

Municipal & Utility Guidebook to Bringing Broadband Fiber Optics to Your Community

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Mitchell Shapiro**

pti Public Technology Institute

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The Authors

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Preface

There has been growing concern among elected local government leaders regarding broadband options for their respective cities and counties. Along with this concern has been a lot of unfortunate negative press regarding the WiFi aspect, which at times has eclipsed the paramount importance of fiber to our communities.

Many people (like myself) believe that the underlying critical infrastructure for the future of our nation is fiber to the premise. And absent a meaningful national broadband strategy, communities have been left to fend for themselves.

This guidebook, co-authored by David Chaffee and Mitchell Shapiro, who together have more than forty years of experience in the telecommunications industry, demonstrates a remarkable set of cases for broadband deployment in communities throughout the country. While all too often we hear from “broadband evangelicals” and the vendor community, what has been lacking is a set of business case specifics necessary to build sound plans for creating sound systems.

"The Municipal Guidebook to Bringing Broadband Fiber Optics to Your Community" is the first comprehensive guide written for city, county, and utility officials. The guide highlights the economic and quality-of-life benefits to communities that have a robust fiber infrastructure, and examines in detail four communities that have successfully deployed fiber-to-the-home services to their citizens and businesses.

This guidebook helps government leaders build a strong case for investing in an infrastructure that brings fiber-to-the-home services, through thorough analysis, interviews, and painstaking research. It sets forth strategies that, if followed, will help American communities whose broadband needs are not being met by current market dynamics to prosper in the information age.

You will find very helpful in-depth case studies of four municipal fiber projects that have achieved or are well on their way to achieving positive cash flow. It also considers other potential benefits of fiber to the home, looking at the transportation and healthcare sectors, both of which face intensifying pressures to become more efficient and less costly.

Finally, this guidebook examines the value a municipal fiber networks in extending the benefits of next-generation broadband to the realm of wireless mobile services.

The Public Technology Institute is pleased to both endorse and help in distributing this guidebook to government leaders throughout the nation.

Dr. Alan R. Shark
Executive Director
Public Technology Institute
Washington, DC

Introduction: The Future of American Communities

Our communities represent a significant part of who we are. We live there, our kids go to school there, many of our friends are there, our place of worship is there, how we eat, the sports we play, the way we live our lives—all of these things are wrapped up in our community.

Our communities help to determine our identity. We proudly say we are from our community. It tells others about who we are. It is a reflection of the good in our lives. It is the place where most of our lives are spent.

We want our communities to succeed, to be well thought of, to be places others would want to live. We want them to function well, to produce well-paying jobs, to play an important role in America, to be as good as we are.

Yet today, as you read this, your community faces a crisis.

No, we don't mean it is going to be flooded, or hit by a tornado or a hurricane. Nor do we mean to imply that we have special knowledge about your real estate values, although this trend has the potential to impact them.

What is happening is the re-sorting of American communities into haves and have-nots when it comes to broadband. Have it, and the place you live is destined to have a vibrant and strong economic future. Miss out, and you will likely see lessening economic fortunes and the strong likelihood of becoming tomorrow's ghost town.

Having enough broadband in your community is critical to your town's economic well being. It is a primary consideration, arguably as important as the water you have access to, the shape of your schools, the safety of your roads.

If you have a strong broadband presence, your community will attract more jobs, with a workforce that is far more productive. Have a strong broadband presence, and your community will have every chance to succeed. Have a strong broadband presence, and you are giving everyone in your community the chance to make the most of themselves. Without it, you run the risk of watching your community decline and your young people leave town, lured by opportunities available only in better-connected communities.

This book is designed to help make sure your community prospers in the information age. And it can help you accomplish this even if the big telcos and cable TV companies are under-delivering the capabilities you need today, and will need even more urgently tomorrow.

In key respects, this book is a community survival guide for the broadband era, one that can help you make choices today that will determine whether 10 or 20 years from now you are living in a vibrant, economically healthy community, or one that is dying.

The good news is that you have the power to choose which fork in the broadband road your community takes. If you choose the path of growth, this book can help you benefit from the lessons, experience and expertise of the pioneers who have already traveled it. By learning from them, you can enjoy an even faster and smoother journey to the economic prosperity and security these pioneers have already begun to enjoy. And as your community travels that path of growth, its members can take pride and satisfaction from working together to create a brighter future, not only for themselves, but also for their children and grandchildren. Their decision to invest in broadband infrastructure today can provide future generations with economic opportunities that allow them not only to stay in their community, but also to insure that it remains vital and prosperous well into the future.

A Call to Action

For better or worse, the United States faces a global economic and broadband competition, the outcome of which will impact our nation's future for decades to come.

In the midst of this worldwide race, the country's municipalities and public utilities face what is both an historic challenge and a game-changing opportunity—to get directly involved in the deployment of future-ready fiber optic networks in their communities.

Why is this race important? It is critical because the Internet has become the new marketplace, and its effective use by individuals, communities and nations will significantly impact how well they do economically. As the U.S. Department of Commerce has observed, economic growth is disproportionately going to those communities that have broadband.¹

The widespread adoption of broadband in the United States would add \$500 billion in growth to the economy and create 1.2 million jobs, according to the respected Brookings Institution.² And, even just a seven percent across-the-board increase in broadband use in America would add \$134 billion to the economy, according to Connected Nation.³

Even more specifically, a study by George Ford and Thomas Koutsky of the Phoenix Center for Advanced Legal and Economic Public Policy Studies evaluated whether broadband investments by municipalities have an effect on economic growth. They compared Lake County, a small county in central Florida, with other Florida counties. Lake County offered fiber optic connections to hospitals, doctors' offices, private businesses and 44 schools. Their conclusion: The rate of economic growth was twice as fast in Lake County as it was for surrounding counties.⁴

The Global Broadband Economy

For older citizens who spent most of their adult life within a traditional brick-and-mortar economy, it may be difficult to understand the economic power and benefits of the Internet. Yet if we consider the amount of business transacted over the Internet, its economic value becomes increasingly clear. Consider the amount of shopping done online at retail portals. Today virtually every major merchandise store can be accessed online, with most having to compete with huge and fast-growing businesses like E-Bay and Amazon, which were born and raised in the online economy.

The ever-expanding Internet-based marketplace is causing a seismic shift in people's perceptions. Many people now buy and sell automobiles over the Internet at places such as craigslist.com. In the not-too-distant past, the newspaper was the dominant vehicle for this kind of information exchange. Today, newspapers are struggling to survive.

There are many other examples. The Internet creates sub-communities where work groups can operate effectively even if not co-located in the same place. Oftentimes,

someone with a cell phone, laptop and broadband connection can be as efficient at work as someone with the accoutrements of office space.

The Internet provides a wide range of benefits to society. For example, instead of waiting for days for a document to be delivered to you, you can easily receive it as an e-mail attachment or by downloading it from a web site. Publications generally can be delivered much faster, more efficiently and less expensively over the Internet. Airline ticketing is another example.

By not having to commute, there are enormous advantages to our economy in terms of reduced gasoline consumption and the associated impact on the environment. If you translate the hours lost on the road into efficient work time, people are far better off telecommuting.

Whole economies are benefiting from these changes, with call centers in India being one of the more widely cited examples. Consider all the jobs that will be necessary to fill in the expanding online banking sector, not to mention the many other online services that are expanding around the globe.

Most of us use the Internet far more than we did five years ago, one year ago, or even six months ago. We use it to do work, to stay in touch with friends, to get news and for entertainment. The Internet is becoming the new marketplace, and the ability to use it wisely can spell the difference between success and failure.

Like it or not, our economy is moving from the industrial age to the information age, and central to our success in the information age is the Internet. The bottom line is that getting broadband to citizens and businesses is becoming a necessity for a community's economic survival in the global economy.

The United States is not the only country realizing this. Every nation on the planet is aware of it to some extent. But, while some governments are developing policies and even providing funds to develop this potential, the U.S. federal government has taken only very limited action.

Americans have always been known as great innovators. Give us the tools and the knowledge and there is no telling what we can do. But the unfortunate reality today is that too many Americans are not getting access to the broadband Internet, and are therefore falling behind in terms of the knowledge and skills needed to succeed in the 21st century.

There are a number of reasons why the United States is falling behind in broadband. For one thing, it is far larger than most other nations, and contains significant areas of low housing density. This increases deployment costs relative to smaller, more compact countries such as Korea, Japan and Sweden, which have much higher levels of availability and penetration for broadband in general, and high-capacity fiber optics in particular.

But studies have shown that issues like housing density can't fully explain the weak position of the U.S. in terms of broadband availability, penetration, capacity and pricing. The fact is that many national governments around the world are adopting policies that favor broadband growth and, in some cases, are focusing specifically on accelerating deployment of fiber optic networks. But in the U.S., the federal government has chosen to mainly stand on the sidelines. Instead of confronting the challenge, too many government officials pretend it doesn't exist. This is hurting the citizens they were elected or appointed to serve.

A Federal Policy Failure

The United States should be the leader in broadband. After all, the Internet was originally a Department of Defense phenomenon, made in America. We had the head start. We knew how it ran. The largest software company (Microsoft) and the biggest chip provider (Intel) are U.S. companies.

But things have gotten off track. The United States has plummeted to 15th out of 30 countries in terms of per capita broadband penetration, according to the Organization for Economic Cooperation and Development (OECD). And only about half of American households subscribe to broadband services. For some this is because broadband is not available in their area, while for others it is a matter of affordability. Perhaps most vulnerable are our smaller and more rural communities, where very low speed dial-up and very high cost satellite service are often the only options available to some or all of their citizens.

Decision makers in Washington, D.C. have so far decided not to institute a national broadband policy. While there is a growing movement to change that, these efforts have not translated into any significant policy changes.

To date, the primary tool employed by the federal government has been to deregulate the dominant cable and telephone companies in the hope they will expand broadband coverage, lower prices and improve service.

In this dual system, or duopoly, the cable TV companies have offered Internet over cable modem while the telephone companies have offered DSL. In some instances, the telephone companies are starting to offer faster Internet service over fiber optics, which sometimes comes to the neighborhood, and sometimes all the way to the residence.

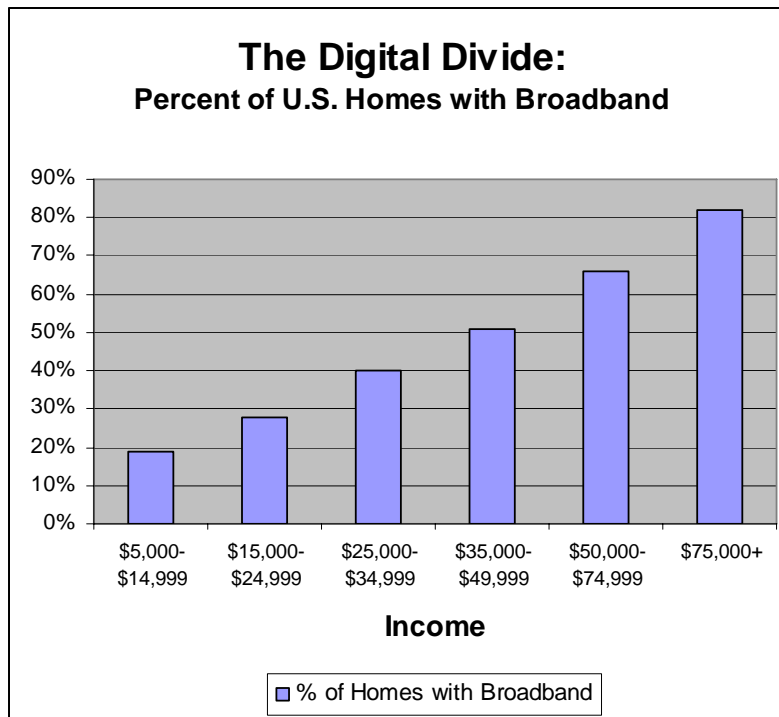
As we have seen over the past decade, broadband competition has remained limited in most cases to one cable company and one telephone company per community. In some areas, only one of the two offers any broadband services, while in others, neither do. As a result, too many American communities are paying the price of these gaps in the availability of even limited-speed broadband service. Often already hurt by the loss of businesses that have either moved or closed up shop, and watching their jobs go overseas,

these communities desperately need the benefits of modern broadband networks to return to healthy growth.

The Digital Divide

Are the big telephone and cable companies creating a digital divide that will leave many Americans behind in the global broadband race? The hope has been that the competition between the two dominant service providers will cut prices to the level where most people can afford broadband services. But, in reality, most communities still pay high prices for inferior or no broadband services, while the major carriers brag to Wall Street of their enhanced ARPU (average revenue per unit), in effect getting rewarded for charging high prices to bandwidth-starved communities because there's not enough competition to make them do otherwise. Shareholders get to squeeze out a few extra dollars, while major portions of our communities cannot afford broadband.

In today's broadband duopoly, the two dominant carriers too often act as if they have a tacit agreement that prices should not fall too low. They are too intelligent to get caught in price fixing, and too smart to get into a price war. The fact that Comcast, the nation's largest cable operator, has for years been able to keep its monthly ARPU above \$40 (it was \$42.18 in 1Q08), is testimony to the lack of effective price competition in the U.S. broadband market. And, according to statistics published by OECD (Organization for Economic Cooperation and Development), as of October 2007, the U.S. had the eighth highest average monthly price for a broadband subscription among 29 countries measured.⁵



Source: U.S. Census Bureau, 2007 Current Population Survey

The issue of broadband affordability is also reflected in data from the U.S. Census Bureau's 2007 Population Survey. As the graph shows, the percentage of households with broadband varies sharply by income. While 82 percent of households with incomes of \$75,000 or more are broadband subscribers, this figure is cut by more than half to 40 percent for those with incomes of \$25,000-\$34,999. And it falls further to 28 percent for those in the \$15,000-\$24,999 income range, and to just 19 percent for households that make less than \$15,000 a year.

In the U.S., some communities have access to only one broadband service provider, while more rural communities may have none. At a time when Americans should all benefit from this opportunity, considering the number of jobs that have gone overseas, many are being told to go to the back of the broadband line.

The table on the following page shows state-by-state data on the availability of DSL and cable modem service compiled by the FCC as of mid-2007. Because the table's percentages are based on company service areas, they are likely to overstate availability as a percentage of total U.S. homes, especially for cable modem service. For example, if cable networks pass only 95 percent of the nation's homes, the reported 96 percent national "cable modem availability" figure would actually represent only 91 percent of the nation's total homes.

The FCC's data show that, nationwide, as of mid-2007, DSL service was available in 82 percent of homes in areas where phone service was available. This included 21 states with coverage levels below 80 percent, three below 70 percent (Maine, New Hampshire and Vermont) and only two (Georgia and Nevada) having reached 90 percent. The FCC did not report DSL data for five states to protect confidential company data.

On the cable side, overall broadband availability within cable's service footprint was 96 percent, with South Dakota and Arkansas the lowest at 73 percent, followed by New Mexico at 77 percent and four others (Iowa, Montana, North Dakota and West Virginia) below 90 percent. As noted above, these figures are likely to overstate cable broadband coverage as a percentage of total homes in most states and the nation as a whole. The FCC did not report cable broadband availability data for eight states.

This FCC data suggest that roughly one of every five U.S. homes does not have a choice of cable modem or DSL service, while perhaps one in ten does not have access to either one.

By far the best medium for bringing broadband to the home is fiber optics. It is small in size, environmentally friendly, free from interference, yet offers incredible broadband capabilities. A single line of fiber optics can carry trillions of bits per second, compared to only millions of bits per second for cable modems and DSL.

Availability of DSL and Cable Modem Service (as of mid-2007)

State	DSL (1)	Cable Modem (2)
Alabama	75%	92%
Alaska	76%	*
Arizona	82%	99%
Arkansas	75%	73%
California	89%	98%
Colorado	87%	96%
Connecticut	*	100%
Delaware	*	*
Florida	89%	97%
Georgia	91%	90%
Hawaii	*	*
Idaho	76%	99%
Illinois	83%	98%
Indiana	79%	94%
Iowa	85%	89%
Kansas	83%	91%
Kentucky	87%	90%
Louisiana	79%	96%
Maine	68%	93%
Maryland	75%	99%
Massachusetts	*	99%
Michigan	72%	98%
Minnesota	85%	94%
Mississippi	72%	91%
Missouri	79%	97%
Montana	78%	88%
Nebraska	88%	94%
Nevada	90%	*
New Hampshire	61%	99%
New Jersey	87%	100%
New Mexico	78%	77%
New York	77%	99%
North Carolina	85%	96%
North Dakota	88%	83%
Ohio	84%	98%
Oklahoma	80%	90%
Oregon	83%	95%
Pennsylvania	83%	94%
Rhode Island	*	*
South Carolina	79%	93%
South Dakota	78%	73%
Tennessee	81%	96%
Texas	79%	96%
Utah	87%	*
Vermont	66%	*
Virginia	66%	95%
Washington	82%	96%
West Virginia	73%	85%
Wisconsin	81%	96%
Wyoming	80%	*
Nationwide	82%	96%

* Data withheld to maintain firm confidentiality.

(1) % with DSL availability where ILECs offer phone service

(2) % with cable modem availability where cable systems offer TV service

Source: FCC

Today, Verizon is the only major carrier bringing fiber optics to American homes, in the form of a service it calls FiOS. It plans to take FiOS to about half of the homes in its service area by 2010. While these 18 million homes are a good start, there are no indications that the most of the nation's remaining living units, which measure over 100 million, will get the benefits of fiber anytime soon.

The reality is that, while other nations, such as Japan, have aggressive national fiber-to-the-home (FTTH) initiatives, most Americans are being left out of the move to next-generation broadband. According to OECD data, less than 3 percent of U.S. broadband connections were via fiber optics at the end of 2007, compared to 40 percent in Japan, 34 percent in Korea, 18 percent in Sweden, 9 percent in Denmark and 7 percent in Norway.⁶

Japan's relatively high percentage of fiber connections helped it claim the world's lowest broadband subscription cost on a per Mbps basis, according to OECD data. While Japanese and Korean customers were paying an average of just \$3.09 and \$5.96 per Mbps, respectively, for their broadband service, the U.S. average was \$12.60 per Mbps, more than four times the per-Mbps cost in Japan and twice that in Korea. The U.K. (\$5.29), Italy (\$4.61) and France (\$3.70) also had per-Mbps subscription rates far below the U.S. average.⁷

It is possible, of course, that, sooner or later, telephone or cable companies will get around to deploying fiber optics and providing broadband at a reasonable price to most citizens. But how long will that take, and how far behind will America have slipped by then? To 20th place? To 30th?

How many jobs will have been lost to other nations that beat America to the punch by providing their citizens with the means to succeed, while ours were waiting for big telcos and cable companies to invest more of their big ARPUs in fiber rather than bigger shareholder dividends and stock buybacks?

Can we afford to wait for answers to these questions?

A Local Challenge and Opportunity

Yet from crisis comes opportunity. To help bridge the country's growing broadband gap, other entities have begun to step up to help American citizens and businesses succeed in the global broadband economy.

This includes a small but growing number of municipalities and utilities savvy enough to identify the problem and courageous enough to do something about it. They have seen the opportunity and are seizing it. And, as we explore later in this report, they are doing so in ways that are both effective and financially responsible. As a result, their communities are enjoying the fruits of public investments in future-ready fiber optic infrastructure.

With a failed national policy causing the U.S. to fall behind, the opportunity—and even necessity—for more municipalities and utilities to become directly involved in expanding broadband’s reach and capabilities is becoming clear.

Utilities and municipalities have the opportunity to help the citizens that have relied on them for so many years. They have the access, the capability and, as this report makes clear, the means to help those whose futures depend on their actions.

The Wall Street Journal has taken notice. In an article entitled *Cities Start Own Efforts to Speed Up Broadband* appearing on Page 1 of the May 19, 2008 issue, the Journal observes: “*In large swaths of the U.S., particularly second- and third-tier cities and towns with more dispersed populations, [the major telcos and cable TV companies] consider broadband less profitable.*”

Certainly, extending fiber optics to every premise is no small undertaking for a municipality or public utility. But for many American communities, it may be the only way to gain access to 21st century Internet infrastructure. Given this, the time is at hand for community leaders to begin educating themselves and evaluating their options. The broadband race is moving too fast and is too important to simply hope that “the market” will somehow solve the problem.

Local leaders have the capacity—and the responsibility--to help their communities compete and thrive in the global economy. To do so, they must update and expand their mission as public servants in the information age.

Yes, this is a new role for public utilities and municipalities. But the Internet has changed everything. And it demands that local leaders also change; that they learn more about their options for Internet connectivity and then take action to insure their communities will be equipped to succeed in an Internet-centric future.

As we all know, change is not always easy--even when necessary, as it is today. But it can be a lot easier when we learn from those who have blazed the trail and are enjoying the benefits. Toward that end, this report is presented as a resource to help inform local community leaders about the muni-fiber option so they, in turn, can help their community create the network infrastructure it needs to prosper in the global broadband economy.

Municipal Fiber: A Solution For Your Community?

The future of too many American communities is being held hostage by the fact that they do not meet the rate-of-return requirements for investments in next-generation networks by private service providers. There is, however, a solution.

This report analyzes the growing body of evidence indicating that municipal fiber networks can be financially sound and strategically important investments for

communities whose broadband needs are not being met by current market dynamics. Based on this analysis, the report concludes that municipal fiber networks:

- 1) can pay for themselves from direct revenues;
- 2) can generate significant and measurable cost savings and other direct benefits to local businesses, government agencies, schools, healthcare providers, utilities and residents and;
- 3) have the potential to generate social value far beyond these direct benefits, including helping to address the skyrocketing costs of transportation and healthcare.

As leaders of your community, you have the capacity to help its members compete while, at the same time expanding and updating your mission as public servants in the information age. This is an enormous opportunity, but a great responsibility, as well. In the pages ahead, we help you understand how you can play such a role.

Structure of this Report

Following a brief overview of fiber optics and its benefits in Chapter II, Chapter III presents in-depth case studies of four municipal fiber projects that have achieved or are well on their way to achieving positive cash flow. These case studies examine each project's 1) origins, strategies and challenges; 2) approaches to financing, pricing, marketing and operations; 3) key financial metrics, including penetration, ARPU and cash flow; 4) lessons learned and course-corrections made and; 5) benefits provided to their communities.

Chapter IV goes on to distill key lessons and success factors from these four pioneers as well as other muni-fiber projects, some of which are also succeeding, some of which have struggled, and some of which are in relatively early stages of development.

Building on the data and insights gleaned from these real-world projects, Chapter V analyzes the economics of municipal and public utility use of fiber. It focuses on key metrics likely to determine success, including those related to capital cost (e.g., density, type of plant, term and interest rate of financing) and those that drive revenue and operating cash flow (e.g., penetration, ARPU, operating margin). It also examines the relationships among these key metrics as they collectively determine the extent to which a muni-fiber project succeeds financially.

The conclusion of Chapter V is that a well-managed municipal fiber project can, in fact, reach the point of positive cash flow, while also providing residential and business customers—as well as schools and government agencies—with service quality, data rates and prices that incumbents are unable or unwilling to match with their legacy networks and business models.

Having determined that a muni-fiber investment can be financed through direct revenues, Chapters VI and VII consider additional benefits beyond this important but limited measure of success.

Chapter VI focuses on measurable benefits reported in our case study communities and other municipal fiber projects. These include 1) cost savings for local consumers thanks to lower rates; 2) revenue growth and cost savings for businesses and the local economy in general and; 3) reduced costs and other improved operations for local government agencies, schools and public utilities.

Chapter VII considers potentially very large but less proven cost savings and other benefits, with specific reference to the transportation and healthcare sectors, both of which face intensifying pressures to become more efficient and less costly. It also examines the value a municipal fiber network has in extending the benefits of next-generation broadband to the realm of wireless mobile services.

Fiber Optics: The Broadband Future, Available Today

Discovered in 1966 by Charles Kao and G.A. Hockham at the old Standard Telecommunications Laboratories in the United Kingdom, fiber optics has opened a new world regarding the way we communicate. It has created the global telecom village and accelerated the use of the Internet.

Fiber optics is the preferred means of communications because it uses massless photons, rather than the slower more troublesome electron, to carry the communications message. Because photons are units of light they are immune to interference, including electro-magnetic and radio frequency interference. This means they can eliminate much of the background noise that shows up in television, phone and Internet signals carried by copper.

This is an important characteristic when working around power lines, as utilities inevitably do, or where other sources of interference are prevalent.

Optical communications, which uses a tiny light source (a laser or LED) to transmit information which is then read by a photodetector, also offers far greater bandwidth, especially when the light is enclosed in an optical fiber, a hair-thin piece of glass through which the signal runs. Fiber optic systems offer far greater bandwidth over much longer distances than the copper-based systems they are replacing.

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Lasers used in optical communications can produce billions of bits of information every second, and the fibers that are used to pipe them through can carry trillions of such pulses every second. These tiny, semiconductor lasers operate via bit streams resulting from their turning on and off. It is this pattern or code that creates the voice, data streams and video signals.

Optical fibers are drawn from glass cylinders called preforms through laborious years of practice and experimentation. The result is a communications medium far smaller, less cumbersome and more environmentally friendly than the heavy copper lines that are run to most residences.

Because most cable TV and telephone carriers use copper to deliver services such as cable modem and DSL, those using only fiber optics have a substantial advantage. For example, while 20 Mbps streams delivered upstream and downstream is very real over fiber networks today, it is far more difficult using copper that transmits electrons. In fact, some fiber optic networks are offering bandwidths of 100-1,000 Mbps to the subscriber over fiber optics. In short, fiber optics provides faster, better information.

Fiber's Impact on Download Speeds

Type of Service/ Connection	Rated Service/ Data Rate	E-mail w/attachment (2 MB)	X-ray Photo (8 MB)	Instructional Video (600 MB)	DVD Movie (4.7 GB)
Dial-Up	56Kbps	7.11 min	28.43 min	1.48 days	11.60 days
DSL Lite	416 Kbps	50 sec	3.33 min	4.17 hrs	1.63 days
DSL	2 Mbps	9.50 sec	38.01 sec	47.51 min	6.20 hrs
Fiber	10 Mbps	2.13 sec	8.53 sec	10.67 min	1.39 hrs
Fiber	100 Mbps	.21 sec	.85 sec	1.07 min	8.36 min
Fiber	1 Gbps	.02 sec	.09 sec	6.40 sec	50.10 sec

Source: Blandin Foundation, M&I Partners

Because fiber optics was smaller and more difficult to deal with than copper, it initially cost more to install and maintain. However, installation costs have come down considerably and some carriers and vendors say fiber installations are now reaching parity with copper.

There are several architectures that can be used to bring the advantages of fiber optics to the residence. A major advantage of passive optical networks, or PONs, is that they have a smaller number of active components, components that have a higher risk of failure. An advantage of Active Ethernet, a competitor technology, is that it enables fiber connection using standard Carrier-class Ethernet technology. The residence is connected either directly or through aggregation switches to the central office.

In addition, fiber optic networks are believed to be more reliable and less costly to maintain than electronic networking. A fiber optic network will typically have fewer points of failure than a copper-based network, and fiber cable typically enjoys an installation life of 20 years or longer.

Municipalities and public utilities that install fiber optics directly to homes and businesses are, in effect, future-proofing their communities to insure access to the bandwidth-hungry services that are being developed today, as well as those that are still only a glimmer in the eye of an Internet entrepreneur.

Internally such applications will translate into more automated and effective public services, as well as expanded and improved internal communications. For the community as a whole, it will mean expanded and more affordable access to valuable services for local businesses and residents, and for the schools and healthcare facilities that support the community's quality of life.

In short, fiber optics provides the ideal network to support the broadband requirements American communities inevitably are going to face in the 21st century. In that sense, it is the broadband future; a future that, as this report makes clear, is available—and affordable—today.

