ul style="list-style-type: none"> <li>• Retail (B2B)</li> <li>• Wholesale</li> </ul>	<ul style="list-style-type: none"> <li>• Wholesale</li> </ul>

(Source: Guidehouse Insights)

## Market Barriers

For utilities wishing to enter the middle mile fiber market, the barriers are few, particularly given that so many are building out fiber infrastructure for internal smart grid needs. As noted previously, utilities must understand whether or not there are open access requirements within their state or country. Access to attractive grants or other funds may depend on providing open access service.

Utilities should also understand local environmental and property rights concerns that could hamper progress. Projects can be delayed if endangered species habitats might be disrupted by the build (in one case, an environmental review took a decade to complete).

Community and property owner support is also key; without it, disastrous litigation can ensue. For example, Sho-Me Power Electric Cooperative in Missouri used grant funding to build hundreds of miles of open access, middle mile fiber. It became embroiled in legal trouble after Missouri landowners filed a

...the incremental nature of the service to internal needs means that utility middle mile offerings can be a high margin new revenue stream, without even factoring in the economic growth—and growth in load—that a robust middle mile fiber network might support.

class action lawsuit against the cooperative for misuse of electrical easements for commercial purposes. After nearly 7 years and two trials, the cooperative settled with the landowners for \$24 million to avoid another trial.

Perhaps most importantly, utilities should have a clear understanding of demand drivers in their region as well as competitive offerings. If there is ample existing fiber capacity across their territory, they should not necessarily augment their fiber build for middle mile applications. However, the opportunity is real,

particularly in underserved markets. It may or may not be large in a given locale, but the incremental nature of the service to internal needs means that utility middle mile offerings can be a high margin new revenue stream, without even factoring in the economic growth—and growth in load demand—that a robust middle mile fiber network might support.

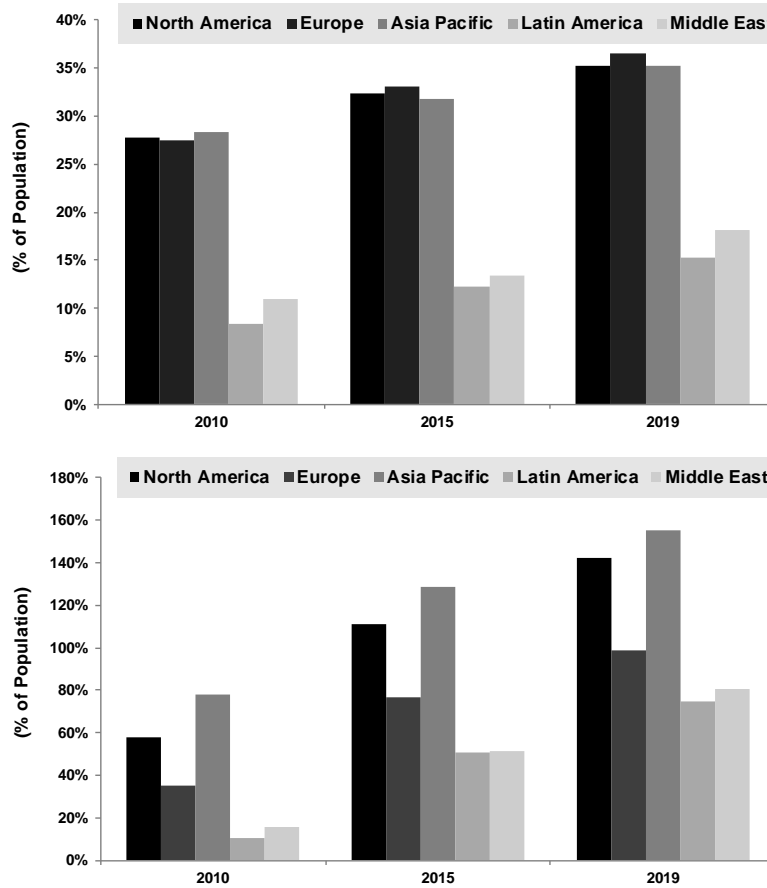
## Market Size for Middle Mile Fiber

Growth in demand for middle mile fiber is expected to be strong due to the digitalization trends in enterprise, growth in data center demand, legacy networks upgrading their infrastructure (e.g., from legacy cable or DSL to fiber), and increased residential demand for high bandwidth connectivity.



According to Guidehouse Insights analysis of Organisation for Economic Co-operation and Development (OECD) data for 38 countries, while mobile broadband connectivity was likely at or above 100% at the end of 2020 in mature markets, fixed (wired) broadband access penetration averaged just 35% in developed economies and was at or below 20% in emerging markets. For countries not included in OECD data collection, penetration of fixed broadband is likely much lower—although mobile phone penetration has skyrocketed in emerging markets, so mobile broadband penetration could be higher.