Successful Pioneers

This chapter contains important news--that towns and cities just like yours are already connecting their members to each other and to the rest of the world via high-capacity fiber optics. These forward-looking communities took the plunge into what, at the time, was pretty uncharted territory. And, to their credit, they are succeeding! And, in doing so, they are showing other American communities how to do the same.

These pioneering communities are making themselves into economic hot beds for decades to come, ensuring their schools have the best connections, that they attract the best jobs, and that that their citizens and businesses thrive.

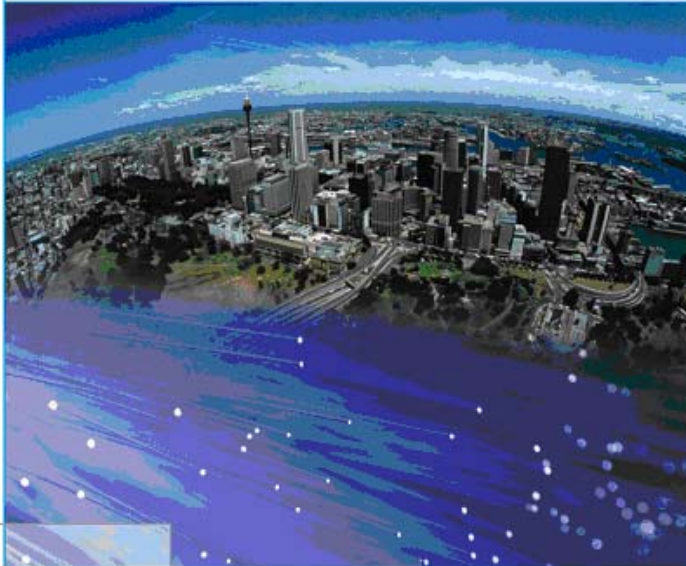
And, as you'll also see, they accomplished this without relying on companies headquartered far way, with agendas far removed from—and too often at odds with--the welfare of their local community. Instead, they relied on the people most familiar with their communities, people who live and work in these communities, people who know them far better than some distant telephone company or cable TV firm. Instead of relying on these companies—which keep merging into ever-bigger and more distant entities—these pioneers built a community-owned and community-controlled network. As a result, the people that answer the phones and make the key management decisions impacting these communities' broadband future are neighbors serving neighbors, not low-paid overseas workers and overpaid corporate executives obsessed with pleasing Wall Street.

Was it easy for these pioneers? Of course not. Nothing that's new and of value ever is. But they stuck to it until they figured out a way forward. And now they can look back on their success with pride, and look ahead with confidence, prepared to deal with the future challenges facing every American community. They can feel secure in the face of an unknown future because they had the gumption to act before it was too late!

As you read on, you'll have the chance to learn from these pioneers, and begin to seriously consider how your community can prepare for a broadband future that will wait for no one who isn't connected to it. Fortunately, it's not too late to act. But, at the same time, it's not too early to seriously evaluate the options for investing in your community's future. It may turn out that, if your community doesn't make those investments itself, no one will.

In this chapter we provide in-depth case studies of four “first-generation” municipal fiber projects that have achieved impressive success in demonstrating that investments in municipal fiber can pay for themselves, while also providing valuable services to their community.

As such, these muni-fiber pioneers are an important source of insights and models for other communities seeking a practical and future-ready solution to the challenges and opportunities presented by the global broadband economy. In the chapter that follows these case studies, we distill the key lessons they offer to communities still grappling with the broadband challenge. *(Continued on Page 18...)*



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(Continued from Page 16...)

Bristol, Virginia

- First muni-fiber system to offer triple-play
- Year service launched: 2003
- Premises passed: Approximately 13,000
- Penetration of premises passed: 63 percent
- Generating net income since 3Q07
- Incumbents are Charter and Embarq
- Has expanded beyond core service area through partnerships
- Created business unit to help other communities deploy and operate municipal networks

The genesis of Bristol Virginia's FTTH network dates back to 1999, when the city's public utility, Bristol Virginia Utilities (BVU), began deploying fiber optics to connect its electric substations. By 2001, BVU was also using the fiber network to deliver broadband and phone service to local schools and government buildings.

As the network was built out, it began to attract interest from local businesses and residents. Like the city's public utility, government agencies and schools, they recognized the value of fiber optics to help their community grow and prosper in a global information economy that might otherwise pass them by.

As businesses and residents pushed for access to the network, BVU began to consider the next logical next step in its network buildout--extending fiber to every location in the city. To help evaluate the financial feasibility of this step, BVU conducted two surveys, both of which confirmed a significant level of interest among consumers. This was followed by the development of two business plans, both of which indicated that success was possible if the network attracted 30-35 percent market penetration. As discussed in more detail below, Bristol has actually achieved a penetration rate of more than 60 percent.

Encouraged by the results of its market research and business analysis, BVU launched a new OptiNet unit, which had a dual mission: 1) to enhance economic development opportunities in Bristol and surrounding areas by providing access to cutting-edge services and future-proof technology; and 2) to improve the quality of life for local citizens and small businesses by offering broadband access at affordable and stable prices.

Legal and Regulatory Hurdles

According to Wes Rosenbalm, BVU's President and CEO, it is reasonable to expect that "incumbents will fight tooth and nail" to stop a muni-fiber project. Given this, he says, such projects "are not something you can half do...you're either in it or not."

As Bristol's own experience suggests, part of being "in it" is being prepared to deal with legal challenges, in particular, those coming from incumbents. So, as BVU's engineers began designing a PON network, its legal counsel and management team were simultaneously mobilizing to overcome key legal and regulatory hurdles.

The first of these was the fact that a Virginia law expressly prohibited municipal entities from offering telecom services. In early 2001, BVU filed a judgment against the State of Virginia to have the law declared invalid. In May 2001, the statute was declared unenforceable, and Senate Bill 245 was passed, authorizing any locality to provide telecom services.

The next legal hurdle occurred when OptiNet's scheduled service launch was delayed after Charter Communications, the incumbent cable TV provider, obtained a permanent injunction trying to keep BVU from offering cable TV services. The basis for the injunction was that Virginia is one of the half dozen "Dillon's Rule" states in which municipalities possess few if any powers except those granted by the state constitution, a municipal charter, or state laws authorizing specific powers. This hurdle was overcome when the 2003 state legislative session passed Senate Bill 875, which authorized BVU to offer cable TV services.

OptiNet's plans to offer telephone service also faced a challenge from the incumbent. In December 2002, United Telephone-Southeast Inc. (Sprint) filed a petition with the Virginia State Corporation Commission seeking an injunction prohibiting the city of Bristol from providing telecommunications service.

The Commission responded with an order denying Sprint's request for injunctive relief and ordering BVU to submit cost studies to support its local exchange prices. In August 2003 Bristol filed its cost studies with the Commission. At an April 2004 hearing, the examiner found that BVU's cost studies showed that, in the aggregate, its telephone service met the requirements of state law and was not being subsidized by other utility services.

In January 2003 BVU formally notified its electric customers they could sign up for OptiNet's telephone, long distance and data services. In early July of that year, Bristol residents also began signing up for cable TV services, following passage of the state law authorizing BVU to provide such services.

Operating in a Competitive Market

Like other successful muni-fiber pioneers, BVU's Rosenbalm believes "the mentality of the public utility monopoly has to change" for a muni-fiber project to succeed.

Among the necessary changes, he says, are an increased focus on marketing and a shift from a "ratepayer" perspective to one in which pricing decisions are made with competitive factors in mind.

Whereas the nature of managing a traditional public utility is “more controlled, less creative, and slower,” Rosenbalm warns that this approach to management is not well suited to a competitive telecom operation.

In contrast to this traditional utility mindset, he says, BVU’s culture has been cultivated to promote creativity. This, he says, has helped BVU achieve penetration rates higher than most other muni-fiber projects (and, in fact, most cable operators), and to attract commercial customers that were not being well served by incumbents. He says these customers have appreciated BVU’s proactive efforts to understand and satisfy their needs, especially when combined with the technical advantages of its all-fiber network.

Nurturing this type of proactive and creative culture, says Rosenbalm, requires a willingness to hire new staff and pay them competitive salaries. He says roughly 90 percent of the people that currently work for him were hired from the outside, not from BVU’s existing utility operation.



Wes Rosenbalm,
President and CEO,
Bristo

Rosenbalm also agrees with other muni-fiber pioneers that success requires management decisions to be insulated from political pressures.

BVU management also stresses the value (to the community and also to OptiNet’s financial success) of being prepared—from both a technical and marketing perspective—to serve the needs of business customers. Part of this is to deliver strong and reliable customer service. Another element, notes Mark Lane, OptiNet’s director of network engineering, is to be proactive and creative in leveraging the power of fiber optics to develop solutions that may not be covered by standard product offerings, and/or that satisfy a need business customers may not even have been aware they had.

Pricing and Consumer Savings

Rosenbalm says that, while OptiNet does have lower a la carte pricing than its cable competitor, its prices are not always the lowest available, especially when compared to some of cable’s discounted bundles. Nevertheless, he estimates that the average customer saves about \$20 a month by subscribing to OptiNet.

While these savings no doubt have helped OptiNet attract and retain customers, Rosenbalm says the network’s number one benefit is “great customer service.” The competitive power of this combination of high-quality service and low, stable pricing is reflected in CFO Stacey Bright’s statement that many Bristol residents have become “immune” to Charter’s promotional discounts, which are sometimes quite steep.

These comments by Rosenbalm and Bright are given credence by the fact that BVU has been able to achieve 60 percent+ penetration rates without offering discounts on multi-service bundles, which Charter discounts very heavily.

Though it doesn't offer multi-service discounts or short-term promotions, BVU's regular prices can still save Bristol residents money over the longer-term, even when Charter's discounted rates are factored into the equation.

For example, Bristol residents can get Charter's highest speed Internet tier, which offers downstream speeds up to 9 Mbps for as low as \$24.99 a month for their first six months of service. But, after this promotional period, they'd be charged \$59.99 if they have any other Charter services, or \$69.99 if they don't. Similarly, the six-month promotional price for Charter's 5 Mbps tier is only \$19.99, but its regular price is \$54.99-\$64.99, depending on whether a customer also subscribes to another Charter service.

This approach to pricing contrasts sharply with BVU's, which offers 2 Mbps, 4 Mbps and 6 Mbps tiers for \$26.36, \$35.16 and \$39.56 a month. While all of these prices are higher than Charter's promotional prices, they are all much lower than Charter's standard prices, especially for customers that don't also subscribe to video or voice service.

Under Charter's current promotions, customers signing up for its 5 Mbps tier would pay \$450 for their first year of service, and then \$660 for their second year. Their first-year and second-year costs for Charter's 9 Mbps tier would be \$510 and \$720. These compare to \$316, \$422 and \$475 per year for BVU's 2 Mbps, 4 Mbps and 6 Mbps tiers.

Comparison of BVU and Charter Internet Pricing

	BVU			Charter*	
	2 Mbps	4 Mbps	6 Mbps	5 Mbps	9 Mbps
First 6 months	\$ 158	\$ 211	\$ 237	\$ 120	\$ 150
First year	\$ 316	\$ 422	\$ 475	\$ 450	\$ 510
Second year	\$ 316	\$ 422	\$ 475	\$ 660	\$ 720
First 2 years	\$ 633	\$ 844	\$ 949	\$ 1,110	\$ 1,230

* For customers that also subscribe to Charter video and/or phone service; other

Charter Internet customers pay \$10/mo. extra
 Source: Analysis of data from service provider web sites

As the table above shows, the total two-year cost for Charter's Internet service would be \$1,110 for its 5 Mbps tier and \$1,230 for its 9 Mbps service. These total costs would be even higher for customers that don't also subscribe to Charter's video or voice service, to the tune of an extra \$10 a month. The comparable two-year costs for OptiNet Internet service are substantially lower, totaling \$633, \$844 and \$949, respectively for the 2 Mbps, 4 Mbps and 6 Mbps tiers.

BVU also offers an always-on 64 Kbps Internet service for \$16.95, which is positioned to attract dial-up subscribers. As Rosenbalm notes, this frees up a household’s phone line, while also reducing BVU’s costs related to dial-up service.

Rosenbalm says gamers are probably the one customer segment that is currently very focused on the technical advantages provided by BVU’s all-fiber network. The rest of its customers, he says, “just want reliable service.” In fact, he estimates that 75 percent of BVU’s residential customers don’t even know they’re being served by an all-fiber network.

BVU offers six tiers of video service, starting with 18 local broadcast and basic cable channels for \$11.95 a month. Its “Expanded Basic” tier provides more than 75 channels of programming and costs \$36.75/mo. This tier roughly corresponds to a service offered by Charter that costs \$52.99. The latter has a six-month promotional price of \$39.99, which is still more than three dollars higher than BVU’s price.

BVU’s next two tiers add additional digital video and music channels and cost \$45.99 and \$49.99 a month, respectively. The closest Charter programming package carries a regular price of \$59.99 and a six-month promotional price of \$49.99, in the same range as BVU’s standard price for a comparable service.

BVU’s top three programming package range in price from \$55.95 to \$69.95. The high-end package roughly corresponds to a Charter package costing \$77.99 and available for six months at \$69.99, the same price charged by BVU on an ongoing basis.

As noted above, Charter offers some steeply discounted pricing for the multi-service bundles it offers in Bristol. The table below shows the extent of its “triple-play” discounts, all of which apply for the first twelve months of service.

Charter Triple Play Bundle Discounts*

Standard Price	Discount Price	Savings from Discount	
		\$	%
\$173	\$130	\$43	25%
\$164	\$110	\$54	33%
\$148	\$70	\$78	53%
\$154	\$100	\$54	35%

* discounts are for first 12 months of service
 Source: Analysis of data from Charter web site

As the table shows, Charter’s 12-month promotional prices provide discounts ranging from \$43-\$78 a month, or 25-53 percent on a percentage basis.

To get a sense of how Bristol residents might view the attractiveness of Charter’s triple-play discounts, we compared the total cost they would pay for one of the bundles listed above to what they’d pay if they bought comparable services from BVU.

Our comparison—reflected in the table below--considers 1, 2 and 3 year timeframes. It compares BVU pricing to the Charter bundle that normally costs \$164/mo. and is available for \$110 for the first twelve months.

BVU Savings vs. Comparable Charter Triple Play Bundle

			BVU Savings vs. Charter	
	Charter	BVU	\$	%
First year	\$ 1,320	\$ 1,608	\$ (288)	-22%
Additional years	\$ 1,968	\$ 1,608	\$ 360	18%
First 2 years	\$ 3,288	\$ 3,216	\$ 72	2%
First 3 years	\$ 5,256	\$ 4,824	\$ 432	8%

Source: Analysis of data from service provider web sites

Not surprisingly, Bristol residents choosing Charter can save money during their first year of service, roughly \$288 for this particular combination of services. But, after this first year of service, these households would pay \$360 more per year for this Charter bundle. As a result, they’d end up paying \$72 (2 percent) more over a two-year period if they signed up with Charter, a cost-premium that would increase to \$432 (9 percent) over a three-year period.

The fact that BVU has performed so well in terms of subscriber growth and retention, even in the face of Charter’s very steep one-year bundle discounts, supports Bright’s contention that Bristol residents are largely “immune” to Charter’s discounts. It also suggests that local residents with an option to subscribe to a muni-fiber network that delivers reliable service at low and stable prices, will, for the most part, choose that service over a cable incumbent, even if the latter provides discounts that offer substantial savings for a full year of service. And, as OptiNet’s experience illustrates, this scenario can lead to financial success.

Beyond the issue of pricing, BVU is “leading the way” in bringing innovative features to the Bristol market, according to Rosenbalm. As an example, he notes that OptiNet was the first local service provider to offer “On Screen Caller ID,” a feature that enables customers’ TV sets to identify who is calling them on the phone (see poster at right). The service is free for “Triple Play” customers and costs \$1.99 per month for other BVU subscribers.



BVU has also begun deploying more advanced GPON (gigabit passive optical networking) equipment in its network, after initially deploying BPON (broadband passive optical networking), an earlier generation of fiber

optic technology. One of the key advantages of GPON is that it offers much faster data rates than BPON, while also working well with newer telecom gear.

BVU's GPON deployment, says Rosenbalm, will be driven by demand for higher speeds and new services, and will probably occur first in new growth areas, to new customers, and to customers willing to pay for services that require GPON's more advanced capabilities and data rates. This ability to cost-effectively upgrade capacity is one of fiber's advantages relative to other network technologies. Fiber optics itself is only limited by the electronics that is attached to it. The fiber itself can deliver trillions of bits of information.

Though BVU has used the same basic radio frequency (RF) technology used by cable operators for its video service, it is currently evaluating business models for adding an "IPTV" overlay, which uses Internet Protocol (IP) technology to deliver video services. BVU management says "IPTV wasn't a viable competitive service platform" when they made this decision in 2003, but that it has the potential to enable new applications, including those that integrate multiple services and interactive features.

Subscriber Growth

Though, as noted above, legal challenges delayed its service launch, OptiNet was able to grow its customer base fairly quickly. In fact, by the end of 2003, its penetration of homes passed had reached nearly 39 percent. By the end of 2007, it exceeded 60 percent, and had reached roughly 65 percent in its original footprint.

Given that OptiNet has continued to take new orders and has experienced very low subscriber turnover (known as "churn"), CFO Stacey Bright sees 70 percent or higher as an achievable long-term penetration rate. Monthly rates of competitive churn, she says, have averaged less than 0.5 percent of subscribers per month, an extraordinarily low rate in a competitive market. OptiNet's penetration would already be higher than it is today, she adds, if it lowered its standards in terms of credit risk.

Bright and her colleagues say BVU's investment in customer service and the brand loyalty it engenders are key to its success in attracting and retaining customers.

In terms of subscriptions to specific services, OptiNet's mix is fairly balanced. At the end of 1Q08, cable TV, telephone and Internet accounted for 35.3 percent, 34.5 percent, and 30.2 percent, respectively, of total OptiNet subscriptions. The average number of services per OptiNet customer has held steady in the 2.36-2.39 range since early 2005.

Economics

As of March 31, 2008, the total investment in OptiNet was \$54.9 million, of which \$26.5 million was in the form of a revenue bond. Bright estimates that this total investment includes \$2.5 million-\$3 million for expenses directly related to the multiple legal and regulatory challenges BVU faced during its startup phase. Excluding these costs, the total investment in OptiNet comes to roughly \$4,000 per premise passed.

OptiNet's per-passing cost is the highest among our case studies in large part because it was the nation's first muni-fiber network to offer triple-play services and, as such, paid equipment prices that have since declined dramatically. As Bright, notes, a comparable project launched today would likely incur costs roughly 40 percent lower than OptiNet's, which would put them in the \$2,400-\$2,500 per passing range.

As of March 31, 2008, OptiNet's overall penetration of homes and businesses passed by the network had reached nearly 63 percent.

During the first quarter of 2008, each OptiNet residential connection was generating an ARPU of \$93.18, while the average business customer was spending nearly \$260 a month on OptiNet services. Both of these figures increased further in April, with residential ARPU up to \$96.11 and business ARPU reaching \$284.86. By our calculation, its blended ARPU (including both residential and business customers) was more than \$112 in the first quarter, and probably north of \$115 in April.

OptiNet has been consistently generating positive EBITDA (earnings before interest, taxes, depreciation and amortization) since the third quarter of 2004, a little more than a year after it was able to offer its customers a full line of voice, data and video services. According to Bright, OptiNet's EBITDA margin has recently been in the 37-38 percent range, which is toward the low end of the range reported by major cable TV operators.

Like all small operations offering cable TV service, BVU pays more per-subscriber for its video programming than large incumbents like Charter. And, given its focus on customer service, it may also be spending more per subscriber on this category of expense. If so, its strong penetration, churn and ARPU performance suggest this incremental spending has been a wise investment.

OptiNet began consistently generating positive net income during the third quarter of 2007—three years after it went EBITDA-positive, and a little more than four years after it began offering a full lineup of services.

BVU's management sees the combination of several factors as key to OptiNet's ability to attract customers and achieve financial success:

- BVU’s history of providing quality electric service that dates back more than 60 years, which provided a solid foundation to enter the competitive telecom industry.
- The provision of locally-provided customer service and technical support, something that is becoming increasingly rare among regional and national telecommunication operators, a lack has frustrated many customers and would-be customers.
- The delivery of quality products and services at affordable and stable prices over a state-of-the-art, fiber-optic network.

A key implication of Bristol’s success is that well-run muni-fiber operations that make customer service a top priority can not only provide valuable services to their community, but can also achieve high enough penetration and ARPU levels to become financially stable and even generate a surplus—and that they can do so even in the face of very aggressive promotional pricing from incumbents.

The strong subscriber growth and low-customer churn in Bristol and our other case-study communities suggest that households feel more favorably toward community-based organizations they can trust will not leave town, be acquired, or try to gouge their fellow citizens. In short, they have confidence that their service provider has their best interest at heart. The result of that trust is strong customer loyalty. And as OptiNet’s success illustrates, that loyalty adds unique strength to the muni-fiber business model in a competitive market in which customer loyalty is hard for commercial providers to build, and easy for them to lose.

Public Benefits

As with other muni-fiber projects, one of the key benefits to local homes and businesses is the amount they save on their monthly bills. As noted above, Rosenbalm estimates that the average residential OptiNet customer saves \$20 a month (\$240/yr.) compared to what they would pay for comparable service from an incumbent. On top of this would be any savings to incumbents’ customers due to price reductions driven by competition from OptiNet.

As noted earlier, BVU’s initial fiber deployment linked local government and school buildings. According to a study done at that time, this yielded annual savings of \$156,000. Today, says Lane, some connections between local schools are operating at data rates as high as 100 Mbps to 1 Gbps. The school’s fiber links, he says, have enabled testing and other applications that could not be supported by the T-1 links on which they previously relied.

BVU provides an important example of how a successful muni-fiber project can drive benefits beyond the borders of the original community it was intended to serve. A key factor in BVU's ability to do this, its management says, was the development of strong partnerships with entities outside their core service area

For example, in 2003 BVU and the Cumberland Plateau Planning District Commission (representing four neighboring counties) collaborated on a plan to construct a 45-mile fiber optic run between Bristol and Richlands, through the town of Lebanon in Russell County. Funding for the project came from a \$1.6 million grant from the Economic Development Administration (EDA), supplemented by \$1.55 million in matching funds from the Virginia Tobacco Commission. The prospect of having access to this fiber network led two large technology companies, CGI Inc. and Northrop Grumman Corporation, to build multi-million dollar facilities in the Russell (County) Regional Business Technology Park during 2007.

In late 2005, the EDA provided a second \$3 million grant to the Virginia Coalfield Coalition, an amount that was once again matched by the Virginia Tobacco Commission. These funds were used to extend BVU's fiber optic cable an additional 155 miles into Southwest Virginia through the counties of Russell, Tazewell, Buchanan and Dickenson. As a result, businesses in these remote, rural locations of Southern Appalachia now have access to some of the most robust digital communication technologies in the world. BVU is also part of an effort to extend a planned medical network linking hospitals, outpatient clinics and other facilities in various communities around the state.

As Bristol developed a reputation as an early muni-fiber success story, BVU's management faced a steady stream of inquiries, from both public and private entities in the United States and abroad, seeking help in developing a communications solution for their communities. This ongoing interest in BVU's growing base of knowledge and experience led in April 2007 to the formation of a new business unit called BVU FOCUS.

Operating as part of BVU OptiNet, FOCUS (Finding Opportunities for Communities in the United States) offers broadband consulting and management services to entities across the country that want to deploy telecommunications and information services to benefit their local communities. FOCUS acquired its first customer in August 2007, a consortium of towns in North Carolina that took ownership of an aging Internet and cable system with more than 15,500 customers. FOCUS is managing the entire system for the towns of Davidson, Mooresville and Cornelius.

A key goal of FOCUS, says Lane, is to help other communities "avoid the potholes," by taking advantage of the lessons BVU has learned. One such lesson relates to the value of developing efficient operations, including procedures to add, move, change and disconnect various services. While a good business plan is obviously important, says Lane, he also notes that business plans often lack sufficient detail with regard to the kind of operational systems BVU found necessary to efficiently deliver high-quality service, and achieve financial success in a competitive market.

(Continued on page 35...)

Lane's comment about operations and BVU's decision to launch FOCUS highlight the value of the first wave of muni-fiber successes to provide models and resources to help other communities move more quickly, efficiently and painlessly along the muni-fiber learning curve. Combined with ongoing and fairly dramatic improvements in the cost/value proposition offered by FTTH technology, this suggests that future generations of muni-fiber deployments will have an even easier time achieving financial success.

(Continue on Page 35..)

(Beginning of Technology Vendor Advertorial)

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Millennials: The Future is Now

How to Position your Network and Services to Meet the Needs of Tomorrow's Users

By Matthew Mair, Alcatel--Lucent

Municipalities are well aware of the boomer retirement wave that is hitting state and local governments. It's an issue that has public officials nationwide thinking about knowledge transfer, as well as employee retention and recruitment.

Additionally, municipality CIOs are dealing with a different problem: how to develop an infrastructure that meets the needs of a new generation of citizens and employees who are on the cutting edge of technology and demand it in their everyday lives. Young, newly hired workers expect to use technology to get their jobs done as well as use services that are typically found only in the "big city".

To understand what the future holds for municipalities, look no further than teenagers with iPod earbuds in their ears, cell phones in their pockets and laptops under their arms. While previous generations of consumers would have been happy for content and applications to remain discretely sealed in their own environments (songs on iPods, voice on the phone and data on laptops), the new "Millennial" generation – those born after 1980 – is insisting on two critical requirements to satisfy their demand for new technology and their willingness to pay for it:

- Interoperability
- Integration

Unlike previous generations, Millennials do not take a passive approach to technology. They want to be able to add, subtract and change key elements of technology offerings and find new ways of using their tools to advance their personal and professional objectives. As a result, they expect their phones, music players and notebook PCs to share data and applications (interoperability). Moreover, they are prepared to reward any player in the market who helps them organize and manage a multitude of technological devices from a single, centralized platform (integration).

This is a generation of natural-born technologists. They are willing to create their own mash-ups of services, and so are looking for someone capable of providing a venue or platform over which their lifestyle is supported and their choices maximized. As a group, Millennials are specifically interested in service providers that let them harness technology in such a way that they can complete their work quickly, while accessing entertainment in short segments. For this reason, Millennials are sometimes referred to as the "snack" generation because they work and play in short intense segments.

The Millennial Perspective

Millennials view consumer goods and services – especially technology products and telecommunications services – as commoditized means to ends. Brand loyalty, for this market, is barely a consideration.

According to a study conducted in the summer of 2007 by Survey U, the decision to purchase the much-hyped iPhone was influenced most by its performance (92%), price (93%) and ease of use (92%). Surprisingly, the Apple brand, according to respondents, was rated as the least important factor (47%).¹ Nonetheless, Millennials contributed to a significant portion of the demand for the iPhone. According to iSuppli, by September 4, 2007, “57% of iPhone purchasers were under 35.”

What these studies (and the general market success of the iPhone) seem to show is that Millennials want products that will simultaneously work with different media types (voice, data, video) and mediums (wired and wireless) to support their lifestyle and interactions with friends, family and co-workers.

So, what does all this mean for municipalities?

All of this strongly implies that the future success of communities will depend on a municipality’s capability to address the Millennials’ lifestyle by delivering content, communication and applications - anywhere, at any time, on any device. Of course, meeting this challenge will require increased network bandwidth and service offerings but the dividends are significant:

- **Economic development:** Adding broadband access increases your community’s attractiveness and ability to retain an additional generation of residents, increasing business and growing your tax base.
- **New revenue opportunities:** Moving beyond basic voice, video and data services to customized user-centric applications improves revenue flow.
- **Community empowerment:** Building community portals for city services, telemedicine and distance learning enrich the lives of community members. Furthermore, broadband access ensures smaller communities and urban centers do not experience the digital divide.