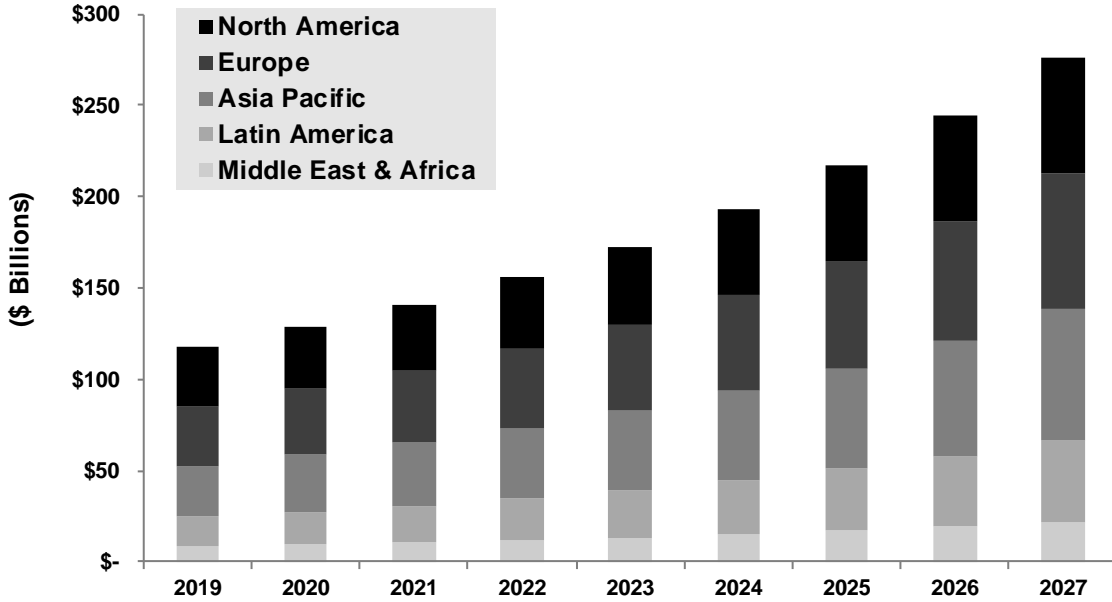
**Chart 1** Fixed (Top) and Mobile (Bottom) Broadband Penetration by Region, OECD Countries: 2010, 2015, 2019



(Source: Guidehouse Insights analysis of OECD data)

Guidehouse Insights estimates the global market for fiber-based retail broadband services was nearly \$130 billion in 2020 and expects that to grow at an 11.3% compound annual growth rate through 2027 to more than \$275 billion. Chart 2 shows regional breakouts.

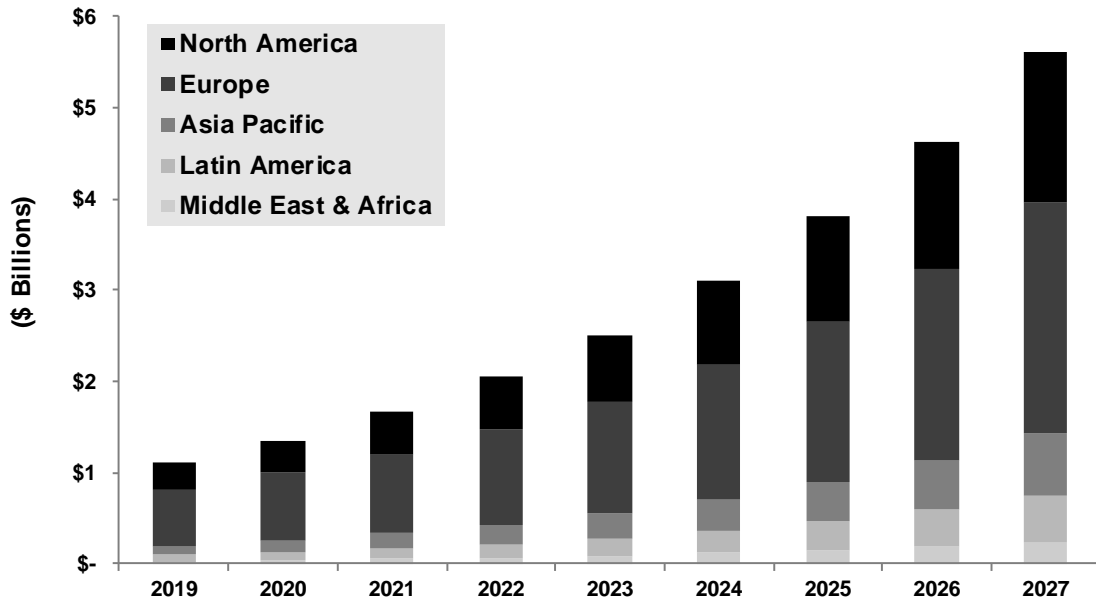
**Chart 2** Fiber-Based Broadband Service Revenue by Region, World Markets: 2019-2027