At Alcatel-Lucent, we believe this “mash-up environment” of devices, communications capabilities and delivery options is giving rise to a rapidly growing market of “blended lifestyle services.” These services seamlessly combine elements of existing offerings with completely new, user-centric services. In short, we believe that it is imperative for service providers to rapidly create new business models that offer businesses and consumers highly personalized, highly profitable offerings.

This is important because, when Millennials find something they like, they broadcast their approval with extensive amplification. For instance, the Millennials surveyed maintain large IM and texting lists that average 37 people (compared to just 17 for the overall sample). As a result, when Millennials find a particular television show they like, a website they enjoy, or a device they covet, they tell an average of 18 people, compared to only 10 people for all other age groups.²

Millennials are the Future

Like the post-World War II Baby Boom generation that has influenced and shaped market and technology trends during the past 30 years, the Millennials' promise to wield incredible market power over the next 30 years. Alcatel-Lucent primary research defines the Millennial's age group as consisting of those between the ages of 11 and 25. In the United States alone, they number 55 million people.

But beyond quantity, the quality of Millennial demand is fundamentally different from previous generations. It is the direct result of their formative years, which has defined their perception of the world and their role within it. Among other things, this group has experienced:

- The emergence of global culture and the 24/7 economy made possible by the Internet and digital technology, which has enabled them to research projects using a global library of virtual knowledge
- More structured and scheduled social lives, with a host of pre-arranged activities, both in the real world and online
- A shift in focus from individualism to family and community, as social and family interaction becomes more virtual, viral and "hyper-connected"
- Greater access to broadband connections as well as technology that enables global, instantaneous and spontaneous communications

Alcatel-Lucent Worldwide Lab Taps into Millennial Mindset

Alcatel-Lucent has an extensive database of blended lifestyle market research data from around the world collected during the last three-plus years. Additionally, Alcatel-Lucent continuously acquires insight into how Millennials perceive mobile services through the work of the Alcatel-Lucent Worldwide Lab.

Established in the spring of 2006, the lab conducts qualitative research, which provides insights into useful trends that set the stage for additional research such as focus group testing or deep quantitative assessments.

Members of the lab are Millennials who are also early adopters, to whom their friends look for advice on new products and services. The lab research helps Alcatel-Lucent to:

- Learn about the user experience from the end user's point of view
- Help operators create better services
- Generate ideas to help build better products

Millennials: A Major Influencer of Broad Purchase Decisions

These key experiences have changed how Millennials view their relationships with friends and family. They remain connected spontaneously and instantaneously with family, friends and colleagues by whatever means available: basic voice service, phone-based text, Internet instant messaging, and e-mail services at home, school and work. The business opportunity is in providing each of these individuals with a unique communications package that attracts their purchase loyalty as well as the purchase loyalty of family and friends who are in their sphere of influence when it comes to adopting new communication services.

Moreover, as we anticipate bandwidth-hungry 4G networks, it is important to note the Millennials' passion for user-generated content, remote multiplayer gaming, and their willingness to broadcast what they think or like. According to a separate study by Deloitte, 62% of Millennials and 41% of Xers watch YouTube or other video streaming sites, while 46% of Millennials embrace cell phones as an entertainment device.³

Millennials: Creating their Own Content and Buzz

Millennials significantly influence the adoption of new services. For example, they keep tabs on the world around them by getting news and information whenever they want it and wherever they want it, rather than being tied to a publisher's or broadcaster's schedule. According to Comscore, in May 2007, nearly 75% of U.S. Internet users watched an average of 158 minutes of online video during the month.⁴ Furthermore, Millennials are increasingly becoming personal content publishers themselves and consumers of the personal content published by others.

This new generation of consumer turns to online sources for information, and uses online venues to share viewpoints on news, products and services through social networks that operate independently and outside of "company-sanctioned" sites. This web "word-of-mouth" can make or break a product or service within days of it being introduced in the market. Indeed, this phenomenon has created a whole new marketing category, referred to as "buzz marketing." If contributors have had a bad experience, they are by no means shy about reporting it to their network to ensure others don't have the same experience. Likewise, a good experience is quickly relayed so that everyone can benefit.

As a result, Millennial reliance on online information and networks is driving growing demand for web-based communities and the hosted services that facilitate collaboration and information-sharing among users.

Tapping into the Millennial Market

Millennials want communications experiences that are richer, portable and integrated. They want to download and play songs and videos, send text messages, conference with colleagues and friends, and exchange pictures or videos on whichever device they are using. And they don't want to be tied to any one location in order to do it.

For Millennials, services and applications must:

- Facilitate their connectivity and ability to share information seamlessly.
- Provide clear pricing for each element of the lifestyle "package," with an underlying presumption that basic service is either flat-rate or – in the case of the Web – free.
- Facilitate their ability to preserve a work/life balance, and thus enable them to control and prioritize their work and off-work time management.
- Give them the freedom to work from anywhere and at anytime.
- Allow them to complete work quickly and access their entertainment in short segments.

In short, Millennials expect converged telecommunications services to be a constitutive component of every type of personal and business communications experience.

Millennials Provide a Great Source of New Revenue

Alcatel-Lucent's primary research confirms that end users in these groups have a strong interest in blended, user-centric services. But service providers need both the interest and the end users' willingness to pay in order to enable the service provider to achieve a return on investment for the development and delivery of these new blended services. The good news is that the research also shows that Millennials are willing to pay more for blended services in all the countries surveyed. Based on Alcatel-Lucent primary market research, the opportunity represents more than \$1 billion per year, by 2011, in North America.

With the right network and service delivery environment in place, municipalities can enable and deliver the personal, blended service solutions that address the needs of Millennials. This requires a network and service infrastructure that can support and blend end-to-end, triple play services, as well as deliver high-performance video and gaming, high-speed data and voice offerings over fixed and mobile infrastructures. This must also be done with a high level of service reliability and seamless transparency across devices and networks, enabling service innovation and operational agility.

Conclusion

Municipalities that do not pay attention to the new demand patterns presented by Millennials do so at their own peril.

- Millennials are a force to be reckoned with owing to their huge numbers and the nature of the new services that they are demanding. This generation of consumers (and future workers) expects their community to adapt technology and services to their needs, not the other way around.
- Millennials want their telecommunications services to be highly personalized and flexible. They want to be able to create, mix and match content, content types and applications.
- Communities that expect to be successful in attracting Millennial demand will have to manage significant change in both their technology infrastructure and business models.

In conclusion, Millennials are redefining the information and communications technology that will be called upon to meet their wants and needs. For this reason, Alcatel-Lucent is studying this demographic carefully. Indeed, to further our understanding of this emerging demographic, we are committed to working with municipalities to amass information on this group. With this information, we shall continue to develop a new generation of blended communications services that will account for the lion's share of revenue generated by the communications industry by the end of the decade.

¹ ©July 2007, iPhone Update, Survey U

² ©2007, [State of the Media Democracy Survey](#), Deloitte

³ ©2007, *Are you ready for the future of media?*, Deloitte

⁴ © July 17, 2007, [Comscore press release](#)

(End of Technology Vendor Advertorial)

(Continued from Page 28)

Burlington, Vermont

- Burlington is Vermont's largest city
- Year residential service launched: 2006
- Premises passed: Approximately 18,300
- Penetration of premises passed: approximately 21 percent overall and 43 percent in initial launch area, which has had service available since February 2006
- Expected to generate net income by 2009
- Financed via capital lease
- Incumbents are Comcast (formerly Adelphia) and Fairpoint (formerly Verizon)
- Former project director Tim Nulty is now spearheading multi-town muni-fiber project planning to serve 23 small Vermont towns

Burlington is Vermont's largest city, with a population of roughly 38,000. Until recently, its telephone company (and the dominant telco in the state) was Verizon, which for some time has wanted to sell its holdings in Vermont (and in New Hampshire and Maine). In March 2008, Verizon achieved its goal, completing a sale of these access lines to Fairpoint Communications, a telco that serves rural and small town communities in 18 states. When the Burlington FTTH project was launched, the state's dominant cable provider was Adelphia, which ended up in bankruptcy, with its Vermont holdings eventually sold to Comcast.

Given their situations, neither incumbent was very aggressive in deploying broadband services in Vermont, with the FCC estimating the state's DSL availability at just 66 percent as of mid-2007, the lowest level of any state, and significantly below the national average of 82 percent.

This, again, points to a major complaint by people who live in communities like Burlington. Why is a major cable TV provider that serves tens of millions of customers, and that has just purchased your bankrupt cable TV carrier, going to care about your community? To them, your community may be well down on its priority list. That would not be the case for a local organization, especially one owned and controlled by the community itself.

The lack of broadband availability and high quality service from incumbents led Burlington citizens in 1997 to vote in favor of a municipal fiber network operated by its local municipal utility, Burlington Electric Department (BED).

In 1999, BED partnered with a private company, Aptus Networks, to build the network. The project subsequently won approval by local voters and the state legislature for a change in the city's charter that allowed it to pursue the FTTH project. It needed state approval because Vermont is one of a half dozen "Dillon's Rule" states in which municipalities only have powers expressly granted to them by state governments. Though the state law, passed in May of 2000, authorized the city to undertake the FTTH

project, it did not allow any of its costs to be supported by revenue from BED's existing utility operations. It also required the city to finance the project in a way that would not place any burden on taxpayers, BED rate payers, or the state.

Having jumped through these initial regulatory hurdles, the city and Aptus sought to finance the project. Unfortunately, this occurred amidst a financial meltdown in the dot-com and competitive telecom sectors. In April 2001, having missed a deadline to raise funds, Burlington's FTTH planners found themselves at an impasse.

As it weighed its options, the city hired Tim Nulty, a telecom industry veteran who had retired in the area, as a consultant. Nulty's background included a PhD in economics from Cambridge University, and experience as Chief Economist for Commerce committees in both houses of Congress, Senior Manager for World Bank telecom projects, and telecom investor and entrepreneur in Eastern Europe. This background gave Nulty an unusually deep and broad perspective on the muni-fiber opportunity, how to make it work, and its potential role in the economy.

After consulting with the city, Nulty was hired in early 2002 to head a new city department called Burlington Telecom. Reflecting the difficult market conditions at that time, as well as the still-emerging nature of muni-fiber business models, Nulty took a conservative approach to the Burlington FTTH buildout. Rather than embarking immediately on a full FTTH deployment, the project was financed and executed in multiple phases, with each phase having to show sufficient signs of success before the next one was launched.



The first phase of the project was a limited deployment to serve 38 government and school buildings, which allowed city agencies and schools to cut telecom expenses by 35 percent, or \$150,000 per year. It involved roughly 17 miles of fiber optic plant, cost about \$2.6 million, and was completed in September 2003. The second phase expanded the network to a number of large businesses, starting with those relatively near it. The third phase expanded the reach to more businesses, while the fourth extended the network to serve the city's residential areas. The bulk of the fourth phase was completed in 2007.

*Tim Nulty, former
General Manager,
Burlington Telecom*

Financing

Unlike most other muni-fiber projects, the Burlington FTTH network was funded through a tax exempt capital lease rather than a municipal bond. It did not use and was not backed by public tax dollars or revenues from the city's other public utility units, neither of which are allowed under the city charter approved by the state. Under Vermont law, a municipal revenue bond would have required a voter referendum.

The network's capital lease operates very much like a mortgage, with the private financier owning the network and leasing it back to the city for the term of the lease, which for the Burlington FTTH network was 15 years. After the term of the lease, the city will own the network. Capital leases are an established form of municipal finance, especially for projects that have their own revenue stream, such as parking garages.

The project's cost was initially funded by Koch Financial Corp. The interest rate for Phase 1 was 5.63 percent. The initial \$20 million for Phases 3 and 4 carried an interest rate of 5.17 percent. Nulty's experience as a telecom operator, as well as the project's conservative multi-phase approach, were helpful in arranging the financing, especially at a time when funding for telecom projects was difficult to attract. Nulty's experience also allowed more design and construction tasks to be handled in-house. This reduced some of BT's costs relative to communities that hire an outside firm to manage design and construction on a turnkey basis.

In 2007, BT went out to raise the final \$8 million needed to get the project to the point of generating positive cash flow. When it received a funding offer carrying an interest rate of just 4.17 percent--a full percentage point below its rate for the previous financing package--BT decided to refinance the entire lease. It also boosted the amount of incremental funding from \$8 million to \$11 million, which provided a larger financial cushion and allowed BT to accelerate installations to levels beyond what could be financed from internal cash generation.

Nulty says that some of the additional funding requirement was a result of Adelphia's unsuccessful challenge to BT's "certificate of public good," which it needed to offer video services. He says that while Adelphia's challenge cost BT only \$50,000-\$75,000 in out-of-pocket expenses, it delayed the project by 14 months, which resulted in \$4 million in lost revenue. As discussed elsewhere in this report, legal challenges are a key element of incumbent strategies to halt or weaken muni-fiber projects. The specific nature of such challenges will vary somewhat based on each state's laws governing the provision of telecom and cable TV services and the rights and powers of municipalities and public utilities (see separate chapter on state laws).

Offering Retail Service on an Open Network

Nulty is adamant that a muni-fiber operation must have the option to offer retail services and that this option should be exercised. He points out that fiber optic networks are very capital intensive, with a large amount of upfront spending, and that this translates into a substantial debt-service requirement that typically begins even before the network is fully built out. This, in turn, puts intense pressure on the project to ramp up revenues as quickly as possible to support debt service as well as operating expenses. The most effective way to do this, he says, is to offer service directly, rather than rely on the business models and ability to execute of unaffiliated retail providers.

The revenue-related advantages of the retail model are reflected in two key metrics, says Nulty—penetration and average revenue per subscriber (known in the industry as ARPU). While wholesale ARPUs may be as low as \$30-\$40, he says, retail ARPUs in today's "triple-play" market environment are likely to be in the \$100 range or even higher.

In terms of penetration rates, Nulty says "being the town" is an invaluable marketing benefit. The message to potential customers is that "it's YOUR network, the customer service reps are your neighbors, the revenue it generates stays in your community, and any profit it makes will help cut your property tax." As evidence of this marketing value, Nulty notes that in its first two years of providing service, BT spent less than \$20,000 on marketing, never purchased a newspaper ad, and that its primary marketing tool was word of mouth among community members. Much of this marketing advantage would be lost, he suggests, if BT had relied on private companies to provide retail services on the network.

Rather than a marketing challenge, the problem faced by BT, Nulty says, was too much demand, which he described as a management challenge. If installations, technical support and customer service are not handled well, he warns, the initially positive wave of publicity can backfire on a muni-fiber project.

Nulty echoes comments from other muni-fiber pioneers in terms of their attitudes toward customer service. While private companies, he says, are inclined to spend the least they can on customer service without losing customers, the approach taken by BT is to "provide the best customer service you can afford." He says he would tell his staff, "if you can't solve [a customer's problem] on the phone, go fix it in their home." And "you only have to do [this] once," he adds, "and you've won [customers'] hearts and minds."

Though Nulty makes a strong case that muni-fiber projects should offer retail services (and against state laws prohibiting this), he is also a believer in open networks that allow other service providers access on a non-discriminatory basis. And, importantly, he sees no fundamental contradiction between these two principles. The analogy he uses is to public roads. Cities, which build and maintain local roads, he says, also use them to provide bus service, trash pickup, police, fire and other public services. At the same time, these roads are open to anyone seeking to use them for virtually any kind of transport service.

Noting that the Burlington network is even open to incumbents, Nulty says access was, in fact, offered to Verizon. While the telco's local management was attracted to the proposition, he says, corporate decision-makers killed the idea. In Nulty's view, this reflected the staunch opposition of major telecom incumbents not only to muni-fiber networks, but also to "open network" and "net neutrality" requirements affecting their own networks.

Pricing and Consumer Savings

In April 2008, BT marked its second anniversary of offering residential service with the introduction of a new set of multi-service bundles as well as HDTV and DVR services. It also announced a price increase of 2.9 percent, which is lower than the typical annual rate increases charged by cable operators. In the brochure announcing its price increase to customers, BT characterized it as “based on our operational costs not an investor dividend expectation.”

BT’s new “triple-play” bundles range from \$99 to \$159 per month. The \$99 package includes unlimited North American calling, voice mail and three other calling features, 3 Mbps symmetrical Internet access, 80+ video channels, video-on-demand and 45 digital music channels. Its \$119 package boosts the video offering to 135+ channels, while its \$159 tier increases video channels to more than 180, including multiple channels of the five major “premium” services (HBO, etc.). It also boosts Internet speeds to 5 Mbps in both directions. The company’s fastest residential broadband tier offers symmetrical service at 8 Mbps.

When it was announced, BT’s new bundled pricing was similar to Comcast’s promotional triple-play offers, which were priced at \$99, \$129 and \$159. While there were some differences in data rates (e.g., Comcast offered download speeds up to 6 Mbps, but upload speeds below 1 Mbps) channel offerings and other features, the packages appeared roughly comparable, except for one thing. This was the fact that Comcast’s prices only covered a 12-month period. After this period, its \$99 bundle’s price would jump to at least \$128 (perhaps as high as \$144), while its \$159 package would see a price hike to roughly \$200.

Burlington's Bundles: BT vs. Comcast

	Triple-Play Bundle Pricing		Description
	First Year	Standard	
BT Standard	\$99	\$99	80+ channels; 3M/3M Internet; Unlimited LD & voicemail
BT Std. Plus	\$119	\$119	Increases video to 135+ channels
BT Premium	\$159	\$159	Increases video to 180+ chs, incl. pay chs.; 5M/5M Internet
Comcast	\$99	\$128-\$144	100+ chs, incl. music; 6M/<1M Internet; Unlimited LD & voicemail
Comcast	\$130	\$160-\$175	Adds video channels, including HBO, Starz!
Comcast	\$160	\$196-\$208	Adds multiple channels for all premium channels

Source: Analysis of data from service provider web sites

BT's pricing, as well as Nulty's comments, are consistent with the experience of other successful muni-pioneers. The consensus seems to be that muni-fiber operations do not need to match the sometimes steep but temporary promotional discounts offered by incumbent service providers as long as they offer competitive rates and high-quality customer service, and enjoy the trust and good will of the communities they serve. Evidence of this can be seen in BT's success in achieving strong penetration and ARPU levels, and the fact that it is expected to begin generating net income in 2009. These and other aspects of BT's business model and financials are discussed in the following section.

Economics

Based on the trajectory of BT's growth thus far, Nulty expects its \$33 million in financing to take it to the point of generating positive cash flow (i.e., payment of operating expenses and lease payments) by 2009, including a financial cushion of \$2 million-\$3 million.

This means BT will be returning positive net income to the city a little more than three years after it began offering residential service and roughly a year after completing the bulk of its network buildout. Nulty estimates that, as of May 2008, this buildout passed roughly 95% of Burlington's approximately 19,300 total premises, including about 16,400 homes and 2,900 businesses. Extension of the network into the remaining areas of the city that involve "difficult underground" construction, he says, is ongoing.

One way BT was able to keep its costs relatively low was to hire internal staff to handle the core network design and construction tasks, rather than to rely on outside expertise. It estimates that this saved it roughly 30 percent in costs over the length of the project.

BT had already reached the point of positive operating cash flow (revenue exceeding operating expenses) by the fall of 2007, less than two years after launching residential service and before network construction was complete.

These cash flow timetables make Burlington one of the nation's most successful muni-fiber projects in terms of financial viability. More importantly for the sector as a whole, they add to the growing body of evidence that muni-fiber networks not only support valuable communication services to local communities, but can also generate financial surpluses to help communities pay for their other needs.

According to Nulty, BT's ARPU was roughly \$98 when he left and is probably a little over \$100 following the early 2008 price increase. This reflected residential ARPU of roughly \$88 and business ARPU in the \$300 range.

BT's per-customer revenue is roughly comparable to the ARPU levels generated by major cable operators at the same point in time. For example, ARPUs reported for the fourth quarter of 2007 by Comcast, Time Warner Cable and Charter, the nation's three largest cable operators, ranged from less than \$98 (Charter) to nearly \$105 (Comcast).

According to a March 2008 presentation, nearly half of BT's customers were signed up for all three of its "triple play" services (voice, video and Internet), with nearly a third subscribing to two of the three services.

Nulty says his net income projection assumes subscribers grow to 5,000 by early 2009, which would represent a little more than 27 percent penetration of the 18,300 premises passed by the network. As of May 2008, he says, the subscriber count was approximately 3,800, roughly 21% of passings.

In the 2,4000-home neighborhood that has had access to the fiber network since February 2006, BT had already achieved a penetration rate of roughly 43 percent by May 2008. The network was extended to six other neighborhoods between early 2006 and early 2008. In these areas, says Nulty, “connections are rising rapidly” and “are expected to reach or exceed the connection rate in the first neighborhood by the time they have been wired for a similar period of time.”

BT also may have room to increase prices to boost its ARPU levels, should it decide that this would help its economics. This is suggested by the ARPU levels reported by Verizon in communities where it has deployed its FiOS fiber-to-the-home network. During the second quarter of 2008, FiOS ARPUs were averaging more than \$130 per month, well ahead of the ARPUs reported by most cable operators, whose networks are not able to deliver the broadband speeds and capabilities available from an FTTH network. For example, second quarter ARPUs reported by the nation’s three largest cable operators were in the \$104-\$110 range.

Operations

While most, if not all, of today’s muni-fiber networks have been deployed in communities with publicly owned utilities, Nulty sees managing an FTTH network as very different from running an electric utility, which delivers a single service that has no competition and is heavily regulated. As he puts it, the core management tasks of an electric utility are to “be safe and control costs,” to follow well established practices and codes, and to work with labor unions.

In contrast to an electric utility, says Nulty, today’s telecom company operates in a dynamic and competitive market environment, typically does not have a unionized labor force (except for some telcos), is generally unregulated, and must offer an ever-changing mix of products and prices to remain competitive. In addition, it must deal with dynamic and complicated technology, with all of this playing out in a highly competitive market dominated by incumbents with strong motivation to defend their market share.

Noting that a muni-fiber operation, like any competitive provider of telecom services, must be “fast on its feet,” Nulty recommends that it not be operated as a “plain vanilla part of the city government.” As examples of how this can slow responsiveness, he cites the delays he faced at BT, when even relatively small contracts had to be approved by the city government, and decisions on personnel matters were constrained by bureaucratic requirements.

Nulty says that, at a stable operational state, BT and most comparable networks are likely to require 4-5 staff persons per 1,000 customers, though this ratio is much higher during the initial construction and growth stage. For example, when BT reached the 3,000 subscriber level it had 28 full time employees, which equates to nearly 10 employees per 1,000 customers. Noting that the construction stage requires more high-level and relatively expensive engineering talent, Nulty says BT handled most of these tasks in-house, allowing it to save money compared to muni-fiber projects that hire an outside firm to manage design and construction on a turnkey basis.

On average, Nulty says, staffing per thousand customers is likely to include two technical positions, one for outside plant, the other to handle headend and other “inside” equipment, as well as two customer service/help desk positions. On top of that are general manager and other management positions to handle sales, marketing, billing and accounting.

Nulty says the total staff counts for a muni-fiber operation are similar to those for a small telco, though the latter will be more weighted to outside plant maintenance and less to customer service. That’s because, for a traditional telco, customer service requirements are fairly simple, while maintenance of a copper network is more time-consuming and costly than it is for an all-fiber network. And, as noted earlier, BT and other successful muni-fiber projects are inclined to spend more on customer service than most private operators.

Nulty says BT “took the high road” on the issue of cross-subsidy—including accounting and structural protections--to make sure it did not provide ammunition for legal challenges by incumbents. BT “pays for everything it gets from the city,” he says, ranging from access to poles to accounting services.

Low-Cost “Community Channels”

One element of BT’s “open network” policy is its offer of leased video channels for just \$65/mo, compared to the \$6,500 charged by Comcast. BT’s IP-based network, says Nulty, has the capacity to support thousands of video channels.

In keeping with its community-centric sense of purpose, BT has chosen to make this capacity available to Burlington citizens, school groups, community organizations, etc. at a very affordable price. This capacity, says Nulty, is available in two modes, a live channel and video-on-demand mode. In addition, he says, these two formats can be tied together in ways that allow a live broadcast to include references to a stored program available on-demand.

BT's offer of low-cost community channels stands in sharp contrast to a growing trend among cable operators. According to a May 2008 survey conducted by the Alliance for Community Media (ACM) and the National Association of Telecommunications Officers and Advisors (NATOA), communities in 18 states that have passed new video franchise laws are seeing declines in funding for and access to PEG (public, educational and government) channels and facilities, as well as network connections for libraries, schools and other public locations.⁸

When Nulty left BT in the fall of 2007, six video channels were being used for public, educational and government (PEG) programming, though more channels were available. He predicted that more of BT's \$65/mo. channels would be used over time, as the local "creative community" came to realize the power and cost-effectiveness of the network's capabilities, and how this could open new opportunities not available when the only option was to deal with the local cable operator.

While BT's use of IPTV technology has helped it deliver large numbers of "community" channels and, over time, could make it easier to add interactive functions to these channels, it also added some new elements to the muni-fiber learning curve. As Chris Burns, BT's current general manager, noted in a March 2008 presentation, "IPTV created issues with content providers due to their perception of the lack of security...of the [IPTV] signal."

BT is also exploring uses of its network's vast capacity to support Burlington's healthcare sector. For example, it has discussed potential "telemedicine" projects with local hospitals and a professor at the University of Vermont. Though Nulty says there had been strong interest in testing telemedicine applications for some time, he says these projects had been stalled by insufficient network capacity until BT built its FTTH network.

(Continue on Page 49 ...)

(Beginning of Technology Vendor Advertorial)

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Broadband Properties Magazine, March 2008

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FTTP PROFILE

FTTP Customers: Municipalities

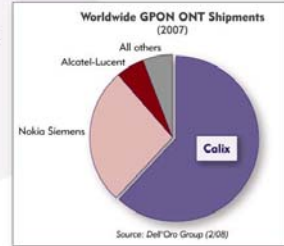
Calix has been a pioneer in enabling municipalities to deploy fiber with cost-effective, scalable solutions. In fact, Calix customers include three of the four municipalities profiled in this publication (shown in **bold**).

- Borough of Kutztown, PA
- **Bristol Virginia Utilities, VA**
- City of Barnesville, MN
- City of Brookings, SD
- **City of Burlington, VT**
- City of LaGrange, GA
- City of Powell, WY
- City of Windom, MN
- Lenox Municipal Utilities, IA
- **Reedsburg Utilities Commission, WI**
- Spencer Municipal Utilities, IA

FTTP Customers: Overall

Over **300 service providers** across North America are deploying Calix FTTP solutions.

- More U.S. FTTP deployments than all other vendors combined (*Broadband Properties, Mar. 2008*).
- More than 200 customers deploying IPTV and/or RF video overlay over GPON.
- Dozens of customers deploying integrated RF Return (RFOG) over GPON.



Market Share	Worldwide GPON OLTs.....	#1 with 53% market share (source: Dell'Oro Group)
	Worldwide GPON OLTs.....	#1 with 40% market share (source: Dell'Oro Group)

FTTP SOLUTIONS

Calix provides a comprehensive portfolio of standards-based, versatile, end-to-end FTTP solutions based on the powerful, proven Calix C7 multiservice platform and incorporating the world's most widely deployed GPON ONTs, also made by Calix.

The Calix C7 platform supports 2.5 Gbps of bandwidth downstream and 1.2 Gbps upstream. Each C7 GPON line card supports up to four PONs, with up to 64 subscribers on each PON. That means that a single, compact C7 platform can support up to 5,120 subscribers.

Calix ONTs provide a remarkable range of options for serving single-family dwellings, multiple dwelling units, and businesses.



PROVEN ADVANCED SERVICES

Calix is the North American market leader in both IPTV and RF overlay solutions deployed by service providers over FTTP. Calix also supports standards compliant RF Return (RFOG) services integrated into specialized ONTs. RFOG allows the deployment of advanced interactive services such as video on demand (VOD) and is compatible with all major cable headend manufacturers.

COMPANY HIGHLIGHTS

Calix is a provider of innovative access platforms and management systems that enable service providers to deliver any service over any type of access at the lowest cost. With the Calix **Unified Access Infrastructure**, service providers are able to streamline operations with a single management view and a common user experience for every service, regardless of media type or protocol.

- Customers** Over **500 service providers** throughout North America, with over **26 million** access lines. Calix supplies strategic access solutions to **14** of the top **20 U.S.** ILECs, including:
- Embarq..... 6.1M lines, **4th largest** US ILEC
 - Windstream 3.2M lines, **5th largest** US ILEC
 - Frontier 3.0M lines, **6th largest** US ILEC
 - CenturyTel..... 2.1M lines, **7th largest** US ILEC
 - Puerto Rico Telecom..... 1.1M lines, **9th largest** US ILEC
 - TDS 1.0M lines, **10th largest** US ILEC
 - Cincinnati Bell..... 800K lines, **11th largest** US ILEC

Calix salutes three municipal fiber pioneers

Read about their success deploying Calix solutions in this Municipal & Utility Guidebook



City of Burlington Burlington, Vermont

Year launched: 2006
Premises passed: approx. 17,000
Penetration: 40%



Bristol Virginia Utilities Bristol, Virginia

Year launched: 2003
Premises passed: approx. 13,000
Penetration: 63%



Reedsburg Utilities Commission Reedsburg, Wisconsin

Year launched: 2003
Premises passed: approx. 4,400
Penetration: 61%

Ask the FTTP experts:

Info@calix.com

877.766.3500



(End of Technology Vendor Advertorial)

(Continued from Page 44)

Jackson, Tennessee

- At launch, offered retail video and wholesale voice and Internet
- Transitioning to full-retail model
- Year residential service launched: 2004
- Premises passed: Approximately 35,000
- Penetration of premises passed: 44%
- Expects to generate net income by year 7 of operations
- Nearly \$8 mil. in consumer savings over 4 years from lower rates in Jackson
- Incumbents are Charter and AT&T
- JEA's experience highlights importance of retail service model and problems with wholesale-only model

As the provider of electricity, natural gas, propane gas, water and waste water utilities to the residents and businesses of Jackson, Tennessee, the Jackson Energy Authority (JEA) has a long history of actively supporting local economic development.

In keeping with its longstanding and proactive community development focus, JEA first considered deploying a broadband network as early as the mid-1980s. Much of the impetus for this came from local businesses and residents, who wanted a competitive and community-based alternative to the incumbent service providers and saw JEA as well suited to provide it.

After considering the type of "hybrid fiber-coaxial" (HFC) network deployed by cable operators during the 1980s and 1990s, JEA concluded that this type of network was not sufficiently "future-ready." Instead, it chose to wait until FTTH technology became sufficiently mature and affordable, recognizing that only an all-fiber network could reliably deliver state-of-the-art broadband services and support the community's economic development goals for the next 20 years.

By late 2001, FTTH costs had declined substantially and the Internet was entering a new and increasingly bandwidth-intensive growth phase that underscored the need for next-generation connectivity to support Jackson's future economic growth.

Responding to these developments and continued customer requests, JEA hired industry veteran Kim Kersey to manage a telecom unit tasked with building and managing an all-fiber network. Kersey had previously managed the local cable TV system under several owners and had also served as chair of Tennessee's cable industry association.

According to Kersey, incumbent service providers tried twice to require a local referendum vote before the FTTH project could move forward, but failed in both cases to gain enough signatures to get the referendum on the ballot. A big part of the reason, he suggests, is that JEA had earned the strong confidence of local residents and businesses, and was widely viewed as a progressive, responsive and community-focused service provider. This contrasted with a general animosity felt toward the local cable TV provider, which had changed owners multiple times and was most recently acquired by Charter Communications, a multiple system operator (MSO) with a relatively weak balance sheet and a poor reputation for customer service and value-for-the-dollar. The incumbent telephone company serving Jackson is AT&T (formerly BellSouth).

Capital Cost

JEA began construction of its FTTH network in January 2004 and signed up its first customers in May of that year. Network construction took 20 months to cover the city of Jackson, which involved approximately 600 miles of fiber plant. The average cost to pass each of the city's 31,000 homes and businesses was \$1,059 per premise. The total cost was approximately \$39 million, including construction of a Master Control Center. Over time, JEA has extended the network to cover a total of roughly 35,000 premises.

To date, JEA has completed fiber installations to over 16,000 home and businesses. The initial budgeted cost to connect a customer to the network was \$1,219. This included extending fiber from the pole to the home, installing a "gateway" device at the home, plus the cost of set-top boxes and in-home installation. Over time, the average cost of installation has decreased to around \$800 as the price of FTTH electronics has declined and JEA developed efficiencies in its installation processes.

Kersey says that if JEA launched its FTTH project today, its network construction and installation costs would be as much as 40 percent lower than the costs it incurred back in 2004. This, he says, reflects price declines for network and customer FTTH equipment, improvements in the capabilities of this equipment, and efficiencies in network design, construction and installation.

Financing

As of March 2008, JEA's total investment in the FTTH project was \$62 million. Of this, \$54.3 million was covered by a bond paying interest at just above 5 percent. JEA also has a line of credit with a local bank that carries a 5.43 percent interest rate.

The FTTH bond is secured primarily by telecommunications revenue, with JEA's telecom division able to borrow up to \$34 million from its electric division for debt service. While these two sources are expected to be more than enough to cover all costs, including debt repayment, there is also a provision for the city, if necessary, to back the bonds with its general obligation taxing authority.

Though JEA's utility-related bonds are typically non-taxable, the initial FTTH bond was taxable, since it was based on a business plan under which JEA would provide wholesale capacity to private retail service providers. This substantial use by private service providers disqualified the bond from tax-exempt status under IRS regulations. However, because JEA ended up providing retail cable television service directly, in 2007 it was able to refinance over 60 percent of the original taxable bond into tax-exempt financing, reducing the interest rate by over 100 basis points. JEA has since moved to acquire the Internet and telephone customers of its largest retailer and to offer retail service under its own brand. This will allow it to refinance most, if not all, of the remaining taxable bond debt via tax-exempt financing.

Shifting from Wholesale to Retail

Under its original business plan, JEA was to be a retail provider of triple-play cable, Internet, and telephone services. However, as the result of a settlement of a lawsuit with Aeneas Internet & Telephone, a local CLEC and ISP, JEA opened its network to become a wholesale carrier for Aeneas and another CLEC/ISP, Cinergy Communications, with JEA remaining the sole retail provider for cable television service.

Under the settlement, JEA agreed not to retail Internet and telephone services if the outside providers could achieve certain customer benchmarks over time. Since these benchmarks were not met, JEA began offering retail Internet services in October 2007. As part of this transition, it acquired the Internet customer base of Cinergy, which transitioned its role to that of a wholesale supplier of Internet backbone and customer support to JEA.

JEA also plans to obtain the necessary license to begin offering retail telephone operations, and to acquire Cinergy's telephone customer base. As with Internet service, Cinergy's revised role will be to provide wholesale dial-tone and customer billing to JEA. Aeneas will continue to be a retail provider on JEA's network.

In addition to forcing JEA to issue a taxable bond, the initial wholesale arrangement required the utility to share revenue and negotiate wholesale deals in a complex and fast-changing market. And perhaps most importantly, it limited JEA's control of both revenue and customer service, two areas that are essential for success in a competitive telecom marketplace.

Kersey expects marketing to become more effective with JEA as a retail provider. He also notes that JEA will have greater flexibility over pricing and content decisions, which will allow it to be more nimble in competing with incumbent providers.

As the entity responsible for the network's bond repayments, one of JEA's highest priorities was to ramp up revenue as quickly as possible by expanding its customer base and ARPU. As JEA and every other muni-fiber pioneer has learned, this means attracting and retaining customers in the face of an aggressive competitive response from incumbent service providers. This, in turn, requires a combination of attractive service offerings, strong customer service and competitive pricing and, in general, an ability to respond quickly and effectively to customers needs.

A key problem with the wholesale model is that it makes these key success factors dependent on the strategies and performance of the network's retail service providers. As it moved forward with its original "hybrid" business model, JEA came to increasingly recognize this risk.

As Kersey notes, this risk is amplified by the kind of revenue-sharing deal JEA had with one of its retailers. Under such an arrangement, JEA's per-unit revenue is largely out of its control, depending instead on the pricing strategy of the retailer using its network.

The wholesale model also leaves a network owner at the mercy of the customer service quality provided by the retailers using its network. If that quality does not measure up in customers' eyes, the network owner loses revenue-generating customers, and is likely to get much of the blame, even if it had nothing to do with the problem and can do very little to correct it.

The bottom line is that, if retail providers drop the ball in terms of attracting and retaining customers, the network owner is left with the burden of debt repayment but without corresponding control over the growth of its subscriber base and revenue.



*Kim Kersey, SVP of
Telecommunications,
Jackson Energy
Authority*

A related problem with the wholesale model, says Kersey, is the risk of diluting JEA's brand which, as he notes, is a very strong and positive one in the Jackson area. He also points out that JEA is usually the first company contacted by a household or business moving to or within Jackson. Like its brand, this important "first-contact" marketing advantage is also diluted if JEA's customer service representatives are not in a position to market a full line of voice, video and data services when contacted for utility hookups.

JEA's shift to retail operations is already having an impact on revenues. As of June 2008, it had realized an 18 percent increase in net revenue from its fledgling retail Internet sales, and was projecting telephone net revenues to grow by 15 percent once it begins retailing that service.

Pricing and Consumer Savings

Like most broadband service providers today, JEA's EPlus broadband service includes several "triple-play" bundles that package video, voice and high speed Internet service. These range from the "Starter Bundle" priced at \$82.90/mo., to the Hometown Bundle at \$95.95, and the MVP Bundle at \$115.95.

The Starter Bundle includes 86 cable TV channels, unlimited local calling plus Call Waiting and Call Return, Internet access speeds of 512 kbps downstream and 256 kbps upstream, and a service assurance plan. The Hometown Bundle adds several calling features and boosts data rates to 6 Mbps downstream and 512 kbps upstream. The MVP package adds a larger number of calling features (including voicemail) plus 60 minutes of long distance, and increases downstream and upstream data rates to 10 Mbps and 1 Mbps, respectively.

JEA's EPlus Broadband Bundles (as of June 2008)

<p>\$115⁹⁵ mo</p> <p>MVP Bundle</p> <p>Cable TV</p> <ul style="list-style-type: none"> • Basic Service, 24 Channels (Channels: 2-13, 17-22, 191, 201-205) • Expanded Service, 62 Channels (Channels: 23-83, 99) • EPlus Service Assurance Plan <p>Telephone</p> <ul style="list-style-type: none"> • Unlimited Local Calling • Features: Caller ID (w/Name), Call Waiting (w/Caller ID), 3-Way Calling, Call Forwarding Variable, Call Return, 60 Minutes FREE Long Distance Calling, Call Forward Busy, Call Forward No Answer, Remote Call Forwarding, Speed Calling 30, Repeat Dialing, Anonymous Call Rejection, Caller ID Delivery Block, Voicemail. <p>Internet</p> <ul style="list-style-type: none"> • 10 Mbps Download/1 Mbps Upload • FREE Internet Security Suite <p>SAVE NEARLY \$20</p>	<p>\$95⁹⁵ mo</p> <p>Hometown Bundle</p> <p>Cable TV</p> <ul style="list-style-type: none"> • Basic Service, 24 Channels (Channels: 2-13, 17-22, 191, 201-205) • Expanded Service, 62 Channels (Channels: 23-83, 99) • EPlus Service Assurance Plan <p>Telephone</p> <ul style="list-style-type: none"> • Unlimited Local Calling • Features: Touch Tone, Caller ID (w/Name), Call Return, Call Waiting (w/ID). <p>Internet</p> <ul style="list-style-type: none"> • 6 Mbps Download/512 Kbps Upload • FREE Internet Security Suite <p>PLUS!</p> <p>Get Digital Plus FREE for 6 months with this bundle!</p> <ul style="list-style-type: none"> • Over 40 Additional Channels, FREE! (Channels: 101-143) • Standard Digital Converter, FREE! (Includes the Electronic Program Guide and Music Choice Channels 901-946) <p>SAVE NEARLY \$14</p>	<p>\$82⁹⁰ mo</p> <p>Starter Bundle</p> <p>Cable TV</p> <ul style="list-style-type: none"> • Basic Service, 24 Channels (Channels: 2-13, 17-22, 191, 201-205) • Expanded Service, 62 Channels (Channels: 23-83, 99) • EPlus Service Assurance Plan <p>Telephone</p> <ul style="list-style-type: none"> • Unlimited Local Calling • Call Waiting and Call Return. <p>Internet</p> <ul style="list-style-type: none"> • 512 Kbps Download/256 Kbps Upload • FREE Internet Security Suite
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2008 Jackson Energy Authority.

On an a la carte basis, EPlus Internet service options include four speed tiers ranging from 512/256 kbps for \$24.95, up to 10/1 Mbps for \$54.95.

On the video side, a basic service featuring 24 channels costs \$16.95, with an expanded basic tier adding 62 additional channels for an additional \$28/mo. A digital tier adds another 43 channels for \$10/mo. A tier of 15 HDTV channels costs an extra \$9.95/mo. Packages of premium movie channels range from \$10/mo. to \$13/mo. The monthly charge for standard set-tops is \$3/mo., with a high-end box featuring HD and DVR capabilities costing \$13.95/mo.

Basic phone service costs \$15.95 and includes unlimited local calling, Call Waiting and Call Return. For an additional \$7-\$10, EPlus voice customers get roughly 10 additional calling features and 60 minutes of long distance. Unlimited long distance costs \$14.95/mo. and voice mail, which includes paging and email notification, runs \$4.95/mo.

Like other broadband service providers, JEA also offers a range of voice, video and data services and add-on features on an a la carte basis. In general, its rates appear to be substantially lower than the standard rates offered by Charter, the incumbent cable operator. In some cases, however, Charter offers short-term promotional rates (e.g., for six months) that are lower than JEA's, along with one-time extras such as gift cards. Kersey says JEA tends to avoid—and doesn't need to resort to—the very steep, temporary discounts used by competitors to attract customers.

JEA's success in expanding its subscriber base (discussed in more detail below), suggests that its combination of low standard rates, trusted brand and strong customer service reputation is potent enough to more than offset the appeal of Charter's short-term promotional offers. Since the latter are quite common in the cable industry today, this suggests that other well planned and executed muni-fiber projects could have similar success if they adopted a pricing strategy similar to JEA's.

According to JEA estimates, Jackson residents have enjoyed savings of nearly \$8 million over four years thanks to lower rates (both from JEA and incumbents responding to its lower prices), compared to those charged in nearby communities.

Subscriber Growth

Today, JEA's FTTH network passes roughly 35,000 homes. As of March 2008, it delivered video services to 15,300 subscribers, roughly 44 percent of homes passed by the network. This gave it well more than half of the community's cable TV subscribers, which have been estimated at roughly 70 percent of total homes. JEA competes with Charter Communications, as well as the nation's two satellite TV providers. The local telephone company serving Jackson is AT&T (formerly BellSouth).

Roughly 58 percent of JEA's video customers (26 percent of homes passed) also subscribe to its Internet access service, and 40 percent (18 percent of homes passed) use its fiber network for phone service.

Noting that, from the start, JEA's penetration grew "pretty fast," Kersey says its current penetration rates for video, Internet and telephone penetration rates are tracking above JEA's original projections.

Economics

Its stronger than expected penetration growth has helped JEA exceed its revenue targets. In 2007, for example, its revenues totaled \$11.4 million, \$2.7 million (31 percent) above its original target of \$8.7 million.

But some of this extra revenue has been offset by greater-than-expected programming costs, which were \$1.7 million above JEA's original projections during 2007. Kersey says much of the increase was driven by the addition of more programming than planned—including expensive sports networks and roughly 25 channels of high-definition programming. He also noted that, as a relatively small startup, JEA must pay more for its programming than Charter and other large cable operators, which enjoy significant volume discounts. Kersey estimates that JEA's programming costs are about 20 percent higher than Charter's.

JEA obtains its programming through the NCTC, a not-for-profit, member-operated organization that negotiates and administers master affiliation agreements with programming networks on behalf of its member companies.

The cost of operating the network has also turned out to be higher than originally projected. In 2007, these costs totaled \$3.9 million, \$1.6 million higher than the \$2.3 million originally projected.

Kersey says the original plan was to operate the system as a stand-alone division from JEA's other utility divisions, including a separate employee base for all operational functions. However, a decision was subsequently made to fully integrate the Telecommunications Division into JEA's matrix organization, which meant that all divisions share employees in areas of customer service, finance and accounting, human resources, operations, marketing and administration. While this resulted in greater operational costs, Kersey says it helped the Telecommunications Division achieve rapid growth and provide the level of customer service to which JEA's utility customers had been accustomed. As part of this arrangement, JEA developed an extensive cost-allocation manual to accurately capture these shared costs and prevent cross-subsidization by the other divisions.

Another change from JEA's original operational plan was the development of a local television studio that JEA uses to televise community events and other local interest programming. Originally, JEA had planned to contract with an outside company to sell advertising on JEA's cable networks and to produce local content. When a 2003 tornado destroyed the facilities of the local production company JEA had planned to use, it hired its staff and moved the operation in-house. Local programming has proven to be a significant differentiator for JEA in the market and helped drive its strong customer growth. At the same time, this local programming effort has added to JEA's operational expenses.

Since IP-based TV technology was not mature enough when its FTTH project was launched, JEA chose to use the same RF-broadcast mode of video delivery used by cable operators. But it uses “digital-only” converters, which reduces its cost compared to the “analog-digital” set-tops used by most cable operators. One reason for this is that JEA’s fiber network has enough unused capacity to allow it to “simulcast” channels in both analog and digital modes, something that’s far more challenging for most cable operators to achieve.

In Kersey’s view, IPTV technology “needs to cook a little longer” before it is ready for deployment, in terms of both technical performance and cost. Once that happens, he says, it could provide a good platform for delivering large numbers of high definition channels. Though he does not expect JEA to replace its RF converter boxes with IPTV set-tops during their useful lifespan, he says it would consider using a “hybrid” converter that combines RF and IPTV technology to deliver HDTV channels if such a device is available from its set-top vendor.

Given its current mix of revenues and expenses, Kersey says JEA is on track to generate a positive net income by year seven of operations. It had originally planned to reach this point in four years. In addition to the higher than expected operating expenses, another factor impacting the payback period is the additional capital that JEA required to expand the network beyond its original plan, which has increased its interest and depreciation expenses. But, as Kersey notes, the current seven-year time horizon is still shorter than those typical of other utility investments undertaken by JEA.

Overall, it seems clear that, while JEA has had to adapt its plan as it has moved forward, the economics of its FTTH investment fit well within the typical financial parameters associated with its other investments in public utility infrastructure, while also providing valuable services and cost savings to the community.

Municipal Applications and Cost Savings

In addition to being financially viable and saving Jackson residents millions each year in voice, video and Internet service fees, the JEA network is also delivering value to local government agencies and schools. Local city and county government agencies, says Kersey, are actively using the fiber network for both internal and inter-agency communications. Among the most active users, he says, is law enforcement, including transfer of records and integrating the fiber network with the police wireless network to improve response time.

In addition, every school in the community is now equipped with a 100 Mbps connection, used for both internal communications and Internet access. Not only are local schools getting more capacity than before, says Kersey, but they are also saving money, since JEA’s bid for the school network was several hundred thousand dollars less than competing bids from Charter and AT&T. Planned for summer 2008, he says, is the addition of video surveillance systems in schools.

The fiber network is also used by JEA's other utility units for SCADA and inter-office links, as well as video surveillance, which has benefits in terms of security and maintenance. JEA is also expected to begin rolling out AMR (automatic meter reading) sometime in the near future. The key issue that has delayed this deployment, says Kersey, has been the lack until recently of commercial "networked smart meters" able to handle not only gas and electricity, but also water. As he explains, water meters are typically at a different location than gas and electric meters, and therefore require some sort of wireless relay.

Kersey also notes that TVA (Tennessee Valley Authority), JEA's supplier of electric power, is moving in the direction of time-of-use pricing, an application that would make good use of JEA's network. This not only has the potential to significantly reduce JEA customers' electric bills, but, if deployed widely within the TVA region (and potentially nationwide), could significantly reduce peak demand levels. This reduction in peak demand would reduce the need for high-cost investments in power generation, as well as the pollution, risk and greenhouse gas emissions associated with them.

By connecting its utility facilities, as well as Jackson's homes, businesses, schools and government buildings with fiber optics, JEA is not only providing better service at lower cost today, it is preparing the Jackson community as a whole to compete and thrive in the coming decades. By doing so, it is redefining its mission as a community-based public utility in the information age.

(Continue on Page 59...)

Top 10 Reasons You Should Consider Active Ethernet

1. Active Ethernet offers subscribers **dedicated bandwidth** of up to 1000Mbps based on their individual requirements and offers differential services for residential and business customers in the same area. In a PON network, the available bandwidth per subscriber terminal is shared with all other subscribers in that area without being able to give different service levels.
2. Active Ethernet supports a **pay-as-you-grow** philosophy since new subscribers can be easily added to an active Ethernet network within the 100km geographic area at minimal cost. PON networks require one splitter for every 32 ONUs within the 20km service area and are cost-effective only when at least 26 ONUs are connected.
3. Active Ethernet is **standards-based**. Ethernet components that are 802.3 compliant offer full interoperability with other standards-based solutions from a broad base of vendors.
4. Since Ethernet is standards-based and is used universally, the **cost** of Ethernet-based products and components is decreasing rapidly. Residential and small business subscribers with FTTH service will benefit from the cost savings as service providers continue to deploy additional equipment.
5. **Triple-Play Ready** – Many active Ethernet solutions support integrated VoIP protocols - H.323, SIP, and MGCP as well as various standards-based mechanisms, which ensure the voice, video (both IPTV or with RF overlay), and data quality of service - IEEE802.1p, voice priority, and TOS marking.
6. Digital voice (VoIP) and video (IP video) services can be delivered using a **single strand of fiber or over CWDM** using up to 16 unique wavelengths over fiber pairs. This ability to provide dedicated bandwidth over a single fiber or fiber pair to multiple subscribers maximizes fiber capacity and keeps costs low.
7. Active Ethernet is **easy to configure and design**. PON requires detailed pre-planning to place splitters in the ideal location from the OLT that support the maximum number of subscribers and ensure that the ONU reaching the maximum number of subscribers. As Active Ethernet has virtually unlimited distance, planning is easier and more flexible
8. Active Ethernet is **easy to support**. Because traffic is pure IP, no transition between protocols is required. Network management of all network elements is simple using off-the-shelf products and standards. Each element in Active Ethernet network can send information to the NOC using SNMP, EFM OAM and others that support not only remote troubleshooting but also mass provisioning and network maintenance. Passive splitters cannot transmit data so troubleshooting a problem requires dispatching a technician to the site – or multiple sites.
9. **Reliability and Availability** – Carrier Ethernet aggregation switches support multiple topologies (mesh or ring) and using standard-based RSTP and MSTP based solution ensure less than 50mSec convergence time which creates an undistributed service. Phone calls and video services will continue even case of a failure
10. **Field-proven, highly reliable Active Ethernet products from Telco Systems give you cost-effective choices to help you find your FTTH direction!**

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-----Technology Vendor Advertisement-----

(Continued from Page 57)

Reedsburg, Wisconsin

- Year residential service launched: 2003
- Premises passed: Approximately 4,400
- Penetration of premises passed: 61 percent+
- Relatively high capital cost due to underground construction
- Expected to generate net income in 2008
- Initial financing was interest-only “Bond Anticipation Note” from local bank; refinancing in 2008
- Incumbents are Charter and Verizon
- Provides local schools with 100 Mbps links for less than \$500/mo., compared to the \$650-\$750/mo. they were previously paying for just 1.5 Mbps connections

Like some other muni-fiber pioneers, Reedsburg began its journey to FTTH with a relatively modest step—using fiber to connect the facilities of its public utility, including electrical substations and water pump stations. And, as was the case with these other pioneers, Reedsburg’s initial fiber deployment triggered a community-wide recognition that universal access to next-generation broadband was an investment worth making—an investment that would enable their town to thrive in a global economy that was hollowing out communities that fall behind in terms of broadband connectivity.

The initial utility network, which cost roughly \$500,000, included construction of a fiber ring around much of the city. As it built this fiber ring, the Reedsburg Utility Commission (RUC) began receiving requests from local schools interested in also using the fiber network. These were followed by similar requests from local businesses and, eventually, from residents. Like Reedsburg’s schools, they too wanted access to fiber’s vast capacity, and were realizing what this access could mean for their future and the future of their community.

Amidst this increasing demand for network connections, RUC began evaluating architectures and vendors, which led to a decision to extend fiber to every location in the community. Roughly five years after its 2003 launch, Reedsburg’s FTTH project is poised to become fully cash flow positive.

Capital Cost

The total cost of Reedsburg’s fiber network was \$13.8 million, including the \$500,000 spent on the initial fiber ring.

Since it involved mostly underground plant, which is more expensive than aerial plant, the project cost roughly \$2,400 to pass each of Reedsburg’s approximately 4,000 homes and 400 businesses. On top of this was the cost to activate service, including installation

of electronics in the Network Interface Device (NID) at the side of the home or business (these devices are sometimes referred to as Optical Network Terminals or ONTs).



According to David Mikonowicz, RUC's general manager, the cost of NID electronics (pictured at left) was initially as high as \$700-\$900, but has since come down to \$400-\$450, which can purchase devices significantly more capable than early generations. Other cost savings as the project moved forward were lower construction costs in new housing developments, where trenching costs could be shared with RUC's electric utility.

RUC's Fiber-to-the-Home Network Interface Device (NID)

Financing

A half million dollars of financing for the Reedsburg FTTH project came from a Public Facilities Grant from the Wisconsin Department of Commerce. The remainder came in the form of a "Bond Anticipation Note" from a local bank that Mikonowicz says "believed in" the project. The 5-year note was tax exempt and required only interest payments for the five year period. Its interest rate varied based on the LIBOR (London Inter-Bank Offered Rate), a commonly used rate benchmark. Mikonowicz says that, during the five years, the rate varied from around 2 percent to as high as 6.15 percent. As of April 2008, he said, it was 4.85 percent.

Mikonowicz says the interest-only bond allowed RUC "to get plant in the ground" before having to pay down the note's principle. He said this approach is fairly common in Wisconsin for electric and water projects.

As of April 2008, RUC was considering two options for refinancing the project's costs. One option was a 20 year bond at an interest rate in the 5.0-5.15 percent range. This approach, says Mikonowicz, would require a bond redemption reserve fund of roughly \$1 million. RUC is also talking with a bank about a 25 year loan that would carry a fixed interest rate of 4.25 percent for five years, after which the rate would become adjustable. Mikonowicz expected RUC to decide between the two options by early summer.

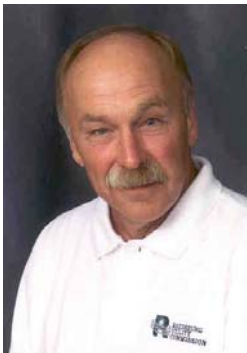
Legal Challenges and State Laws

In order to offer telephone service, RUC needed to receive authorization from Wisconsin state regulators to serve as a competitive local exchange company (CLEC). Shortly after

receiving this authorization, it faced legal challenges from the state’s telephone and cable associations. The ensuing legal battle took six months, with Reedsburg sharing the roughly \$25,000-\$35,000 in costs with Sun Prairie, another community that had also applied for and received CLEC certification.