(Source: Guidehouse Insights)

The middle mile wholesale market is a subset of the overall broadband services market. Not all retail service providers rely on wholesale middle mile providers, preferring to build their own infrastructure. Furthermore, not all middle mile wholesale service is provided by utilities. In fact, Guidehouse Insights believes utility share of the middle mile market is quite small, estimated at \$1.4 billion worldwide in 2020 (or approximately 1% of the global retail fiber-based broadband services market). Over time, particularly in North America, Guidehouse Insights expects utilities will play a larger role in the market as federal, state, and local governments push to improve rural broadband access and reduce the digital divide.

**Chart 3** Utility Middle Mile Fiber Services Revenue by Region, World Markets: 2019-2027



(Source: Guidehouse Insights)

## Attractive Utility Returns

Utilities can lease their middle mile fiber to ISPs for negligible incremental costs if they are already building the fiber network for internal, grid management purposes and have regulatory signoff. Even where the fiber network is a new build, the middle mile opportunity can go a long way toward offsetting those expenses.

Guidehouse Insights developed a hypothetical middle mile fiber leasing revenue and cash flow model for a cooperative utility in a rural area serving multiple small towns with a total population of 50,000. The utility territory covers more than 2,000 square miles, but the subject towns cover just 75 square miles. A total of 112 fiber miles are built to serve these towns. Only one existing broadband service provider covers the market, with broadband pricing that is higher than in more competitive markets.

The model assumes that not only does utility provision of middle mile access service enable new ISPs to enter the market, but the resultant falling prices also lead to higher broadband service penetration over time. It does not assume new business or data center relocation to the market—although these eventualities would further improve the community benefit and utility economics for the offering. An estimated 5% of ISP broadband services revenue is paid to the utility for its middle mile services.

Under these assumptions, the utility generates more than \$36 million in new cash flow over 20 years at a 95% EBITDA margin and generates an internal rate of return of more than 12%. Table 2 provides further details for the hypothetical model.

**Table 2** *Incremental Electric Utility Cash Flow Calculation: Hypothetical Five Town Middle Mile Fiber Leasing Opportunity*

<b>Project Build</b>	<b>Total CAPEX</b>	<b>Loan Term</b>	<b>Annual Loan Service at 6%</b>	<b>Network Life</b>
Network Build Cost	\$5,600,000	10 years	\$746,058	20 years
<b>Market Characteristics</b>	<b>Town Sq. Miles</b>	<b>Population</b>	<b>Meters</b>	
Cooperative; Fiber Build Serves Five Small Towns, Each Serves/Covers:	15	10,000	3,800	
<b>Operating Metrics Years 1-20</b>	<b>Year 1</b>	<b>Year 10</b>	<b>Year 15</b>	<b>Year 20</b>
Annual Five Town Broadband Services Revenue	\$41,750,371	\$36,557,696	\$37,692,254	\$38,859,985
Annual Utility Middle Mile Leasing Revenue	\$2,087,519	\$1,827,885	\$1,884,613	\$1,942,999
Percentage Increase Over Core Utility Revenue				~4%
<b>Annual Utility Middle Mile Leasing EBITDA at 95%</b>	\$1,983,143	\$1,736,491	\$1,790,382	<b>\$1,845,849</b>
<b>Cumulative Net EBITDA Over 20 Years</b>				<b>\$36,489,051</b>
<b>Percentage of Initial Network Investment</b>				<b>652%</b>
<b>Internal Rate of Return</b>				<b>12.4%</b>

(Source: Guidehouse Insights)

## Recommendations to Utility Network Managers and Planners

Utilities, especially those serving rural or economically disadvantaged markets, need to understand the value of the fiber networks they are building. They should proactively seek out partnership opportunities with local government, businesses, and regional ISPs. Utilities can survey these entities to understand the potential demand for middle mile fiber, and create buildout plans that complement the local need. They should fully understand regulatory requirements in their operational territory, including whether or not open access is required. Finally, utilities should architect their fiber build in a flexible manner that accommodates future demand for middle mile service—even if the business case is not obvious today—which can result in higher revenue potential in the future.

The future economic success of every community will not only rely on access to affordable, reliable electricity but also to broadband service. Utilities are uniquely positioned to provide middle mile fiber services to their communities. It is a chance to generate new revenue and provide real opportunity in their communities, for residents and businesses alike.

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1800 Tysons Blvd., 7<sup>th</sup> Floor  
McLean, VA 22102 USA  
[www.guidehouseinsights.com](http://www.guidehouseinsights.com)

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