After losing their first legal challenge to the FTTH network, the state telephone and cable associations shifted their focus to the state legislature. The result was passage of a new law that placed restrictions on muni-fiber projects, though it grandfathered the Reedsburg FTTH project.

The new law required proposed muni-fiber projects to complete a detailed business plan and make it available for public inspection—including by the incumbents with which they’d be competing. It also forbids muni-fiber projects from using “excess” revenue (i.e., after all expenses, including debt repayment) from a community’s existing public utility services. Prior to the law’s passage such excess revenues could be used to support investment in a muni-fiber project, though other revenue (i.e., revenue needed to support costs of existing utility services) could not be used for this purpose.



*David Mikonowicz,
General Manager,
Reedsburg Utility
Commission*

Mikonowicz notes that, before the law was passed, roughly 30 Wisconsin communities had received CLEC certifications. But since it became law, the state has seen the launch of only one other muni-fiber project, which is currently being built in the town of Shawano. This highlights the importance of state laws to the muni-fiber sector, something we discuss in a later section of this report.

Pricing and Consumer Savings

On its web site, RUC advertises three “triple play” packages ranging in monthly price from \$91.94 to \$124.93.

The \$91.94 package provides local phone service, 70 channels of video and symmetrical 1 Mbps Internet service. A second package costs \$120.99/mo. It offers the same TV package, but bundles this with a high-end telephone package (unlimited long distance and more than a half dozen calling features) and symmetrical 5 Mbps Internet service.

The \$124.93 package is geared toward heavy TV users, with more than 100 channels of digital cable, including HDTV, HBO, pay-per-view programming and a set-top equipped with a digital video recorder (DVR). It bundles this high-end video package with the same local phone and 1 Mbps service offered in the \$91.94/mo. package.

“Double play” bundles featured on the RUC web site start as low as \$36.99/mo. for a package that combines local phone service with an 18-channel “basic cable TV” package.

Local phone plus 5 Mbps Internet runs \$60.95, while a 70-channel video service packaged with 1 Mbps Internet access is priced at \$75.94.

Catherine Rice, Director of Marketing says RUC is “very competitive” in its pricing. But she contrasts RUC’s practice of offering consistently low prices with the steep but short-term discounts offered by Charter, the incumbent cable operator.

A review of Charter’s offerings in Reedsburg as of May 2008 underscores Rice’s point. While Reedsburg residents can sign up for service from Charter at promotional prices below those available from RUC, these same customers would find themselves paying monthly rates much higher than RUC’s after the promotional period, which is usually six months and, for some packages, up to 12 months.

The extent of Charter discounting varies. For its video-only packages, promotional discounts listed on its web site are typically \$10 a month. For Internet service they are much steeper, running \$35 below the standard monthly rates of \$54.99-\$59.99.

This means Reedsburg households can get Charter Internet access for as little as \$19.99/mo. for six months but, after that, would have to pay \$54.99. This same household could get Internet service on an a la carte basis from RUC for a standard price as low as \$29.95/mo.

Based on these prices, an RUC customer would pay less than \$360 for their first year of Internet service. This is roughly \$90 (20 percent) less than they would pay for a full year of service from Charter, even with the latter’s six month promotion. For their second year of service, Charter customers would be charged roughly \$660. That is a whopping 83 percent (\$300/yr. or \$25/mo.) more than they would pay as an RUC customer. RUC’s strong penetration suggests that this math is not lost on Reedsburg residents, in spite of Charter’s aggressive short-term promotions.

Reedsburg Internet Cost Comparison: RUC vs. Charter*

	First Year	Second Year	First 2 Yrs.	First 3 Yrs.
RUC Internet Service*				
1Mbps/1Mbps	\$359	\$359	\$719	\$1,078
5Mbps/5Mbps	\$479	\$479	\$959	\$1,438
10Mbps/10Mbps	\$599	\$599	\$1,199	\$1,798
Charter 6 Mbps/<1 Mbps**	\$450	\$660	\$1,110	\$1,770

* Prices assume service sold a la carte; \$5/mo. less if sold as part of bundle

** Prices assume customer also signs up for at least one other Charter service;

if not, price is \$10/mo. higher than those listed

Source: Analysis of data from service provider web sites

RUC, like some other muni-fiber service providers, RUC offers its residential customers symmetrical data rates. This contrasts with the highly asymmetrical Internet speeds

offered by Charter, other cable operators, and most telco DSL providers. This highlights a key advantage of FTTH networks relative to cable's HFC networks and commonly used ADSL technology, both of which are severely constrained in terms of their upstream capacity. In an effort to downplay the significance of these upstream constraints, Charter's web site (and those of some other incumbents) heavily promotes download speeds, but provides no clear information regarding upload speeds, which are probably no faster than 1 Mbps, and perhaps significantly slower.

Charter's advertised download speeds in Reedsburg ranged from 5 Mbps to 9 Mbps as of May 2008. This compared to three RUC tiers offering speeds of 1, 5 and 10 Mbps, all of them provided on a symmetrical basis. According to Rice, online gamers are the market segment that most values RUC's symmetrical data rates. In the future, applications like videoconferencing may also increase the value and importance of symmetrical high-speed data rates.


In terms of standard pricing, it's worth noting that even the \$49.95/mo. a la carte price for RUC's high-end 10 Mbps symmetrical service was \$5/mo. less than the standard price for Charter's 5 Mbps service, which probably offers upload speeds well below 1 Mbps. This highlights the dramatic advantages of a muni-fiber network relative to cable and DSL networks in terms of the price/value equation they can cost-effectively deliver to customers.

Charter's approach to promotional pricing for its multi-service bundles is similar to its pricing strategy for a la carte Internet access. For example, in May 2008 it was advertising a 12-month promotional price of just \$69.95/mo. for a triple-play package that included a "limited basic" video package (roughly two dozen channels), unlimited long-distance voice service and 5 Mbps Internet access. But once this promotion ended, the price for this package more than doubled to \$147.97. It was also offering \$99.97 and \$129.97 promotional prices for other triple-play bundles, with these jumping \$54 (54 percent) and \$43 (33 percent) after the promotional period.

Rice says RUC does not try to compete directly on price with Charter's steepest triple-play promotional discounts. Rather, she says, the combination of low and stable prices, high-quality "locally provided" service, and free installation, has been enough to allow RUC to generate strong penetration rates, healthy per-subscriber revenues, and low rates of customer loss (known in the industry as "churn"). She estimates that RUC's monthly churn has averaged about 1 percent, excluding non-voluntary disconnects due to non-payment. This compares favorably to rates in the neighborhood of 2 percent or even higher in the cable industry. And while Rice says churn has sometimes reached the 2 percent level, it has also sometimes been as low as 0.5 percent, a level that's virtually unheard of in the cable industry.



RUC's low-level of churn is especially impressive since it is deploying Reedsburg's third terrestrial network, and has to compete with cable and telephone companies, as well as two satellite TV providers. As such, it underscores the power of muni-fiber's combination of unmatched capacity and community-focused service and pricing.

(Continue on Page 65...)





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(Continued from Page 63)

It's worth noting that RUC offers a \$36.99/mo. package that combines local phone and basic cable service. This package presumably appeals to households that either can't afford or aren't interested in higher-end packages, but have need for basic voice and video services at an affordable price. A review of Charter's web site did not uncover any such "budget" package. This distinction between the two service providers suggests that RUC is better attuned to local market conditions, something that is also strongly suggested by RUC's strong churn and penetration rates.

Like BVU and JEA, RUC chose to deliver video using the traditional radio frequency (RF) technologies employed by cable operators. Though IPTV technology has some potentially significant long-term advantages, especially in the area of service innovation, its cost and performance were not competitive with RF approaches in the 2003-2004 timeframe during which all three of these projects were launched. Nevertheless, Mikonowicz recommends that communities planning muni-fiber projects in the future seriously consider using IP technology for voice and/or video, given the continued evolution of these technologies in terms of maturity and cost declines.

RUC currently does not offer video-on-demand (VOD) service. The reason for this, says Mikonowicz, is cost. For a standard VOD service to be profitable, he says, a subscriber base of at least 5,000 is needed, roughly double the size of RUC's residential customer base. As an alternative, he says, RUC is considering a model in which it would work with a web-based service provider to deliver on-demand video programming to its customers.

Operations

Mikonowicz agrees with other muni-fiber pioneers that new staff and new assets are required to plan, build and operate a fiber network. Relying on existing staff that already have full-time jobs, he says, would be a mistake, and very likely lead to burnout.

While the salaries of staff that work solely for RUC's telecom operation are allocated fully to the telecom unit, "shared" staff and other costs are allocated proportionally among RUC's multiple services. For example, Rice's salary is allocated 75 percent to telecom and 25 percent to the utility's other services.

Since launching its FTTH services, RUC has added two customer service staff positions, pushing its total to six. According to Rice, all six can field telecom-related calls, but in some cases these calls are passed over to the telecom specialists. Other telecom-specific staff positions include two billing clerks, two field service technicians, and a telecom supervisor.

Mikonowicz emphasizes RUC's focus on providing responsive and locally based customer service and tech support, and the positive impact it has had on its take rates and customer loyalty. Reedsburg citizens, he says, have confidence that RUC "will be there today to fix" any problems. He estimates that perhaps 30 percent of RUC customers are loyal because they want the muni-fiber project to succeed, while the rest's loyalty is probably more grounded in an antipathy toward Charter and Verizon, Reedsburg's cable and telco incumbent service providers.

Mikonowicz says one of the largest and most challenging elements of operating expense is the cost of video programming. He says RUC gets most of its programming through the NCTC, and contracts directly for another 10 or 12 channels. He says programming costs account for 42-45 percent of total video revenue, and estimates that Charter, with its much larger national customer base, pays roughly 25 percent less than RUC for a comparable mix of cable channels.

Given the high cost of programming, Mikonowicz says video generates the lowest operating margin of RUC's three main communication services, with telephone generating the highest, followed by Internet access. In the future, he says, margins may shift in favor of Internet service, as web-based alternatives to traditional voice and video service continue to grow.

RUC operates under the direction of a local utility commission, which meets with RUC management once a month. Both Mikonowicz and Rice underscore the importance of high levels of trust between operational management and this kind of oversight body, and the need to keep telecom and other utility management sufficiently insulated from the pressures of local politics. Mikonowicz also notes that RUC operates as an enterprise fund, and pays nearly \$600,000 a year in taxes to the city.

In response to claims that muni-fiber management will be hobbled by government bureaucracy, Mikonowicz and Rice say this is not the case in Reedsburg, in part because the utility commission trusts RUC management to make decisions in response to changing market conditions. In fact, they suggest, RUC is usually able to be more responsive than local Verizon management, which often needs approval from the corporate office, which is sometimes slow in coming.

Economics

During 2007, Reedsburg's FTTH network generated roughly \$2.87 million in revenue. Combined with annual operating expenses of nearly \$1.69 million, this yielded an operating cash flow of \$1.18 million (often referred to as EBITDA, or earnings before interest, tax, depreciation and amortization). This reflected a 41.2 percent operating margin, toward the high end of margins reported by most large cable operators, and virtually the same 2007 margin reported by Comcast, the nation's largest cable operator. The network's operating income for the year was \$456,216, while the interest payments on its debt totaled \$745,000.

Mikonowicz says Reedsburg's FTTH project is expected to generate positive cash flow after operating expenses and debt service in 2008, roughly five years after it was launched.

The fact that Reedsburg's FTTH network has gotten to the point of positive cash flow in a relatively short timeframe is especially notable given the project's relatively high per-premise costs, which were driven in part by its heavy use of underground construction.

A key to this impressive financial success has been the fiber network's success in attracting customers. According to Rice, RUC claimed roughly 2,465 residential customers out of roughly 4,000 homes passed, as well as 235 business customers from among roughly 400 passings. This translates into residential and business penetration rates of nearly 62 percent and 59 percent, respectively, and an overall penetration rate of more than 61 percent. In terms of individual services, 42 percent of homes passed are signed up for the RUC video service, 40 percent for telephone and 37 percent for Internet access.

Mikonowicz says RUC's footprint has expanded by about 100-120 new homes per year, but that the rate of local housing growth has slowed recently. Noting that in 2007 the network expanded to a new 45-lot subdivision just outside the city limits, he says RUC has already attracted 25 (56 percent) of these homes as customers, and expects to sign up an additional ten homes in the future. This would push its penetration in the new subdivision to nearly 78 percent.

The take rates achieved by Reedsburg's muni-fiber network compare very favorably to cable penetration rates in the low 50s for Comcast and Time Warner, the nation's two largest cable operators, and below 50 percent for Charter, the industry's third largest operator, and RUC's cable competitor in Reedsburg.

Another important ingredient in RUC's financial success is its relatively healthy per-customer revenues. An analysis of its financial reports suggests that its fully loaded average revenue per customer, including all telephone, video and Internet revenues, and both residential and business customers, was roughly \$115 per month as of late 2007.

With its heavy mix of underground plant, Reedsburg's FTTH network was relatively expensive to build. Including the cost to pass each premise and connect customers, as well as operating costs up to the point when they can be covered by revenue, the network cost more than \$3,100 per premise passed and \$5,100 per customer.

The fact that RUC’s telecom unit is expected to generate net income in 2008 has major implications for the muni-fiber sector as a whole, since it demonstrates a real-world path to positive cash flows even for a network that is relatively expensive to build.

As the above discussion of Reedsburg and our other case studies suggest, key ingredients for financial success include strong penetration and ARPU levels. And, as our case studies also reveal, well-run, community-focused muni-fiber networks offering competitively priced retail services and delivering high-quality customer service are uniquely well equipped to achieve these financial targets. In a later section of the report we examine the economics of muni-fiber networks in more detail.

Public Benefits

As a “public” entity, RUC’s ability to generate positive cash flow by delivering commercial services to Reedsburg’s homes and businesses is not the only important measure of its success. Others include benefits related to education, healthcare, community programming and overall quality of life.

One early indicator of such “public” value is the fact that RUC’s fiber network now connects Reedsburg’s schools with more bandwidth than they had before, and at a lower price. Before the network was available, schools were paying \$650-\$750 a month for T-1 service, which delivers only 1.5 Mbps of capacity. Today, RUC provides 100 Mbps links between school buildings at a cost below \$500 per month.

Another aspect of RUC’s community focus is the fact that it provides customers with two local TV channels, in contrast to Charter, which offers none. In the wake of a Wisconsin law that removed requirements that cable operators provide financial support for PEG (public, educational and government) access channels, Rice says RUC is working on plans to continue operating its local channels, to make them more attractive and, in doing so, to further differentiate its service from Charter’s in terms of being responsive to the local community.

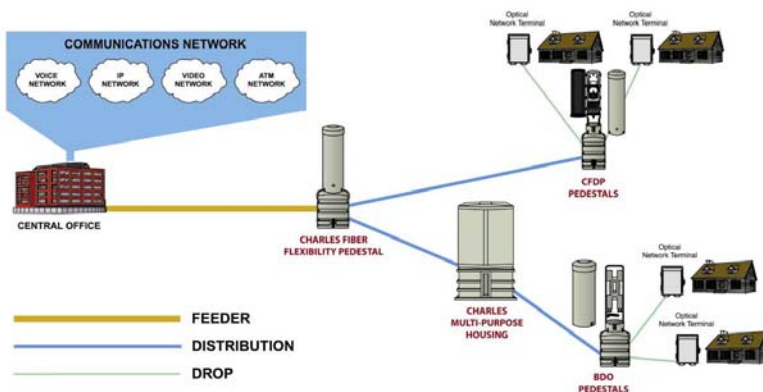
As noted in our Burlington case study, Charter’s lack of local community channels is consistent with a trend identified by a recent survey conducted by the Alliance for Community Media (ACM) and the National Association of Telecommunications Officers and Advisors (NATOA). According to that survey, communities in 18 states that have passed new video franchise laws are seeing declines in support from local cable operators for PEG (public, educational and government) channels and facilities, as well as network connections for libraries, schools and other public locations.⁹

On the healthcare front, Rice says RUC's network has reduced the cost and improved the accessibility and ease-of-use in sharing large documents, X-rays and other bandwidth-hungry applications for Reedsburg's medical community. She also cites signs of increased telecommuting since the fiber network has been available.

As in our other case study communities, Reedsburg's public and private institutions are beginning to leverage the power of fiber optics to improve the quality of life in their local community. It is impossible to say how long one of the incumbents would have taken to provide the same service, but one thing is certain: The citizens, businesses and public institutions of Reedsburg now have the chance to succeed. Without RUC stepping up, it very well may have been a different story for this small midwestern community.

(Continued on Page 71...)

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(Continued from Page Page 69...)

Key Success Factors

As our case studies have shown, the benefits of municipal fiber networks are real, achievable and affordable for communities with the necessary leadership and commitment. And, as they also make clear, this is true even for small towns like Reedsburg, which faced the extra cost of underground construction, and for those like Bristol, which faced multiple challenges from incumbents who viewed their own bottom line as more important than a local community's future welfare.

Even as they faced costs much higher than today's, and had no existing roadmap to success, these early pioneers demonstrated that municipal fiber can be a viable solution for American communities poorly served by incumbent cable and telephone companies. If you are one of these communities, take heart...and keep reading! In this chapter we distill the lessons learned by and from these muni-fiber pioneers. They've cleared a path for others to follow, a path that leads to strong communities and strong economies. The aim of this book is to help you travel that path even more quickly and smoothly than they were able to as trailblazing pioneers.

While our case studies demonstrate that municipal fiber projects can succeed, they also highlight the importance of careful planning and execution, from start to finish.

As a point of contrast, it's worth considering the wave of exaggerated hype followed by exaggerated disappointment that characterized the municipal WiFi sector over the past few years. Though well-conceived and executed muni-wireless projects are, in fact, moving forward successfully, some communities rushed headlong into a muni-WiFi project because they let themselves become convinced it could be done on the cheap and with technology and business models that were oversold and proved not ready for primetime.

Fortunately, because muni-fiber involves a higher level of investment than WiFi, it has not attracted anything like a comparable level of hype. Instead, it has yielded a small but growing group of successful pioneers who, while each unique, have traveled similar roads and learned similar lessons. We review some of these key lessons in this chapter.

Do Your Homework!

A universal theme raised by our muni-fiber pioneers is to do careful and extensive research and planning before moving forward.

The experience in Bristol, Virginia, which has the distinction of launching the nation's first muni-fiber network to offer "triple-play" services, provides some useful lessons in the value of preparation.

As was the case with other successful muni-fiber pioneers, Bristol Virginia Utilities (BVU) began deploying its fiber network by interconnecting utility facilities, schools and government buildings. And, as has also been the case for other pioneering projects, this initial fiber buildout began to attract inquiries from local businesses and residents wanting connections to the network.

In response to this interest, BVU began to consider the next logical next step in its network buildout--extending fiber to all Bristol's homes and businesses. To help evaluate the financial feasibility of this step, BVU conducted two surveys, both of which confirmed a significant level of interest among consumers. This was followed by the development of two business plans, both of which indicated that success could be possible if the network attracted as little as 30-35 percent market penetration (as discussed in our Bristol case study, BVU has actually achieved a penetration rate of more than 60 percent).

Armed with two encouraging pairs of market research and business analysis, BVU was ready to launch a new OptiNet unit to design, build and operate a citywide fiber network.

As BVU's engineers began designing the fiber network, its legal counsel and management team were simultaneously mobilizing to overcome key legal and regulatory hurdles, including challenges from incumbents. This was a smart move since, as our case studies (including Bristol's) illustrate, these challenges are likely to occur. As Wes Rosenbalm, BVU's President and CEO, notes, it's reasonable to expect that "incumbents will fight tooth and nail" to stop a muni-fiber project.

David Mikonowicz, general manager of Reedsburg Utility Commission (RUC) stresses the importance of market research in the early planning stages. He advises communities considering a muni-fiber project to put together a team to start surveying customers about "what they need and think they need." In particular, he says, it's important to gauge community support for the project as well as citizen dissatisfaction with incumbent service providers. He says RUC planners "talked [themselves] blue in the face" before the project was launched, including in-depth conversations with schools, hospitals, local businesses and residential customers. Mikonowicz also stresses the importance of having a sound business and engineering plan that is realistic about costs, prices, revenue, services, and other key elements.

Tim Nulty, the former director of Burlington Telecom who is currently leading a multi-town, muni-fiber project in Vermont, advises communities considering a muni-fiber project to spend six months or so educating themselves, including joining The FTTH Council. Nulty's comments are echoed by Kim Kersey, senior vice president of Telecommunications at Jackson Energy Authority (JEA), who recommends using muni-fiber pioneers as a resource for getting your questions answered.

As part of the planning process, Nulty suggests that city leaders consider involving local citizens with relevant expertise, perhaps assigning some early planning and outreach tasks to a group of 4-6 "enthusiastic techie types that know something" and are eager to

bring state-of-the-art broadband connectivity to their local community. After this period of education and initial planning, he says, the community will likely be ready to start putting together a proposal.

During the planning stage of Nulty's new project, East Central Vermont Community Fiber Network (ECFiberNet), town boards involved in the project are distributing pre-subscription forms to their citizens and business. To help match buildout plan as closely as possible to demand, project planners are considering prioritizing their network connection schedule based on which towns have the highest pre-subscription rates.

Based on early pre-subscription rates and a survey done in the project's target area, Nulty is convinced a relatively strong 50 percent take rate and \$110 average monthly revenue per subscriber (ARPU) are achievable, if not conservative. Part of the reason for this is that the survey showed that households in ECFiberNet's target area currently pay an average of \$132 per month for voice, video and Internet service, including \$20 for dial-up Internet access. As a further check on the feasibility of its ARPU target, ECFiberNet's project team has already informed area residents that monthly rates will be \$10-\$15 higher than those charged in by Burlington Telecom, and they have responded positively.

While some communities have planned and managed network design, vendor selection and construction on their own, it is fairly common in the muni-fiber sector to work with an engineering firm. Bristol, Clarksville and others, for example, have worked with Braselton, Georgia-based Atlantic Engineering, one of the more active engineering firms in the muni-fiber sector.

While a key part of the technology learning curve involves a careful evaluation of deployment costs and alternative fiber architectures and vendors, another element relates to advancements in service-related platforms.

For example, while most muni-fiber pioneers employed the "RF-video" and "circuit-switched voice" technologies traditionally used by cable and telephone companies, RUC's Mikonowicz recommends that communities plan muni-fiber projects today consider using IP technology for voice (known as "VoIP") and video (known as "IPTV"). The reason, he says, is that these technologies are becoming more reliable and cost effective, and have advantages for providing a community with new and valuable services. And, in fact, Burlington, which launched video service in 2006 is using an IPTV platform, as is Clarksville, Tennessee, which began service in early 2008.

While BT's use of IPTV technology has helped it deliver large numbers of "community" channels and, over time, could make it easier to add interactive functions to these channels, its experience suggests that IPTV could add some new elements to the muni-fiber learning curve. As Chris Burns, BT's current general manager, noted in a March 2008 presentation, "IPTV created issues with content providers due to their perception of the lack of security...of the [IPTV] signal." Burns advises muni-fiber projects considering IPTV as a platform for video services to "understand DRM (digital rights

management) and encryption requirements,” as well as the costs associated with acquiring and delivering IPTV services.

While Nulty describes BT’s decision to go with IPTV as a “knife-edge judgment call” for which it “paid a considerable price,” he says the choice of IPTV over RF video will be a “no-brainer decision” for his new ECFiberNet project. Among the reasons, he says, is that, when BT was making its decision, there were no IPTV content aggregators to work with, which meant it had to go through the difficult process of negotiating channel carriage arrangements itself. Today, he notes, there are several content aggregators active in the IPTV market, which makes it a lot easier for a muni-fiber operation to put together IPTV programming packages and substantially reduces the cost of an IPTV headend facility.

Given the ongoing evolution of IPTV technology in terms of cost and functionality, it seems that, over time, it will become more and more attractive as a video platform. Evidence of this can be seen in the fact that, while early muni-fiber projects (e.g., Bristol, Reedsburg and Jackson) opted for traditional RF video solutions, a number of more recent projects (e.g., Burlington, Clarksville and the planned ECFiberNet project) have gone with the IPTV option.

This suggests that communities launching muni-fiber projects in the future should carefully compare the traditional RF approach to video with the more innovative but less mature IPTV option. And we would recommend that they make their selection not only based on a generic technology comparison, but also in light of their current and future goals in terms of delivering video services to their community.

Understand Your State’s Laws

State laws can be important determinants of whether municipal fiber optics projects can first of all move forward and then whether they will succeed.

Part of the reason for this is that state laws exist in a vacuum caused by the lack of applicable federal legislation. While a number of bills focused on municipal broadband have been introduced in Congress during the past few years, there is no clear signal as to what and when such federal legislation may be passed. While it is unlikely this will occur in 2008, the prospects for action could improve after the election, which is likely to strengthen Democratic control of Congress. It is also worth noting that Senator McCain has co-sponsored a bill aimed at preempting state prohibitions on municipal broadband and establishing a federal framework for allowing such projects to move forward.

The federal legislation that one might expect to have the largest impact on state provisions, The Telecom Act of 1996, has no bearing in this matter. This is because the Supreme Court in March 2004 ruled in *Nixon v. Missouri Municipal League* that the 1996 Telecom Act was did not preempt state laws that prohibit municipal telecom initiatives.

After the Court's ruling that, in effect, there was no guiding federal legislation, large incumbent carriers were quick to try to ram through state legislation that would put the muni-fiber sector at a disadvantage.

One of the first examples of this wave occurred in Pennsylvania, which passed a law restricting municipal networks in late 2004. As part of a political compromise apparently needed to get the state's Democratic Governor to sign it, the bill grandfathered Philadelphia's highly-publicized plan to deploy a citywide WiFi network.

Some other state legislatures followed Pennsylvania in passing restrictions on muni-broadband initiatives. A number of others saw similar proposals introduced that did not become law. These include provisions proposed but not passed in Illinois, Indiana, Iowa, Ohio, Oregon, Texas, Virginia and West Virginia. During the first half of 2006, a provision restricting municipal participation in telecom was proposed in the Indiana legislature, but was not included in a final bill that became law.

As we state throughout this report, municipal fiber and wireless builds can expect opposition from the incumbent carriers throughout the process. This certainly includes the state law-making level, where incumbents are doing all they can to thwart such builds before they begin.

Given this, it is important that communities understand the language and implications of relevant laws in their state before embarking on a muni-fiber project. A helpful step in achieving this understanding would be to contact other communities in the state that have undertaken or even considered such a project, as well as communities in other states that have similar laws.

As an initial step in promoting this understanding, we provide the following overview of current state laws impacting the ability of municipalities and public utilities to participate in the telecom, cable TV and broadband sectors.

Arkansas prohibits municipal entities from providing basic local exchange services. Governmental entities that operate an electric utility or cable TV system may provide telecommunications capacity to the public after reasonable notice and a public hearing, but this may not include basic local exchange services.

Colorado passed a law in June 2005 that allows local governments to provide cable TV or telecom service if they hold a successful public election on the issue or in cases where no private provider currently offers the service and incumbent providers decline to commit to service within 60 days of a formal request, or fail to fulfill service

commitments within 14 months of making them. Local governments are also prohibited from granting themselves any undue preference and must apply laws and regulations equally to themselves and private providers.

Connecticut is considering legislation, *An Act Concerning Widespread Broadband Internet Access*, that would allow broadband-related funds to come through the Local Capital Improvement Program. The bill also establishes a nine-member Broadband Internet Coordinating Council.

Florida has for some time imposed various taxes to increase the prices of telecommunications services (as distinguished from other services) sold by public entities. In June 2005, the state passed a new law that required governmental entities seeking to provide communications service to: 1) hold at least two public hearings; 2) consider various factors such as whether the service is currently being offered in the community and, if so, whether it is generally available throughout the community; 3) make available to the public a written business plan containing, among other things, a plan to ensure that revenues exceed operating expenses and debt service payments within four years. The law also forbids cross-subsidies that price services below cost. Municipalities must hold a public hearing each year to report on the municipal system's progress, and if system revenues are not covering operating costs and bond payments after four years, the municipality must hold a public hearing to review a plan to do one of four things: shut the system down, sell it, enter into a partnership with a private entity, or continue operating the system.

Illinois has approved legislation, *The High-Speed Internet Services and Information Technology Act*, which establishes a fund to be controlled by the Department of Commerce and Economic Development for purposes of providing grants to non-profit organizations. This includes \$4 million for the Digital Divide Elimination Infrastructure Fund.

Iowa forbids cross-subsidies of local exchanges services by municipal utilities. During 2005, bills were introduced in both the state House and Senate that would have mandated new requirements, including public votes and funding restrictions, on proposed municipal telecom projects, but these did not become law.

Louisiana passed compromise legislation in July 2005 that allows municipalities to provide telecom service if a majority of voters within the municipality vote in favor of provision of the service. This vote can take the form of an election held for authorization to issue bonds to finance such provision, which was what took place in Lafayette, La., whose plans to build a fiber optic network have been discussed in other sections of this report.

Michigan passed a law in November 2005 that allows a public entity to provide telecommunications only under the following conditions: (a) the public entity has issued a request for competitive sealed bids to provide telecommunication services; (b) the public entity has received less than 3 qualified bids from private providers 60 days after

the date the request for bids was issued; (c) the public entity provides telecommunication services under the same terms and conditions required under its request for bids.

Minnesota requires municipalities to obtain a majority vote before providing telecommunications services and a super-majority vote of 65 percent in cases where service is already available from another provider.

Missouri bars municipalities and municipal electric utilities from providing retail or wholesale telecommunications services or facilities, except, under certain conditions, to telecommunications carriers; the state does not, however, prohibit services for internal uses, for educational, emergency and health care uses; and "Internet-type" services.

Nebraska, which already had in place some restrictions on municipal telecom, passed new legislation in June 2005. Subject to exceptions specified in earlier statutes and the grandfathering of existing systems, the new law forbids political subdivisions of the state from providing retail or wholesale broadband services, Internet services, telecommunications services, or video services. The law also prohibits a public power provider from offering such services on a retail basis, or until 12/31/07 on a wholesale basis. Telecom services for internal use are allowed under the law. The bill also created a Broadband Services Task Force to draft and submit by 12/1/06 a report on issues related to possible future provision of communication or video services by municipalities or public power suppliers. The latter provide power to roughly 98 percent of Nebraska residents.

Nevada generally prohibits municipalities with populations larger than 25,000 or counties with populations of 50,000 or more from providing retail "telecommunications services," as defined by federal law. These public entities may, however, purchase or construct facilities for providing telecommunications if a study determines it is in the public interest.

New Jersey has approved legislation allowing local communities to provide broadband wireless services.

North Carolina defeated legislation, *The Local Government Fair Competition Act*, that regulates what local communities can do in offering broadband services.

Ohio law places conditions on the provision of cable TV services by municipalities. These include safeguards with respect to expenditure of public funds, including a requirement for a financing plan and the opportunity for the electorate to demand majority approval by referendum.

Pennsylvania prohibits political subdivisions from providing advanced telecommunications and broadband services for a fee to the public unless no such services are provided by the local exchange company and the LEC has refused to provide such services within 14 months of a request by the political subdivision for those services

at the requested data speeds. The law grandfathered networks in operation prior to 1/1/06 as well as the Philadelphia muni-wireless project.

Rhode Island is considering legislation that would improve Internet access.

South Carolina imposes restrictions and procedural and imputed-cost requirements on municipal providers of communications services and makes them subject to regulation by the state PSC. These services may not receive anti-competitive financial benefits nor cross-subsidies from other government activities. In calculating rates, the government-owned provider must impute the cost of capital, taxes, fees and other costs required of private sector providers. They must also satisfy certain accounting and financial reporting requirements.

Tennessee passed legislation in June 2005 stating that municipalities operating an electric plant may provide telecommunications services based on authorization by the supervisory body responsible for the plant. The law forbids subsidies for such services, but allows the municipality to dedicate a reasonable portion of the electric plant to the provision of such services. The municipality may also lend funds to the telecom operation, but not at rates below the highest rate it is earning on invested electric plant funds. The municipality is also required to make tax equivalent payments for telecom services in the same manner required for electric systems.

An earlier Tennessee law bans municipal provision of paging and security service, but allows provision of cable, two-way video, video programming, Internet and other "like" services only upon satisfying various anti-competitive public disclosure, hearing and voting requirements that a private provider would not have to meet. These services are not allowed in cases where: 1) a private company is providing cable service to 6,000 or fewer subscribers or; 2) an existing telephone cooperative has been providing cable service for not less than 10 years.

Texas bars municipalities and municipal electric utilities from offering telecommunications services to the public either directly or indirectly through a private telecommunications provider. A municipality or municipal electric system may, however, lease dark fiber on a nondiscriminatory basis.

Utah imposes procedural and accounting requirements and restricts the authority of municipalities to provide retail cable television and public telecommunications services. Specific requirements include: a preliminary public hearing and feasibility study; a determination that revenues will exceed costs in an amount sufficient to cover debt service; adoption of the feasibility study by resolution of the legislative body. The legislative body can call an election on whether or not to offer these types of services. State law also specifies the conditions under which municipalities can issue bonds to fund cable TV or telecom operations and forbids cross-subsidy of such services and discrimination against competing providers of the same services.

Vermont has passed legislation to advance broadband and wireless communications infrastructure throughout the state. A key provision is that all state residents have affordable broadband by the year 2010. The Act created a Vermont telecommunications authority to help bring broadband to the state. Vermont also encourages the creation and development of bonds to fund such infrastructure. It also establishes a broadband development grant program.

Virginia allows municipal electric utilities to provide telecom services, including local exchange services, provided that they do not cross-subsidize these services, and that they impute costs that private sector providers would incur, and comply with a number of procedural, financing, reporting and other requirements that do not apply to the private sector.

Washington limits public utility districts to providing only wholesale telecommunications services. State law also provides some safeguards against discriminatory pricing and imposes some financial reporting requirements. The state legislature is considering a bill that would provide broadband to underserved sections of the state through utilities.

West Virginia's state legislature passed the Electronic Telecommunication Open Infrastructure Act (ETOPA) encouraging broadband use throughout the state to every residence by 2010. The governor has vetoed the measure.

Wisconsin imposes a number of requirements on municipal communications providers, including prohibitions on cross-subsidies and requirements that they charge market rates that reflect the cost of private competitors. Municipalities must also conduct a feasibility study and hold a public hearing prior to providing telecom, cable or internet services. Some requirements do not apply to specific cases, including the provision of broadband service in the absence of private providers and the provision of nondiscriminatory wholesale broadband services.

Wyoming has enacted legislation providing restrictions on political subdivisions entering exclusive telecom service contracts; providing for a complaint process; and for an effective date.

We would like to thank Jim Baller and the Baller Herbst Group for providing much of the information included in this review of state laws.

Dealing with Incumbent Challenges

As BVU's Rosenbalm notes, it is reasonable to expect that incumbent telephone and cable companies will challenge a muni-fiber project on both the legal and public relations front. The likelihood of these challenges underscores Rosenbalm's statement that muni-fiber projects "are not something you can half do...you're either in it or not."

Though muni-fiber planners should always be prepared for legal challenges, the intensity of such challenges is likely to increase the larger the community, especially those served by the larger and deep-pocketed telephone and cable companies that dominate today's telecom market.

The focus and strategy of incumbent legal challenges will depend to a large extent on the specifics of relevant state laws, which are reviewed in the prior section. As noted then, it is important to understand your state's laws in order to both anticipate and effectively respond to incumbent legal challenges. Depending on which state a community is located within, incumbent legal challenges may relate to the proposed funding mechanism, claims of illegal cross-subsidy by existing public utility revenues, lack of proper licensing, the need for voter approval and other state-imposed prerequisites, the terms under which service can be provided, among other things.

The fact that the legal basis for an incumbent challenge may be quite weak does not necessarily mean such a challenge will not be mounted. For example, on May 21, 2008, the city of Monticello, Minnesota obtained commitments from private investors to purchase revenue bonds to finance the establishment of a city owned and operated telecommunications utility called "FiberNet Monticello." The project had previously obtained strong support from Monticello citizens, in the form of a 74 percent favorable vote in a September 2007 referendum, significantly higher than the percentage required by state law.

As the financing agreement was coming together, the incumbent telco, TDS Telecom, through its subsidiary Bridgewater Telephone, filed a lawsuit against the city claiming that state laws do not grant the right to use revenue bonds for establishment of a telecommunications system. This occurred in spite of the fact that Minnesota state law expressly allows revenue bonds to be issued for revenue-based "utilities and public conveniences."

Supporters of Monticello's muni-fiber project have suggested that the timing and the claims alleged in the lawsuit reflected an intention to interfere with the bond offering and saddle the project with additional costs and delays. In a public statement shortly after the suit was filed, the city expressed confidence that it was "well within its legal rights to use revenue bonds to build a municipal network and...will prevail against the suit." The city also indicated that its bond managers will "continue to prepare for the bond sale which will include a disclosure to investors of the existence of the lawsuit." It also said it would "vigorously oppose the law suit" with financial help from the League of Minnesota Cities Insurance Trust, of which it is a member.

The history of an FTTP project long planned by Lafayette Utilities System (LUS), which serves roughly 57,000 retail electric customers in Lafayette, LA, provides a useful case study for how a muni-fiber project can prevail even in the face of prolonged and multi-pronged challenges from incumbents.

The terms of the legal battle over Lafayette's muni-fiber project date back to legislation passed in July 2005, in the wake of lawsuits filed by BellSouth and Cox following a LUS FTTH feasibility study in 2004. The legislation, which reflected an uneasy compromise between muni-fiber supporters and opponents, allows municipalities to provide telecom service if they win a majority vote of their citizens, which can take the form of a vote authorizing the municipality to issue bonds to finance a telecom project.

In July 2005, LUS won the required vote to authorize a \$125 million bond issue by a margin of 62 percent to 38 percent, in what was considered an unusually high turnout, and an impressive victory for LUS.

The story didn't end there, however. BellSouth and other opponents of the project continued to file legal challenges to LUS's plans. The final challenge was rejected in a unanimous ruling by the Louisiana Supreme Court in late February of 2007, and LUS is currently building a network it expects to begin delivering service by January 2009.

The Lafayette story also highlights the fact that anti-muni legislation and legal challenges are not the only strategies used by incumbents to stall or stop muni-fiber projects.

LUS, along with other proposed municipal fiber projects, has had to deal with well-funded advertising and PR campaigns aimed at convincing voters and/or local political leaders to oppose such projects. In the LUS case and at least one other, these campaigns have allegedly employed the tactic of "push polls," in which telephone surveys appear to be designed not only to gather information as to citizens' attitudes, but also to plant doubt in respondents' minds regarding the proposed project.

A May 4, 2005 article in *The Daily Advertiser*, a newspaper in the Lafayette area, described the reaction of one citizen questioned in one such pre-vote poll:

"I thought it was kind of clever and funny at the same time," said resident Dan Lavergne, an employee of Fenstermaker and Associates who was questioned Monday. The pollster said because of the constitutional separation of church and state, a judge may rule that LUS cannot provide religious programming over its fiber, Lavergne said. The pollster also said "that since LUS rations water, how would you feel about receiving cable only a few days a week," Lavergne said. "I couldn't finish. I was laughing too hard toward the end," he said. "It was interesting all the different angles they played, like if they asked enough questions and played enough angles they were bound to get something you're angry with the city about."¹⁰

Another Lafayette resident reported a similar line of questioning, and reacted quite negatively to it, suggesting that, at least among some residents, such "push-poll" strategies may backfire:

"Everything was negative about LUS and positive about Cox and BellSouth," Ringo said. "It was just a paid political announcement pushing you to think LUS is bad and everybody else is good. It's not fair marketing, and I told the lady she should be ashamed."¹¹

There is evidence that such tactics were used earlier, and with more success, in Geneva, Batavia, and St. Charles, three Illinois cities where citizens ended up voting down an attempt to build a \$60 million municipal broadband. A copy of a survey believed to have been sponsored at the time by incumbents Comcast and SBC was obtained and published by the broadbandreports.com web site. The final set of questions in the survey, as published 2/22/03 at <http://www.dslreports.com/shownews/26435> is provided below:

*-Are the following reasons persuasive to vote "No" in the upcoming referendum:
All taxpayers might pay higher taxes for only a few users.
The proposed plan creates a large expensive and inefficient bureaucracy like that of Amtrak and the Post Office.*

-Do you believe local schools will have to cut teaching staff, increase class sizes and eliminate after school programs because the Tri-Cities broadband referendum competes with existing school referendums?

-Should tax money be allowed to provide pornographic movies for residents?

-Do you believe, if the broadband proposal fails, there would not be money to spend on transportation and educational needs?

-Would a government broadband invade privacy and allow the government to listen to your telephone conversations, monitor the Internet sites you visit and

know what cable shows you watch?

-Would the following questions make you more or less likely to support Tri-City's broadband:

- *The technology local government would use would be obsolete in a few years therefore requiring another bond issuance later.*
- *The government plan requires property taxes to increase if 30 percent of the households do not immediately sign up for service.*
- *Because private company offers broadband service there is no need for government to provide the same service.*

-Now after listening to the previous questions, do you support or oppose the government broadband plan?

Though tactics like this led to two failed referendum votes, some local citizens working on behalf of the Tri-City project made a point of sharing their experience and the lessons they learned with their counterparts in Lafayette, which ultimately prevailed against similar tactics.

According to Annie Collins, one of the Tri-City project's citizen leaders, overcoming incumbents' public relations attacks requires a strong political will, an ability to frame and communicate effective arguments, and emphasizing the "local community" nature of the project. As discussed in several other sections of this report, a notable strength of muni-fiber projects—both in the pre-launch and operational phases—is that they are grounded in the local community and focused on locally provided customer service. This contrasts with most large cable and telephone companies, many of whose decisions are made at a distant corporate headquarters based on bottom-line profit considerations, and whose customer service staffs are likely to be in remote locations.

In terms of the importance of framing pro-muni arguments in ways that gain traction in a given community, Collins cites a successful strategy used in Lafayette, where pro-muni advocates stressed that the parish would end up on the wrong side of the digital divide without the FTTH network.

Lafayette's success in overcoming incumbents' PR assaults may also have something to do with the growing power of the Internet for sharing information and opinions via e-mail, blogs and other formats. These "distributed" and inherently democratic forms of communication are very hard for corporate PR campaigns to control, and efforts to do so have often painfully backfired. Related to this trend is the fact that both local and national journalists increasingly look to blogs and other online sources for alternative points of view and a sense of what's going on "at the grassroots." The Lafayette pro-muni effort included several blogs and other online information sources, which may have helped the project gain an impressive level of national visibility, including revelations about the incumbent-sponsored push polling.

According to a February 19, 2007 article in *The Daily Advertiser*, City-Parish President Joey Durel said that, as of early 2007, the city had spent \$1.18 million on legal fees, including the final State Supreme Court battle, which drew to a close later that month.

Though these legal fees are significant, Durel, noting that the price of FTTH technology had dropped during the two years since the project was first proposed, pointed to a silver lining in the delays. "If the Supreme Court rules in our favor," he said, "it won't be that it cost us \$1.1 million in legal fees. It's that the lawsuit saved us \$6.9 million because the cost of the technology and hardware dropped."¹²

Cost reductions are not the only change in FTTH technology during this period. According to May 23, 2008 article in *The Advocate*, another local paper, data rates offered on the LUS fiber network will range from a low of 10 Mbps to a high of 100 Mbps, at prices "about 20 percent below competitors." The article also cited early market surveys indicating that 70 percent of residents and 80 percent of businesses were interested in the LUS service if competitively priced.

Though it has been a long haul getting Lafayette's muni-fiber project to the launching pad, its combination of capital costs, services, prices and likely penetration rates suggest it may soon join the ranks of muni-fiber success stories. And, though hard-fought, its success confronting incumbent challenges and strong market positioning bode well for other communities wanting to join it in the next-generation of fiber-powered municipal networks.

Financing Issues and Options

The most commonly used form of muni-fiber financing is a tax-deductible revenue bond. These can be backed by revenue strictly from the telecom operation or, for a community with an existing utility, by the latter's total revenue. In some cases, including Dalton, Georgia and, initially, Bristol, Virginia, projects have been funded internally by a community's public utility.

Another potential source of funds are low-interest loans and loan guarantees from the US Department of Agriculture's (USDA) Rural Utilities Service (RUS). To qualify for these, a muni-fiber network must provide broadband services to an "eligible community," which is defined as "an area of the United States that is not contained in an incorporated city or town with a population in excess of 20,000 inhabitants."

RUS is required to be technologically neutral in terms of its loans, and to give priority to rural communities with no existing residential broadband service. It has, however, provided loans in communities that do have some existing broadband service.

According to a 2007 report prepared by the Congressional Research Service, the process of applying for and receiving RUS funding has been criticized for being too slow, complex, burdensome in its requirements, and both restrictive and confusing in terms of what types of communities can qualify for such funding. The report also noted that “all applicants are required to demonstrate adequate credit support—a minimum of 20 percent of requested loan amount, including cash on hand equivalent to one full year of operating expense,” with the cash-on-hand requirement waived for companies with two previous years of positive cash flow.¹³

Grants can also play a role, albeit a small one. For example, a half million dollars of financing for the Reedsburg FTTH project came from a Public Facilities Grant from the Wisconsin Department of Commerce.

Reedsburg is relatively unique among muni-fiber pioneers in that the bulk of its initial funding came in the form of a “Bond Anticipation Note” from a local bank that, according to RUC general manager David Mikonowicz, “believed in” the project. The 5-year note was tax exempt and required only interest payments for the five year period. Its interest rate varied based on the LIBOR (London Inter-Bank Offered Rate), a commonly used rate benchmark. Mikonowicz says that, during the five year period, the rate varied from around 2 percent to as high as 6.15 percent. As of April 2008, he said, it was roughly 4.85 percent.

Mikonowicz says the interest-only bond allowed RUC “to get plant in the ground” before having to pay down the note’s principle. He said this approach is fairly common in Wisconsin for electric and water projects.

Having used the note to get to the verge of positive net income, RUC was, as of April 2008, considering two options for refinancing the project’s costs. One option was a 20-year bond at an interest rate in the 5.0-5.15 percent range. This approach, says Mikonowicz, would require a bond redemption reserve fund of roughly \$1 million. RUC was also talking with a bank about a 25 year loan that would carry a fixed interest rate of 4.25 percent for five years, after which the rate would become adjustable. Mikonowicz expected RUC to decide between the two options by summer.

In Jackson, the bulk of FTTH funding came from a bond paying interest at just above 5 percent. JEA also secured a line of credit with a local bank that carries a 5.43 percent interest rate. The FTTH bond is secured primarily by telecommunications revenue, with JEA’s telecom division able to borrow up to \$34 million from its electric division for debt service. While these two sources are expected to be more than enough to cover all costs, including debt repayment, there is also a provision for the city, if necessary, to back the bonds with its general obligation taxing authority.

Though bonds issued by JEA are typically non-taxable, its initial FTTH bond was taxable, since it was based on a business plan under which JEA would provide wholesale capacity to private retail service providers. This disqualified the bond from IRS tax-exempt status, a factor that was reflected in its interest rate of just over 5 percent.

Because JEA ended up providing cable television directly as a public entity, it was able in 2007 to refinance over 60 percent of the original taxable debt into tax-exempt financing, a change that reduced its interest rate by over 100 basis points. JEA is also transitioning to a retail model for Internet and voice service, which will allow it to refinance most, if not all, of the remaining taxable bond debt via tax-exempt financing.

Unlike most other muni-fiber projects, the Burlington FTTH network was funded through a tax exempt capital lease rather than a municipal bond. The capital lease operates very much like a mortgage, with the private financier owning the network and leasing it back to the city for the term of the lease, which for the Burlington FTTH network was 15 years. After the term of the lease, the city will own the network. Capital leases are an established form of municipal finance, especially for projects that have their own revenue stream, such as parking garages.

The relatively small initial phase of the Burlington buildout was funded at an interest rate of 5.63 percent. A much larger round of funding was financed at 5.17 percent, and a final round, that included new funds and also refinanced the earlier lease balances, carried an interest rate of just 4.17 percent.

Tim Nulty, who headed BT until last fall, sees both advantages and disadvantages in lease vs. revenue bond financing, and suggests that a project is likely to benefit from having ready access to both options.

Though Nulty notes that revenue bonds typically sell into a wider market and can generally raise larger amounts than capital leases, he points out that the latter have some advantages. One advantage from the perspective of funding sources is that a lease gives them ownership of the network and the ability to repossess it in the case of default. In contrast, holders of revenue bonds for projects that run into trouble must, as Nulty put it, “whine to the judge” to recover the value of their investment.

Nulty also notes that, in today’s environment, leases may be able to attract a somewhat larger share of capital than they have in the past. The reason, he says, is that municipal bonds, while generally less risky than comparably rated corporate bonds, may suffer, at least temporarily, from the current troubles plaguing bond insurers and the bond market in general. This concern about increased risks in the bond market, Nulty suggests, is less likely to impact capital leases, since they have never been insured.

A capital-lease approach could also provide some political advantages to a muni-fiber project, especially since one of the core arguments made by incumbents and other muni-fiber opponents is that a muni-FTTH investment puts tax dollars at risk. While this is not true for some revenue bonds, it is even more clearly not the case for lease financing. If a lease-financed muni-fiber project finds itself unable to make its payments, it would not have to look to the city for financial help to pay off its bond. The most likely scenario in this case would be a restructuring of the capital lease terms (for example, a longer term).

And, even in the case of default, the financier's first recourse would be to repossess the network, something that would not put tax dollars at risk.

Nulty's comments about financing options suggest that communities wanting to build FTTH networks should at least consider the lease option, particularly if they are not looking to raise too much more than Burlington did.

Nulty's current multi-town project (discussed elsewhere in this report) is looking to raise roughly \$90 million, which he describes as a "big amount" for a privately-placed capital lease, "even without the current [financial market] turmoil."

Given the amount of money involved and current market conditions, ECFiberNet was unable to secure a private capital lease arrangement to finance its network. Instead it has struck a deal with Oppenheimer & Co. in which the investment banker will raise the capital lease funds through a public offering known as a "Certificate of Participation" (COP). Oppenheimer's confidence in the ECFiberNet project is suggested by the fact that it has agreed to do the deal on a contingency basis, including both its fees and its out-of-pocket expenses.

COPs, says Nulty, are typically sold in relatively small denominations in the public market, like bonds. The disadvantage of this approach is that it involves extra time, costs and legal requirements. But, at the same time, he says, it is likely to involve an interest rate about 0.5% below a private placement lease, which offsets much if not all of the extra upfront costs. And because it is sold into a much larger market, a COP is a more liquid financial vehicle than a privately-placed lease. And if a COP's resale price rises above its initial price, it can enhance a project's credibility—and potentially also the credibility of the muni-fiber sector as a whole.

Nulty says many cities of different sizes already have the expertise needed to put together a project's financing. For those that don't, he says, acquiring that expertise is likely to be easier than building a staff that can successfully build and manage the network and the services it delivers. As Nulty's experience in Burlington suggests, achieving the latter is not only important to achieve operational and financial success, it is also likely to be helpful in obtaining an attractive financing package. Putting on his former venture capitalist hat, Nulty cites the standard VC description of the three most important factors in deciding whether to fund a project: "management, management and management."

Community-Focused Marketing & Customer Service

There is a strong consensus among successful muni-fiber pioneers that a community-focused approach to marketing and customer service was a key ingredient in their success. In particular, it allowed them to achieve high levels of customer loyalty and service penetration.

As noted in our case studies, both Bristol and Reedsburg have already reached penetration rates above 60 percent. This is also the case for the muni-fiber network operated in Dalton, Georgia. According to the management of Dalton Utilities, its OptiLink service has attracted as customers nearly 70 percent of the town's business and roughly 62 percent of its residences.

These penetration levels are all the more impressive when we consider that the average penetration rate for the nation's two largest cable operators—Comcast and Time Warner Cable—are both in the low 50s, while the comparable measure for Charter, the third largest operator, is below 50 percent. All the more so, since only a small percentage of these private companies' networks are subject to direct competition from another local provider of cable TV service. The fact that some muni-fiber networks are achieving 60%+ penetration when they do face such competition is testimony to the inherent attractiveness of these community-focused networks, as well as the dissatisfaction so many customers feel with the prices and service quality provided by incumbent cable and telephone companies.

As Nulty puts it, "being the town" is an invaluable marketing benefit. The message to potential customers, he says, is that "it's YOUR network, the customer service reps are your neighbors, the revenue it generates stays in your community, and any profit it makes will help cut your property tax." As evidence of this marketing value, Nulty notes that in its first two years of providing service, BT spent less than \$20,000 on marketing, never purchased a newspaper ad, and that its primary marketing tool was word of mouth among community members.

At the same time, Nulty warns communities to be ready to handle a rush of demand. If installations, technical support and customer service are not handled well, he says, the initially positive wave of publicity can backfire on a muni-fiber project.

Nulty echoes comments from other muni-fiber pioneers in terms of their attitudes toward customer service. While private companies, he says, are inclined to spend the least they can on customer service without losing customers, the approach taken by BT is to "provide the best customer service you can afford." He says he would tell his staff, "if you can't solve [a customer's problem] on the phone, go fix it in their home." And "you only have to do [this] once," he adds, "and you've won [customers'] hearts and minds."

BT's pricing, as well as Nulty's comments, are consistent with the experience of other successful muni-pioneers. The consensus seems to be that muni-fiber operations do not need to match the sometimes steep but temporary promotional discounts offered by incumbent service providers as long as they offer competitive rates and high-quality customer service, and enjoy the trust and good will of the communities they serve.

BVU CEO Wes Rosenbalm says that, while the average customer saves about \$20 a month by subscribing to BVU's OptiNet service, the network's number one benefit is "great customer service." That service quality, says CFO Stacey Bright, helped make

Bristol residents “immune” to incumbents’ promotional discounts, even though they are sometimes quite steep. She says BVU’s investment in customer service and the brand loyalty it engenders are key to its success in attracting and retaining customers.

Similarly, Reedsburg’s muni-fiber operation doesn’t try to compete directly on price with incumbents’ steepest discounts. Instead, says Director of Marketing Catherine Rice, the combination of low and stable prices and free installation, backed by high-quality and locally-provided customer service and tech support, has been enough to allow RUC to generate very strong penetration rates, healthy per-subscriber revenues, and low rates of customer loss. A key factor in RUC’s success, says General Manager David Mikonowicz, is that Reedsburg citizens have confidence that RUC “will be there today to fix” any problems.

Another element of the “community-focused” strategy shared by our muni-fiber success stories is the provision of fiber connections to local schools, government agencies, medical facilities and businesses at prices substantially below those available from incumbents, and at higher data rates and service quality.

For example, Reedsburg’s muni-fiber network connects its schools with 100 Mbps links at a cost below \$500 per month, compared to the 1.5 Mbps T-1 circuits the schools were previously leasing from incumbent service providers for \$650-\$750 a month. Similarly, in Bristol, a study has estimated the annual savings from linking government and school buildings via fiber at \$156,000. These connections are operating at data rates as high as 100 Mbps to 1 Gbps, compared to the T-1 circuits typically used before the fiber network was built.

Another aspect of being community focused lies in the video-programming arena. For example, in Burlington, BT provides leased video channels for just \$65/mo, compared to the \$6,500 charged by Comcast. When Nulty left BT in the fall of 2007, six channels were being used for public, educational and government (PEG) programming. He predicted that more of BT’s \$65/mo. channels would be used over time, as the local “creative community” came to realize the power and cost-effectiveness of the network’s capabilities, and how this could open new opportunities not available when the only option was to deal with the local cable operator.

Retail vs. Wholesale; Open vs. Closed Networks

Just as our case studies reveal a consensus on the value of high-quality, community-focused customer service, they also highlight a shared view regarding the value of being a retail-service provider. In fact, these two elements are closely tied together since, as muni-fiber pioneers have discovered, the ability to reliably deliver high-quality customer service and tech support is fundamentally dependent on being a retail service provider.

Among our four case studies, three have been retail service providers since their inception. And though Jackson's fiber-network initially provided only retail video services, JEA is in the process of adding retail voice and Internet service, having come to the conclusion this will be a more successful strategy--for itself and also for Jackson residents.

Nulty explains the basic rationale behind this consensus view. He points out that fiber optic networks are very capital intensive, with a large amount of upfront spending, and that this translates into a substantial debt-service requirement that typically begins even before the network is fully built out. This, in turn, puts intense pressure on the project to ramp up revenues as quickly as possible to support debt service as well as operating expenses. The most effective way to do this, he says, is to offer service directly, rather than rely on the business models and ability to execute of unaffiliated retail providers.

As examples of the risks associated with "wholesale-only" models, Nulty points to muni-fiber projects in Utah and Washington, two states in which state laws were passed limiting such projects to wholesale service models. The fact that these projects have struggled to achieve targeted penetration rates and revenues strongly suggests that such laws significantly increase the risks and challenges faced by muni-fiber projects. Nulty characterized such restrictive state laws as "a second line of defense" pursued by incumbents who are unable to get laws passed that totally restrict muni-fiber projects.

The revenue-related advantages of the retail model are reflected in two key metrics, says Nulty—penetration and average revenue per subscriber (known in the industry as ARPU). While wholesale ARPUs may be as low as \$30-\$40, he says, retail ARPUs in today's "triple-play" market environment are likely to be in the \$100 range or even higher.

RUC's Mikonowicz says the wholesale-only model seriously weakens one of muni-fiber's chief advantages—high quality, community-focused and locally provided customer service and tech support. In the wholesale model, he says, "you lose the ability to take care of your own customer."

As it moved forward with its original "hybrid" wholesale/retail model, JEA came to see the risks inherent in the wholesale-only model. As Kersey notes, this risk was amplified by the kind of revenue-sharing deal JEA had with one of its retailers. Under such an arrangement, JEA's per-unit revenue was largely out of its control, depending instead on the pricing strategy of the retailer using its network.

The wholesale model also leaves a network owner at the mercy of the service quality provided by the retailers using its network, says Kersey. If that quality does not measure up in customers' eyes, he says, the network owner loses revenue-generating customers, and is likely to get much of the blame, even if it had nothing to do with the problem and can do very little to correct it.

Kersey also notes that managing customer service and tech support are inherently more complex in a wholesale model. Customer management and communication of business policies can be confusing among different outside providers, and outside providers may have customer policies that are different, or in conflict, with the policies of the network owner. And customers typically go back to the point of purchase if they have billing or service issues, and the hand-off of problems to the outside provider may not be seamless.

Technical issues can also arise between the network operator and retail providers, notes Kersey, and these can result in finger-pointing and delays in resolution. And managing multiple outside providers can lead to operational problems and internal competitive issues among these providers.

Having operating in both retail and wholesale mode, Kersey highlights a fundamental risk of the latter: if retail providers drop the ball in terms of attracting and retaining customers, the network owner is left with the burden of debt repayment, but without corresponding control over the growth of its subscriber base and revenue.

A related problem for a public utility adopting the wholesale model, says Kersey, is the risk of diluting its brand which, for JEA and most other public utilities, is a very strong and positive one.

Kersey also points out that a utility is usually the first company contacted by a household or business moving to or within a community. Like a public utility's positive brand ID, this important "first-contact" marketing advantage is also diluted if its customer service representatives are not in a position to market a full line of voice, video and data services when contacted for utility hookups.

Though the history of the muni-fiber sector provides a strong argument against wholesale-only business models and laws that mandate them, this does not mean that other service providers should not be allowed access to the muni-fiber network.

Nulty, for example, points out that, while he strongly believes that muni-fiber projects should offer retail services (and that state laws should not prohibit this), he also favors "open networks" that allow other service providers access on a non-discriminatory basis. And he sees no contradiction between these two principles.

The analogy Nulty uses is to public roads. Cities, which build and maintain local roads, he says, also use them to provide bus service, trash pickup, police, fire and other public services. At the same time, these roads are open to anyone seeking to use them for virtually any kind of transportation service.

As Mark Lane, BVU's director of network engineering notes, the practical implementation of this "open network" functionality is likely to become easier over time, as services continue their migration to an IP platform. As the Internet's plethora of services and ease of entry dramatically illustrate, an IP-based platform is especially friendly to the kind of "open network" functionality described by Nulty.

Noting that the Burlington network is open to incumbents, Nulty says access was, in fact, offered to Verizon. While the telco's local management was attracted to the proposition, he says, corporate decision-makers killed the idea. In Nulty's view, this reflected the staunch opposition of major telecom incumbents not only to muni-fiber networks, but also to "open network" and "net neutrality" requirements affecting their own networks. If a major incumbent agreed to deliver retail services on a muni-fiber network, he says, it would destroy their argument against both "open" networks and municipally owned networks. As a result, he considers it very unlikely that any major incumbent would offer services on a muni-fiber network, regardless of the potential benefits to them in doing so.

New Expertise is Needed

Another area of agreement among successful muni-fiber pioneers is that operating a competitive telecom operation is very different than running a public power utility, and even more so than operating a local government.

Nulty, whose background includes launching and running commercial telecom businesses, explains some of the key differences. The operation of an electric utility, he says, involves delivery of a single service that has no competition and is heavily regulated. As he puts it, the core management tasks of an electric utility are to "be safe and control costs," to follow well established practices and codes, and to work with labor unions.

In contrast says Nulty, today's telecom company operates in a dynamic and competitive market environment, typically does not have a unionized labor force, is generally unregulated, and must offer an ever-changing mix of products and prices to remain competitive. In addition, it must deal with dynamic and complicated technology, with all of this playing out in a highly competitive market dominated by incumbents with strong motivation to defend their market share.

Rosenbalm agrees that "the mentality of public utility monopoly has to change" for a muni-project to succeed. Among the necessary changes, he says, are an increased focus on marketing and a shift from a "ratepayer" perspective to one in which pricing decisions are made with competitive factors in mind. Whereas traditional public utility management is "more controlled, less creative, and slower" transferring this approach to a competitive telecom operation, he says, is a mistake.

In contrast to this traditional utility mindset, says Rosenbalm, BVU's culture has been cultivated to promote creativity. Also needed, he says, is a willingness to hire new staff and pay them competitive salaries. Roughly 90 percent of the OptiNet staff, he notes, was hired from the outside, not from BVU's existing utility operation.

RUC's Mikonowicz agrees that new staff is required to plan, build and operate a fiber network. Relying on existing staff that already have full-time jobs, he says, would be a mistake, and very likely lead to burnout.

When possible, hiring telecom staff that not only know the industry, but also know the local market, can help. For example, as it was preparing to launch its fiber network in Jackson, JEA hired cable industry veteran Kim Kersey to manage its new telecom unit. Kersey had previously managed the local cable operation under several owners and had also served as chair of Tennessee's cable industry association.

And in Clarksville, Tennessee, Christy Batts was hired as CDE LightBand's Telecommunications Marketing Manager, following 13 years of marketing experience in the cable industry, including serving as Charter's marketing manager for the Kentucky and Tennessee areas. After leaving that position, Batts had served five years as director of the local Chamber of Commerce, which meant she was also well connected within the Clarksville business community, from which the network's highest-revenue customers will come.

It is also important to insure that politics or bureaucratic delays do not interfere with management. Noting that a muni-fiber operation, like any competitive provider of telecom services, must be "fast on its feet," Nulty recommends that they not be operated as a "plain vanilla part of the city government." As examples of how this can slow responsiveness, he cites the delays he faced at BT, when even relatively small contracts had to be approved by the city government, and decisions on personnel matters were constrained by bureaucratic requirements.

Rosenbalm stresses the importance of insuring that management is sufficiently insulated from political pressures. As an example, he notes that BVU's original business plan called for it to charge rates for cable TV service roughly \$3-\$4 below those charged by the incumbent. But a city councilmember felt that rates should be lower and pressured management to cut them. A year or so later, OptiNet's management came back to the council to request the higher rate, because the reduced rates were threatening the project's financial viability. Rosenbalm says this early experience provided the council with a valuable lesson about the importance of adhering to the OptiNet business plan.

In Reedsburg, RUC operates under the direction of a local utility commission, which meets with RUC management once a month. Both Mikonowicz and Rice underscore the importance of high levels of trust between operational management and this kind of oversight body, and the need to keep telecom and other utility management sufficiently insulated from the pressures of local politics. Crucial to RUC's success, they suggest, is the fact that the utility commission trusts its management to make decisions in response to changing market conditions.

While avoiding bureaucracy and political interference are important for a muni-fiber operation, Mikonowicz makes the point that this is also the case for private companies, and that the latter don't always measure up all that well. For example, he says, in the Reedsburg market, RUC is usually able to be more responsive than local Verizon management, since the latter often needs approval from the corporate office, which is sometimes slow in coming.

As our case studies show, success in providing services to the local business community is both possible and beneficial in driving revenue and achieving positive cash flow. It is therefore very helpful to be prepared—in terms of technical, marketing and customer service expertise—to serve the needs of business customers.

According to Rosenbalm, BVU's creative approach to the business market helped it achieve strong penetration among commercial customers, many of whom were not being well served by incumbents. These customers, he says, appreciated BVU's proactive efforts to understand and satisfy their needs, especially when combined with the technical advantages of an all-fiber network. As Lane puts it, when comparing an all-fiber network to competitive copper-dependent alternatives "the sky's the limit" in terms of what types of services can be provided. He says the combination of fiber's capabilities and BVU's creative approach to the business market sometimes led to solutions that were not included in standard product offerings, but satisfied customers' needs—in some cases, needs these customer were initially not even aware they had.

One choice facing a muni-fiber project is whether to hire internal staff to handle core network design and construction tasks, or rely on outside engineering firms for this relatively high-level expertise. While BVU and JEA initially took the latter route, BT took the step of hiring the necessary staff in-house, which it says led to an estimated 30 percent cost savings over the length of the project.

Do You Need a Public Utility?

Since all of our case studies and most muni-fiber projects launched to date have been in communities with public utilities, a logical question to ask is whether a community without a public utility can launch a successful muni-fiber project.

JEA's Kersey expresses the view that, while muni-fiber makes good sense for communities with an existing public utility, it would be more of a challenge for those that do not. Among the advantages he cites for the former are: 1) easier access to conduit and poles for network construction; 2) trucks and staff that already handle plant operations and maintenance; 3) billing relationships and ongoing contact with existing customers and "first-contacts" with those moving to the area; 4) the ability to offer "one-stop shopping" that includes utility and telecom services and; 5) in most cases, a strong and positive brand that conveys reliability, competence and service quality.

Nulty, however, is considerably more bullish on the muni-fiber prospects for communities without a public utility, and also less convinced that, on balance, the presence of an existing utility operation is a net benefit. Part of his rationale ties back to the points raised by him and other muni-fiber pioneers in the previous section of this report, which focused on the important differences between managing a competitive telecom operation and a public utility. To Nulty, these differences suggest that having an existing public utility could have more disadvantages than advantages for a community seeking to build an FTTH network.

As discussed more fully in the following section (pg. 98-9), Nulty hopes to test his theory by spearheading a multi-town FTTH project called East Central Vermont Community Fiber Network (ECFiberNet).

Nulty hopes the ECFiberNet project will pioneer a new variation on the successful muni-fiber models created so far. For example, unlike Burlington and our other muni-fiber case studies, none of the ECFiberNet communities have an existing public utility unit. In addition, many of them are quite small, with very low housing densities.

Given this, the ECFiberNet project has the potential to help the muni-fiber sector understand the extent to which municipal fiber projects can succeed: 1) without building on the foundation provided by an existing public utility; 2) in low-density rural areas and; 3) when undertaken by relatively large numbers of small communities. If it succeeds, it could have major implications for the still-large portions of the country that have remained underserved in terms of broadband availability and data rates.

Drawn by the opportunity to extend the muni-fiber model to small underserved communities in Vermont, Nulty left his position with BT in the fall of 2007 to head up ValleyFiber, a new fiber-focused unit of ValleyNet. The latter is a 501(c)(3) non-profit that brought local Internet access to parts of Vermont in the mid-90s and managed over 6,000 local dial-up customers before exiting the dial-up business in January 2006. It has also been an advocate for universal and effective Internet access in the state.

Among ValleyFiber's roles in the ECFiberNet project will be to design the regional network, draft the necessary legal documents, finance the initial organizational effort (legal fees, etc.), obtain financing for the project, secure the necessary state regulatory approvals, and then build and manage the network. Over time, the participating towns can decide whether to take over operations themselves, stay with ValleyNet, or choose another operator.

Aside from Nulty's experienced leadership, the ECFiberNet project has another advantage that could help it break new ground in the muni-fiber sector—Vermont's long history of local activism and citizen participation in local government. According to Nulty, roughly half of Vermont's citizens have held some public office, and the state has a monthly holiday dedicated to local town meetings and votes.

While a strong sense of local community and citizen activism cannot replace all the assets brought to bear by an existing public utility, it is likely to be very helpful in generating a sense that "this is YOUR network," a factor that our case studies have shown to be central to success. As Nulty and other muni-fiber pioneers have observed, having customers identify with and trust a muni-fiber operator provides a crucial marketing advantage that translates into strong take rates and customer loyalty which, in turn, are key ingredients to financial success.

Like Nulty, BVU's management team is moving to expand beyond their initial muni-fiber success to help other communities—including those without a public utility--follow in Bristol's footsteps. They are doing so through a new unit called BVU FOCUS, which was launched in April 2007.

FOCUS (Finding Opportunities for Communities in the United States) offers broadband consulting and management services to entities across the country that want to deploy telecommunications and information services to benefit their local communities.

FOCUS acquired its first customer in August 2007, a consortium of three towns in North Carolina that took ownership of an aging Internet and cable system with more than 15,500 customers. Only a small portion of the area served by the network is also served by a local public power company.

Among the important areas often not addressed sufficiently in a muni-fiber business plan, says BVU's Mark Lane, is the development of efficient operations, including procedures to add, move, change and disconnect various services. Having been through this learning curve as it built BVU's successful muni-fiber operation, he says, the FOCUS team can help other communities "avoid the potholes" by taking advantage of the lessons BVU has learned as a muni-fiber pioneer.

According to BVU's Rosenbalm, FOCUS' compensation in its North Carolina project is based largely on a per-unit flat fee and a per-unit variable fee. The idea is to compensate it for adding subscribers rather than hiring extra staff, whose costs FOCUS passes on to its clients with no markup. This approach, he says, provides a win-win working relationship, and is likely to enhance client communities' trust that FOCUS' goals are aligned with their own.

By helping communities—including those without public utilities—move up the technology, operational and marketing learning curves, FOCUS and ValleyNet can help create a new generation of successful muni-fiber projects.

This prospect highlights the importance of the first wave of muni-fiber successes as a source of models, expertise and resources that can help a much larger number of communities—including some without public utilities--follow in their footsteps. Combined with ongoing and fairly dramatic improvements in the cost/value proposition offered by FTTH technology, this suggests that future generations of muni-fiber projects will not only be more numerous, but will also have an even easier time achieving financial success.

Other resources that can help in this regard include the Fiber to the Home Council (<http://www.ftthcouncil.org/>) and the United States Connected Communities Association (<http://www.us-cca.org/>). The FTTH Council is a non-profit organization established to help its members with planning, marketing, implementing and managing FTTH solutions, while US-CCA's main focus is to help communities understand and manage their

communications future by providing a foundation for standards development, education awareness, non-partisan political advocacy, and systematic approaches to applying communications and broadband networking goals.

Other potentially helpful organizations include the American Public Power Association (APPA, <http://appanet.org/>) and the Utilities Telecom Council (UTC, <http://utc.org/>), though their memberships and activities are focused mainly on utilities.

Can it Work in Rural Areas?

As noted in the previous section, Tim Nulty, who ran Burlington's successful muni-fiber project until last fall, is heading a project called ECFiberNet that aims to bring FTTH to nearly two dozen Vermont towns.

Ranked 49th in population and 45th in total area, Vermont is among the most rural states in the nation, comprised of more than 300 small towns and cities. As noted in our Burlington case study, that city is Vermont's largest, with a population of only 38,000.

Towns involved in the ECFiberNet project range in size from Montpelier, the state capital, with a population of 8,000, to small rural towns with populations well below 1,000 and housing densities of just 5-6 homes per plant mile. Overall, the average housing density for participating towns is roughly 14-15 homes per mile.

Though it remains too early to gauge whether ECFiberNet will succeed, its ambitious approach to bringing high-capacity broadband to small rural towns, plus the fact that it is headed up by Nulty, a successful muni-fiber pioneer and telecom entrepreneur, makes it noteworthy. So does the fact that Oppenheimer & Co. has agreed to raise roughly \$90 million in a public offering to fund a capital lease for the project, and to undertake the financing project on a contingency basis.

To the extent it does succeed, ECFiberNet has the potential to create a model for the large number of American communities in relatively rural areas that are very unlikely to attract fiber-upgrade investments from incumbent service providers.

As of June 2008, 23 Vermont towns had signed InterLocal Contracts to participate in the ECFiberNet project. Parallel to the process of town approvals has been exploration of funding options, with the focus being the capital lease route taken by Burlington. Given the recent turmoil in financial markets, Nulty expects an ECFiberNet financing deal to be tougher and slower to consummate than it would have been a few years ago, perhaps taking as long as a year.

Vermont's long history of local activism could help feed the sense that "this is YOUR network" that our case studies have shown to be a key factor for success. Another factor likely to help ECFiberNet's take rates and revenue is that roughly half the population in its targeted communities had no broadband service as of early 2008, and were paying relatively high rates for voice, video and dial-up Internet service.

As of April 2008, the ECFiberNet project was being managed by a Steering committee that included Nulty and two other representatives from ValleyNet, plus the chairs of four committees: Legal, Finance, Community Outreach and Select Board Liaison.

The ECFiberNet plan calls for town Select boards to nominate representatives to a newly formed “joint municipal” legal entity that will arrange the financing. Participating towns will cosign for a portion of the lease based on their relative population, and will share in profits in proportion to the number of subscribers in their area. The joint municipal entity will contract with a “build, operate, transfer” company, which initially will be ValleyFiber.

Nulty expects the ECFiberNet buildout to require funds in the range of \$3,200-\$3,400 per home passed, which includes construction costs as well as five years of operating costs to get to the point of generating positive cash flow. It also includes the cost of the centralized equipment that will be needed to deliver video, voice and Internet service. By sharing these costs among multiple communities, the per-home cost of this equipment will be a lot less than it would be if only one or a handful of small towns undertook this kind of project.

Based on his own experience and input from an engineering firm that has built other muni-fiber projects and expressed an interest in doing the same for ECFiberNet, Nulty estimates that the per-home cost to connect a customer will be roughly \$200 higher in rural areas than in more urban areas like Burlington.

The cost premium to pass a home will be a more significant factor, says Nulty, due to the much greater distances between homes in rural areas. Part of this distance-based cost premium will be offset by the more intensive use of aerial plant, which costs substantially less per mile than underground plant, which is more common in urban and suburban areas. Nevertheless, Nulty expects ECFiberNet’s cost per passing to be \$850 more than the average cost in a city like Burlington.

Offsetting this cost disadvantage, says Nulty, will be increased revenues from higher take rates and ARPU levels. These will be attainable, he says, because the project’s target communities generally lack attractive competitive options. Based on early pre-subscription rates and a survey in the ECFiberNet target area, Nulty believes a 50 percent take rate and a \$110 ARPU level are achievable, if not conservative.

The survey, he says, showed that households in ECFiberNet’s target area pay an average of \$132 per month for voice, video and Internet service, including \$20 for dial-up Internet access. He also notes that the ECFiberNet project team has already informed area residents that monthly rates will be \$10-\$15 higher than those charged by BT and they have responded positively.

Given that the \$110 target ARPU is \$22 (17 percent) lower than what they’re currently paying, and their Internet access will go from dial-up to fiber-grade speeds, Nulty expects residents in the targeted town to enthusiastically embrace ECFiberNet’s offering. To put the projected \$110 ARPU in context, it’s worth considering that the comparable figure for Verizon’s FiOS service—which is also delivered on a FTTH network—was more than \$130/mo. during the second quarter of 2008.

Fiber-Friendly Building Standards

The city of Loma Linda, a fast growing city in California, has been a leader in developing FTTH-friendly building standards. As the value and increasingly favorable economics of municipal fiber become more widely understood, such standards could prove useful to communities that want to bring the benefits of fiber to their citizens.

In 2003, following discussions of "smart home" and Internet capabilities in new developments, the Loma Linda City Council adopted a set of standard specifications that became known as the "Loma Linda Connected Community Program" (LLCCP) standard. According to the city's web site:

“The Loma Linda Standard” was brought about as a public-private partnership between the City of Loma Linda, California, its citizens, and real estate developers to foster standardized, high-quality communications assets for both new construction, and existing homes and businesses. These standards were built to ensure a long investment life, using referential standards that provide one of the fastest and most resilient communications infrastructures in the nation.

To achieve this high common denominator, the Loma Linda City Council in conjunction with builders and city IT executives, designed a modular high-speed fiber optic design around the city using numerous redundant rings...and wireless communications coverage areas....

The City Council also promulgated connectivity standards into the City’s building codes to ensure that each new residence or commercial building would be connected to this City fiber utility using a methodical approach and common structured wiring scheme. These additions to the Loma Linda Building Codes were the first in the United States to reference this high common denominator of data communications speed with referential integrity throughout... Each component cited in the Loma Linda Building Code is referential to common US industry standards.

The Loma Linda Standard mandates that new construction connect to the City’s fiber optic communications infrastructure. Other vendors and wiring plans can optionally be installed provided the building meets the minimum Codes. The Building Codes describe specific compatible communications components and architectures into each new building, describe development and use of City right-of-ways for communications connectivity, and standardizes specific wiring standards for structures. At the end of construction, each development has capital communications assets deployed in an easily understandable, highly usable configuration.¹⁴

Yes, Muni-Fiber Can Pay for Itself!

Just like any other big and important step in the life of an individual, a family or a community, the prospect of investing in a future-ready, community-wide network can create tension between desire for the benefits and fear of failure. In the case of municipal fiber, the fear usually relates to “can this thing really pay for itself, or are the incumbents right that it’ll end up draining our community’s coffers rather than insuring its economic health in the 21st century?” This is a question that needs to be addressed.

The good news, as suggested by our case studies, is that there is a growing body of evidence that muni-fiber projects can, in fact, pay for themselves, while also delivering numerous benefits to those communities willing to invest in them.

Our case studies also highlight some of the key strategies necessary to achieve financial success and some of the key metrics that contribute to it. In this chapter we dig into these a little more deeply, to help clarify their significance, their interactions, and how they might apply to different types of communities.

Taken together, our case studies provide clear evidence of the financial feasibility of muni-fiber projects. They also highlight some of the key strategies necessary to achieve financial success and some of the key metrics that contribute to it.

Key Success Factors

A common theme throughout our case studies has been the importance of providing retail rather than just wholesale services, and delivering high-quality customer service in a way that reinforces the sense among residents and businesses that “this is your network.” Both the comments and track record of successful muni-fiber pioneers underscore the importance of these factors in achieving the take-rates, per-subscriber revenues and customer loyalty necessary for financial success.

On the cost side of the equation, the primary factors at play are the average cost to pass a home or business and the average cost to connect it to the network and activate service. These costs can vary significantly, and are driven mainly by housing density and the mix of aerial and underground plant. The mix and timing of costs can also be impacted by how a particular project allocates specific pieces of equipment and labor costs to “passing” versus “connecting” a home, with these allocations dependent in part on a project’s deployment strategies.

The real-world variation in network construction costs can be seen among the pioneering projects reviewed in this report. For example, Reedsburg, whose network involved mainly underground plant, had relatively high average construction costs, which it financed at roughly \$3,160 per premise passed. In contrast, comparable costs for the Jackson FTTH network are only about \$2,000 per passing, with Burlington’s even lower. At the other extreme is the planned ECFiberNet project, which aims to serve relatively

rural areas in Vermont, and is expected to involve costs even higher than those financed in Reedsburg. While the main cost driver in Reedsburg was its use of underground plant, the key issue for ECFiberNet will be the low housing density in its service area.

Another key factor in the financial equation is the ongoing cost reductions (and performance improvements) in fiber optic network technology. As our case studies suggest, a muni-fiber project being launched today might be able to save as much as 40 percent on construction costs relative to what the sector's pioneers paid for earlier generations of technology. And it is reasonable to assume that equipment costs will continue to decline in the future.

Though construction costs are the major component of capital investment, muni-fiber projects must also finance operating expenses until they can be fully supported by operating cash flow. In general, the faster that paying customers are connected to the network, the faster operating expenses will be covered by revenue.

As noted in our case studies, this is one reason why providing retail services and good customer service are so important, since they expedite subscriber growth and therefore reduce the amount of operating expenses that must be supported via external financing.

The experience of muni-fiber pioneers also highlights legal challenges from incumbents as a factor that can cause delays in launching service. Because these delays extend the timeframe needed to reach positive cash flow, they tend to increase the amount of costs that need to be financed. Such challenges also add direct legal and related expenses to the cost equation. To the extent these challenges can be avoided or dealt with expeditiously, the ramp to positive cash flow is likely to occur faster.

Success Scenarios

To clarify the interaction of factors influencing a muni-fiber project's financial success, we've created a model that considers a range of scenarios based on variations in those factors likely to have the most financial impact. While every project will experience a somewhat unique mix of these factors, the goal of our model is to consider how they work together to impact a network's ability to reach the point of generating positive net income.

Our model considers variations in the capital cost of the project, including operating expenses until they can be covered by revenue. Based on our case studies and other research, we consider "per-passing" costs ranging from \$1,750 to \$3,500, in intervals of \$250.

As noted above, where a project would fit on this cost scale will depend in large part on housing density, the mix of aerial vs. underground plant, the generation of technology employed, the specifics of the deployment strategy, the success of marketing, as well as other factors. For example, we would expect networks with fairly high densities and a preponderance of aerial plant to fall toward the low end of the cost range. In contrast, projects undertaken in very low-density areas and/or those with a high percentage of underground plant could be expected to fall toward the high end of the range.

In addition to variations in network costs, we also consider multiple values for the following key performance metrics:

- 1) Subscriber penetration of premises passed by the network
- 2) Per-subscriber monthly revenue, or ARPU, as it is known in the industry
- 3) Operating cash flow margin
- 4) The rate of interest paid to finance the project
- 5) The time period for project financing

Positive Net Income

Our model calculates a monthly net income (or loss) per premise passed based on various combinations of these variables.

Net Income Table 1

	30%	40%	50%	60%	30%	40%	50%	60%
Penetration rate								
ARPU	\$ 100	\$ 100	\$ 100	\$ 100	\$ 115	\$ 115	\$ 115	\$ 115
Oper. cash flow margin	38%	38%	38%	38%	41%	41%	41%	41%
Interest rate	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%
Term of financing (yrs.)	20	20	20	20	20	20	20	20
Monthly Net Income Per Premise								
Capital cost per premise passed								
\$1,750	\$0.56	\$4.36	\$8.16	\$11.96	\$3.31	\$8.02	\$12.74	\$17.45
\$2,000	(\$0.98)	\$2.82	\$6.62	\$10.42	\$1.76	\$6.48	\$11.19	\$15.91
\$2,250	(\$2.53)	\$1.27	\$5.07	\$8.87	\$0.21	\$4.93	\$9.64	\$14.36
\$2,500	(\$4.08)	(\$0.28)	\$3.52	\$7.32	(\$1.34)	\$3.38	\$8.09	\$12.81
\$2,750	(\$5.63)	(\$1.83)	\$1.97	\$5.77	(\$2.88)	\$1.83	\$6.55	\$11.26
\$3,000	(\$7.18)	(\$3.38)	\$0.42	\$4.22	(\$4.43)	\$0.28	\$5.00	\$9.71
\$3,250	(\$8.73)	(\$4.93)	(\$1.13)	\$2.67	(\$5.98)	(\$1.27)	\$3.45	\$8.16
\$3,500	(\$10.27)	(\$6.47)	(\$2.67)	\$1.13	(\$7.53)	(\$2.81)	\$1.90	\$6.62

The table above is the first of four derived from our “muni-fiber net income” model. It considers variations in penetration, ARPU and operating margin under the assumption that a project is financed at an interest rate of 4.25 percent for a 20-year term.

The range of penetration rates we consider is 30 to 60 percent increasing in intervals of ten percentage points. In terms of ARPU and margin, we look at two combinations: \$100 and 38 percent, and \$115 and 41 percent. The former generates per-subscriber monthly operating cash flows of \$38.00, an amount that increases to \$47.15 under our second set of ARPU and margin assumptions. As our case studies have shown, ARPUs and margins in this range are achievable by muni-fiber projects, and are in the same general range as those reported by incumbent cable operators.

As the table shows, both pairs of ARPU and margin assumptions, when combined with 20-year financing at 4.25 percent interest, generate positive net income if a network is able to achieve 60 percent penetration, even if costs were as high as \$4,000 per passing. In this context, it's worth noting that some muni-fiber projects, including a few of our case studies, have already exceeded this impressive penetration threshold.

At 50 percent penetration, our more conservative ARPU and margin assumptions yield positive net income for costs up to \$3,000 per passing. If ARPU and margins are \$115 and 41 percent, net income is achievable at 50 percent penetration even when costs of more than \$3,500 must be financed for each premise passed by the network.

At 40 percent penetration, our more conservative assumptions generate net income at per-premise costs up to \$2,250, an amount that increases to \$3,000 under our more aggressive revenue and margin assumptions. At 30 percent penetration, these two "breakeven" cost thresholds are \$1,750 and \$2,250 per premise, respectively.

Net Income Table 2

Penetration rate	30%	40%	50%	60%	30%	40%	50%	60%
ARPU	\$ 100	\$ 100	\$ 100	\$ 100	\$ 115	\$ 115	\$ 115	\$ 115
Oper. cash flow margin	38%	38%	38%	38%	41%	41%	41%	41%
Interest rate	5.25%	5.25%	5.25%	5.25%	5.25%	5.25%	5.25%	5.25%
Term of financing (yrs.)	20	20	20	20	20	20	20	20

Capital cost per premise passed	Monthly Net Income Per Premise							
	30%	40%	50%	60%	30%	40%	50%	60%
\$1,750	(\$0.39)	\$3.41	\$7.21	\$11.01	\$2.35	\$7.07	\$11.78	\$16.50
\$2,000	(\$2.08)	\$1.72	\$5.52	\$9.32	\$0.67	\$5.38	\$10.10	\$14.81
\$2,250	(\$3.76)	\$0.04	\$3.84	\$7.64	(\$1.02)	\$3.70	\$8.41	\$13.13
\$2,500	(\$5.45)	(\$1.65)	\$2.15	\$5.95	(\$2.70)	\$2.01	\$6.73	\$11.44
\$2,750	(\$7.13)	(\$3.33)	\$0.47	\$4.27	(\$4.39)	\$0.33	\$5.04	\$9.76
\$3,000	(\$8.82)	(\$5.02)	(\$1.22)	\$2.58	(\$6.07)	(\$1.36)	\$3.36	\$8.07
\$3,250	(\$10.50)	(\$6.70)	(\$2.90)	\$0.90	(\$7.75)	(\$3.04)	\$1.68	\$6.39
\$3,500	(\$12.18)	(\$8.38)	(\$4.58)	(\$0.78)	(\$9.44)	(\$4.72)	(\$0.01)	\$4.71

Our second table (see above) includes one change from the assumptions reflected in the first table: it increases the rate of interest a full percentage point to 5.25 percent.

While this increase in interest expense still allows a project reaching 60 percent penetration to generate positive net income even with costs as high as \$4,000 per passing, the “breakeven” cost threshold for most of the other scenarios declines by one \$250 step in our per-passing cost scale. This includes our most conservative scenario (30 percent penetration, \$100 ARPU and 38 percent margin), which experiences a net loss even if the project cost to be financed is as low as \$1,750 per premise.

Net Income Table 3

Penetration rate	30%	40%	50%	60%	30%	40%	50%	60%
ARPU	\$ 100	\$ 100	\$ 100	\$ 100	\$ 115	\$ 115	\$ 115	\$ 115
Oper. cash flow margin	38%	38%	38%	38%	41%	41%	41%	41%
Interest rate	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%
Term of financing (yrs.)	25	25	25	25	25	25	25	25

Capital cost per premise passed	Monthly Net Income Per Premise							
	30%	40%	50%	60%	30%	40%	50%	60%
\$1,750	\$1.92	\$5.72	\$9.52	\$13.32	\$4.66	\$9.38	\$14.09	\$18.81
\$2,000	\$0.57	\$4.37	\$8.17	\$11.97	\$3.31	\$8.03	\$12.74	\$17.46
\$2,250	(\$0.79)	\$3.01	\$6.81	\$10.61	\$1.96	\$6.67	\$11.39	\$16.10
\$2,500	(\$2.14)	\$1.66	\$5.46	\$9.26	\$0.60	\$5.32	\$10.03	\$14.75
\$2,750	(\$3.50)	\$0.30	\$4.10	\$7.90	(\$0.75)	\$3.96	\$8.68	\$13.39
\$3,000	(\$4.85)	(\$1.05)	\$2.75	\$6.55	(\$2.11)	\$2.61	\$7.32	\$12.04
\$3,250	(\$6.21)	(\$2.41)	\$1.39	\$5.19	(\$3.46)	\$1.25	\$5.97	\$10.68
\$3,500	(\$7.56)	(\$3.76)	\$0.04	\$3.84	(\$4.82)	(\$0.10)	\$4.61	\$9.33

Our third and fourth tables are the same as our first two, except that they extend the financing term for 25 years, which reduces the monthly amount of principle that would need to be supported by operating cash flow. As expected, this change increases the maximum per-passing cost-thresholds under which a project could generate positive net income, usually by one or two \$250 steps.

For example, a project financed at 4.25 percent over 25 years that had 40 percent penetration, a \$100 ARPU and a 38 percent margin would generate positive net income even if it cost \$2,750 per passing, compared to a cutoff in the \$2,250-\$2,500 range if it was financed over 20 years.

Net Income Table 4

Penetration rate	30%	40%	50%	60%	30%	40%	50%	60%
ARPU	\$ 100	\$ 100	\$ 100	\$ 100	\$ 115	\$ 115	\$ 115	\$ 115
Oper. cash flow margin	38%	38%	38%	38%	41%	41%	41%	41%
Interest rate	5.25%	5.25%	5.25%	5.25%	5.25%	5.25%	5.25%	5.25%
Term of financing (yrs.)	25	25	25	25	25	25	25	25
Monthly Net Income Per Premise								
Capital cost per premise passed								
\$1,750	\$0.91	\$4.71	\$8.51	\$12.31	\$3.66	\$8.37	\$13.09	\$17.80
\$2,000	(\$0.58)	\$3.22	\$7.02	\$10.82	\$2.16	\$6.88	\$11.59	\$16.31
\$2,250	(\$2.08)	\$1.72	\$5.52	\$9.32	\$0.66	\$5.38	\$10.09	\$14.81
\$2,500	(\$3.58)	\$0.22	\$4.02	\$7.82	(\$0.84)	\$3.88	\$8.59	\$13.31
\$2,750	(\$5.08)	(\$1.28)	\$2.52	\$6.32	(\$2.33)	\$2.38	\$7.10	\$11.81
\$3,000	(\$6.58)	(\$2.78)	\$1.02	\$4.82	(\$3.83)	\$0.88	\$5.60	\$10.31
\$3,250	(\$8.08)	(\$4.28)	(\$0.48)	\$3.32	(\$5.33)	(\$0.62)	\$4.10	\$8.81
\$3,500	(\$9.57)	(\$5.77)	(\$1.97)	\$1.83	(\$6.83)	(\$2.11)	\$2.60	\$7.32

And, even at 5.25 percent interest, a 25-year financing term would allow a project under our most conservative operating scenario (30 percent penetration, \$100 ARPU and 38 percent margin) to generate positive net income if its network costs were at the low end of our range.

Though the above tables obviously do not cover every possible combination of these six key financial metrics, they hopefully provide a sense of how these metrics can interact to determine a project’s financial success.

Since our case studies demonstrate that the range of assumptions reflected in these tables is achievable, our analysis leads to the conclusion that well-managed muni-fiber projects based on key lessons and strategies gleaned from early pioneers can, in fact, be financially self-supporting, and can generate net income that can be fed back into their local community.

And, as our case studies have also shown, muni-fiber networks can achieve this financial success while: 1) providing a community’s residents, businesses, schools, healthcare sector and government agencies with new and valuable services that leverage the power of fiber optics; and 2) delivering this improved level of service at lower prices than these end-users would otherwise be paying incumbent providers for a lower grade of service. These public benefits are considered further in the following chapter.

Benefits to Your Community

Based on the evidence and analysis contained in earlier chapters, it seems clear that well-managed muni-fiber projects can be financially self-sustaining and even generate surpluses that can be reinvested in the community. In the following two chapters, we consider a range of additional benefits such projects can provide beyond this important but limited measure of success.

Such benefits include direct cost savings and improved services delivered to and by government agencies, schools, public utilities, the healthcare sector, local businesses and residents. They also include less direct and less easy-to-measure benefits. Among these are increased economic growth and competitiveness, reduced traffic congestion and pollution and, most fundamentally, providing a core infrastructure to support enhanced quality of life in the 21st century.

Lower Rates and Consumer Savings

One significant economic benefit of municipal fiber is the money saved by local homes and businesses when a muni-fiber network enters the market with lower rates than those offered by incumbents.

Though these savings are often ignored or downplayed by critics of muni-broadband, they represent real economic benefits. As John Kelly, Director of Economics and Research at the American Public Power Association (APPA), noted in a 2005 study entitled *Paying the Bills, Measuring the Savings* and sponsored, "consumer savings from lower rates are an essential part of financial and economic analysis of municipal cable enterprises [and] are analogous to the profits of private enterprises."¹⁵

For example, Jackson Energy Authority has estimated that residents of Jackson, TN have enjoyed savings of nearly \$8 million over four years thanks to lower rates (both from JEA and incumbents responding to its lower prices), compared to those charged in nearby communities.

Similar results have been reported by other municipal network projects. In 2005, James Krieg, general manager of Cedar Falls Utilities', which operates an earlier-generation municipal network based on an HFC architecture, estimated that Cedar Falls residents were saving roughly \$2 million per year because the utility's combination of video and broadband service costs only \$69.50/mo. compared to the statewide average of \$89.81.¹⁶

This monthly savings is comparable to that cited by Wes Rosenbalm, president and CEO of Bristol Virginia Utilities. Rosenbalm estimates that the average customer subscribing to service from BVU's OptiNet service saves about \$20 a month compared to what they'd be paying for service from an incumbent provider.

Similarly, an April 2005 study by Free Press, a media reform group, estimated \$266 in annual per-home savings in Glasgow, KY, where the public utility was selling a 70 channel cable package for \$18.95/mo. The Free Press study cited also estimates by Tacoma Power, which operates an HFC network in Tacoma, WA, that in the cities where its Click! Network services are available, prices for cable TV and high-speed Internet are 20-25 percent lower than areas where competition does not exist. The study also pointed to a fiber network in Ashland, OR, as an example of consumer savings "similar in magnitude to that realized in Glasgow." In areas within the Ashland Fiber Network footprint, the study said, Charter, the incumbent cable operator, had dropped its rate to \$24/mo., a little more than half the \$46/mo. it was charging in areas where customers did not have access to the Ashland fiber network.¹⁷

If we assume, based on these examples, that the average savings per customer is \$20 per month, then each household subscribing to a muni-fiber network would save \$240 per year. If a project is financed over 20 years, the total per-customer savings over the term of the financing would be a whopping \$4,800. At an interest rate of 5 percent (roughly what a muni-project financing might cost), these savings amount to \$3,030 on a present-value basis. If the muni-fiber network achieved 50 percent penetration, this would be more than \$1,500 per premise passed. If we include rate reductions by incumbents responding to the muni-net's lower prices, this per-premise saving would be even higher.

This suggests that, if customer savings are included in the economic evaluation of a muni-fiber project, these savings have the potential to justify a substantial portion of the project's total cost.

Impacts on Local Business & Economy

In this section of the report, we review key findings from research designed to measure the impacts of municipal fiber on local businesses and, more broadly, on a community's economic growth.

Business Impacts in Bristol, Jackson and Reedsburg

We begin with research measuring muni-fiber's impact on local businesses in three of our four case study communities: Bristol, Jackson and Reedsburg. The research was sponsored by the FTTH Council and conducted in April and May of 2007 by Strategic Networks Group (SNG), a Canadian research and consulting firm focused on helping communities understand and leverage the value of information and communication technology.¹⁸

The surveys were designed to collect information on uses of these three cities' muni-fiber networks by local businesses and organizations, and the impacts this use had on their sales, costs, employment and capital expenditures.

The most commonly cited uses of the fiber networks were research, document transfer and purchasing. Also cited were new opportunities for increased online sales. The survey found that the use of telecommuting was a function of business type, job function and local environment.

According to SNG, fiber’s speed and bandwidth were widely cited as benefits by the surveyed businesses, with many also noting the increased reliability of fiber compared to their prior forms of connectivity. Respondents also cited pricing and customer service as benefits of switching over to the uni-fiber network. Overall, the most commonly perceived benefits were to make operations easier, increased efficiency and saving time.

Among the industries reporting the largest impacts were manufacturing; retail; professional and technical services; arts, entertainment and recreation; tourism, hospitality and food services; and agriculture.

In all three communities, 58-60 percent of businesses responding to the survey cited cost savings as an important benefit of having access to a fiber network. In Bristol and Jackson, 69 percent of respondents said they had adopted new processes as a result of using the FTTH network, while this benefit was cited by half the businesses interviewed in Reedsburg.

Percent of Businesses Citing Benefits of Fiber Network

	<u>Bristol</u>	<u>Jackson</u>	<u>Reedsburg</u>
Cost savings	60%	58%	60%
Adopted new processes	69%	69%	50%
Reach new customers	68%	73%	44%
Increase Sales	60%	50%	46%

Source: Strategic Networks Group

Marketing and sales benefits were also cited by substantial percentages of businesses. The ability to reach new customers improved for 68, 73 and 44 percent of businesses in Bristol, Jackson and Reedsburg, respectively, while the comparable percentages reporting increased sales were 60, 50 and 46 percent.

In terms of dollar benefits of fiber 30 (22 percent) of 169 organizations surveyed in Bristol reported an average annual sales increase of \$21,017, while 4 (19 percent) of 21 businesses in Jackson reported an annual sales gain averaging \$17,905 per organization. In Reedsburg, 7 (17 percent) of 41 businesses reported an average sales increase of \$8,659 per year.

In terms of fiber-enabled cost savings, 120 businesses in Bristol reported an average of \$2,951 in savings per year, while, in Reedsburg, 33 cited annual cost savings averaging \$20,682. Twenty Jackson businesses reported cost impacts due to fiber, with one large organization reporting a total of \$3 million in savings. The other 19 Jackson respondents reported a net average cost increase of \$3,150 per organization.

Sales, Cost and Employment Impacts

	<u>Bristol</u>	<u>Jackson</u>	<u>Reedsburg</u>
Annual sales increase	\$ 21,017	\$ 17,905	\$ 8,659
Annual cost savings	\$ 2,951	na*	\$ 20,642
Employment increase**	10.1%	7.3%	19.8%

* one organization saved \$3 mil./yr, the remainder reported an average cost increase of \$3,150

** among businesses with increased sales from fiber

Source: *Strategic Networks Group*

Among the businesses reporting increased sales from fiber, the net increase in employment was 10.1 percent in Bristol, 7.3 percent in Jackson and 19.8 percent in Reedsburg.

According to SNG, a simple extrapolation of the survey's results to all organizations using the three cities' muni-fiber networks would result in an annual direct increase in sales of \$19.4 million in Bristol, \$3.3 million in Jackson and \$1.85 million in Reedsburg. Using the same approach, total net cost savings would be \$2.7 million in Bristol and \$4.4 million in Reedsburg.

SNG President and Founder Michael Curri says that, while fiber's speed and bandwidth were widely cited as benefits by the surveyed businesses, it was the networks' reliability that allowed businesses to "transform their business models and operations" in ways that were heavily dependent on Internet connectivity. He explains that "[s]uch transformations of customer order systems, financial systems, etc... would only be undertaken once users have full confidence that Internet connectivity is at a 'mission critical' level of reliability (i.e., no downtime)."

In addition to its capacity advantages, fiber optics also is more reliable than other means of transmission. The optical fiber itself can last for upwards of 20 years and the fact that optical networks can transmit much greater distances without repeaters means less active devices that can go wrong. Add to this its immunity from interference and you have an extremely reliable high-capacity network.

Not surprisingly, the greatest gains were reported by companies moving up to fiber from dial-up access, though SNG also reported significant gains from those transitioning from other forms of broadband access.

The survey also found that fiber's benefits take time to materialize in terms of operations, with the majority of sales, cost and employment impacts occurring after 2-3 years of using the fiber network. This was a reflection of the time it took for new technologies and business operations to be fully learned and adopted.

Sales Increases and Cost Savings Per Employee

	<u>FTTH</u> <u>< 2 yrs.</u>	<u>FTTH</u> <u>> 2 yrs.</u>
Sales increase per employee		
<i>Previously dial-up</i>	\$1,301	\$1,500
<i>Previously broadband</i>	\$111	\$555
Cost savings per employee		
<i>Previously dial-up</i>	\$377	\$701
<i>Previously broadband</i>	\$77	\$119

Source: Strategic Networks Group

As the table above shows, the average sales increase and cost savings per employee across the three cities was higher for companies transitioning from dial-up and for those that had been using the fiber network for more than two years.

Boosting a Community’s Economic Growth

In a presentation entitled “The Transformation Effects of FTTP” (Fiber to the Premise), Curri cited “economic multiplier effects” (increases in GDP, jobs, tax revenues) that greatly amplify the economic impacts of the kind of direct benefits discussed above. **SNG’s research, he says, indicates that there are “significant increases in local economic activity attributable to broadband,” with the increase in local GDP being “more than ten-fold the value of the investments in broadband infrastructure.”**

SNG’s findings regarding the “economic multiplier effects” of broadband have important implications for our nation’s communities, particularly those in which a significant percentage of homes and businesses lack access to affordable broadband services.

Not only can such networks generate net income while providing substantial direct benefits to their users, they also promise to spur local economic growth and other indirect benefits that greatly amplify their direct return on investment.

In an earlier study, SNG analyzed the impacts of a municipal fiber network in South Dundas, Ontario. This study found that a \$750,000 investment in the fiber network resulted in \$25.2 million in increased sales, 207 person years of employment and \$8.0 million in increased tax revenues.¹⁹ SNG also studied the economic impact of municipal broadband investments in other Canadian communities. In one of these it found that a \$2 million investment in broadband applications yielded a \$28.6 million increase in local GDP, 928 person years of employment and \$8.2 million in additional tax revenue.²⁰

Doris Kelley, Telecommunications Coordinator of the Iowa Association of Municipal Utilities also published an analysis of the economic impacts of a municipal broadband network. Her study was based on a comparison of two neighboring Iowa communities: Cedar Falls, which had invested in a municipal broadband network, and Waterloo, which did not.

Kelley indicated that prior to construction of its network, Cedar Falls, which was roughly half the size of Waterloo, was considered the weak-sister of the two from an economic perspective. But, once the network was in place, she found, Cedar Falls outperformed the larger city in terms higher land values, better business growth, lower taxes, and better healthcare facilities.²¹

In April 2005, George Ford, an economist with Applied Economic Studies, and Thomas Koutsky, a telecommunications attorney, published a study of economic growth in Lake County, FL, which in 2001 had deployed a fiber optic network linking hospitals, doctors offices, private businesses and 44 schools. The study used an econometric model to compare Lake County's economic growth with that of 10 similar Florida counties. The study concluded that Lake County experienced a 100 percent increase in economic growth relative to comparable Florida counties since launching services on its fiber network. The study also controlled for population growth, and found that the growth differential increased to 128 percent on a per capita basis.²²

Supporting Government and Schools

As our case studies make clear, muni-fiber networks can provide both improved service and reduced costs to local government agencies, schools and healthcare providers.

In Bristol, for example, a study has estimated the annual savings from linking government and school buildings via fiber at \$156,000. With connections operating at data rates as high as 100 Mbps to 1 Gbps, the Bristol fiber network has allowed schools to develop testing and other applications that could not be supported by the T-1 links on which they previously relied.

Burlington achieved roughly comparable savings. By switching its nearly 1,000 city lines from Verizon over to its fiber network, it saved 35 percent, or \$150,000 per year.

And in Jackson, local city and county government agencies are actively using JEA's fiber network for both internal and inter-agency communications. According to JEA's Kim Kersey, law enforcement is among the most active users of JEA's fiber network, using it to transfer records and integrating it with the police wireless network to improve response time.

In addition, says Kersey, every school in Jackson is now equipped with a 100 Mbps connection, used for both internal communications and Internet access. Not only are local schools getting more capacity than before, he says, but they're also saving money, since JEA's bid for the school network was several hundred thousand dollars less than competing bids from Charter and AT&T. Also planned for summer 2008, says Kersey, is the addition of video surveillance systems in schools.

Similarly, Reedsburg's muni-fiber network has allowed its schools to be connected with more bandwidth than they had access to before, and at a lower price. It provides 100 Mbps links between school buildings at a cost below \$500 per month. Before the network was available, they were paying \$650-\$750 a month for T-1 service, which delivers only 1.5 Mbps of capacity.

Utility Applications

As our case studies have shown, the use of fiber to support internal utility applications has often been the first step a community takes on the road to a full-blown FTTH network. And, as we also have seen, once these initial fiber links are in place, a broader demand for fiber connectivity makes itself known, as does the technical and financial feasibility of extending the network to every business and every home.

Among the most common utility applications are SCADA (Supervisory Control And Data Acquisition) systems for network management, as well as inter-office links. Others include video surveillance, which has benefits in terms of both security and maintenance.

Automatic meter reading (AMR) is another potential application for a muni-fiber network. Today, however, AMR only makes sense for some communities, due to the current cost of "networked" meters.

One such community is Clarksville, TN, where the Clarksville Department of Electricity (CDE) began offering service on its FTTH network in early 2008 and expects to have its entire footprint built out by the first half of 2009. The key reason AMR makes economic sense today for Clarksville is its high proportion of military households and college students. Since both of these population groups move relatively often, the cost to connect and disconnect service and read meters in Clarksville is notably high.

According to Christy Batts, Telecommunications Marketing Manager at CDE Lightband, CDE averages more than 130,000 truck rolls each year to connect, disconnect or read the more than 54,000 meters it operates. With those truck rolls costing an average of \$30 each, Batts says this operational cost was becoming more difficult to manage and control as the community continued to grow. She says CDE expects remote reading, connection and disconnection through the fiber connection will eliminate over 90 percent of these truck rolls, saving CDE more than \$3 million annually. That's roughly \$56 in annual savings per meter, which is enough to finance the cost of a networked meter and make a contribution to the cost of the FTTH network.

JEA is also expected to begin rolling out AMR sometime in the near future. The key issue that's delayed this deployment, says Kersey, has been the lack until recently of commercial "networked smart meters" able to handle not only gas and electricity, but also water. As he explains, water meters are typically at a different location than gas and electric meters, and therefore require some sort of wireless relay.

In Bristol and Reedsburg, the economics of networked AMR have yet to reach the point where they are attractive. For example, Reedsburg's David Mikonowicz explains that RUC currently employs one full-time meter reader for the entire city, at a fully-loaded cost of \$50,000-\$55,000. He says the existing meters RUC uses cost \$30-\$35, compared to a current price of \$255 for networked units. At the latter price, the equipment cost to replace the city's roughly 4,400 meters would be roughly \$1.1 million.

Mikonowicz says RUC is working with vendors to reduce the cost of networked meters. Should these costs fall below \$100, he says, RUC would probably begin deploying them in areas of new home construction.

Though the current economics of networked meter reading are not attractive to RUC, Mikonowicz says it's reasonable to expect that, over the next 3-5 years, the utility may begin using its FTTH network for higher-value applications such as time of use (TOU) pricing and demand-side management (DSM).

Noting that the cost of power in Wisconsin has gone up roughly 30 percent in the past five years, Mikonowicz says part of the fees paid by industrial energy users already reflect a premium designed to reduce peak-demand levels. He expects state regulators to expand this type of pricing over the next five years, as energy costs continue to rise which, in turn, increases the value of reducing peak demand. Increasingly, this value is measured not only by direct savings, but also by reduced pollution, risk and greenhouse gas emissions. Given these utility industry trends, Mikonowicz sees real potential in the future for TOU pricing and DSM applications delivered on Reedsburg's FTTH network.

JEA's Kersey also sees a future in which TOU pricing and DSM will make more and more sense for communities like Jackson. He notes that TVA, JEA's supplier of electric power, has already begun moving in the direction of TOU pricing.

According to Billy Ray, Superintendent of the Glasgow Electric Plant Board in Glasgow, KY—which also gets its power from TVA—the regional power supplier plans to spend more than \$18 billion over the next ten years to add generating capacity. Ray argues that the money could be better spent on advanced fiber networks that enable peak demand reductions that have the potential to eliminate the need for additional power generation. And it turns out, he says, that TVA's planned spending of \$18 billion is roughly equal to the cost of deploying an FTTH network to virtually all of the roughly 9 million homes in TVA's service area.

Ray, who spearheaded Glasgow's pioneering HFC network deployment years ago, and is currently exploring plans for an upgrade to FTTH, laid out his vision in a March 25, 2008 blog post on his "Red, Blue & Green" web site:

If TVA had an unlimited capacity data connection to every home, they could use that connection to control thermostats on heating, air conditioning, water heating, freezers, refrigerators, washing machines, clothes dryers, dishwashers, etc. That sort of control would easily allow them to shave one, probably two,

likely even three to four kilowatts of demand off of their peak demand. So, spending that money on broadband networks for every home and business in the Tennessee Valley region would likely double or triple the capacity improvement they are looking to get through building new nuclear plants,... [allowing them to also] shut down a filthy coal unit or two instead!

There is no more earth friendly way to add capacity to an electric system than by acting to reduce demand...At the same time, everyone would get an advanced broadband connection with infinite capacity and speed for free!²³

Increased Home Values

Another potential benefit of a municipal fiber network is that it can increase the home values in a community.

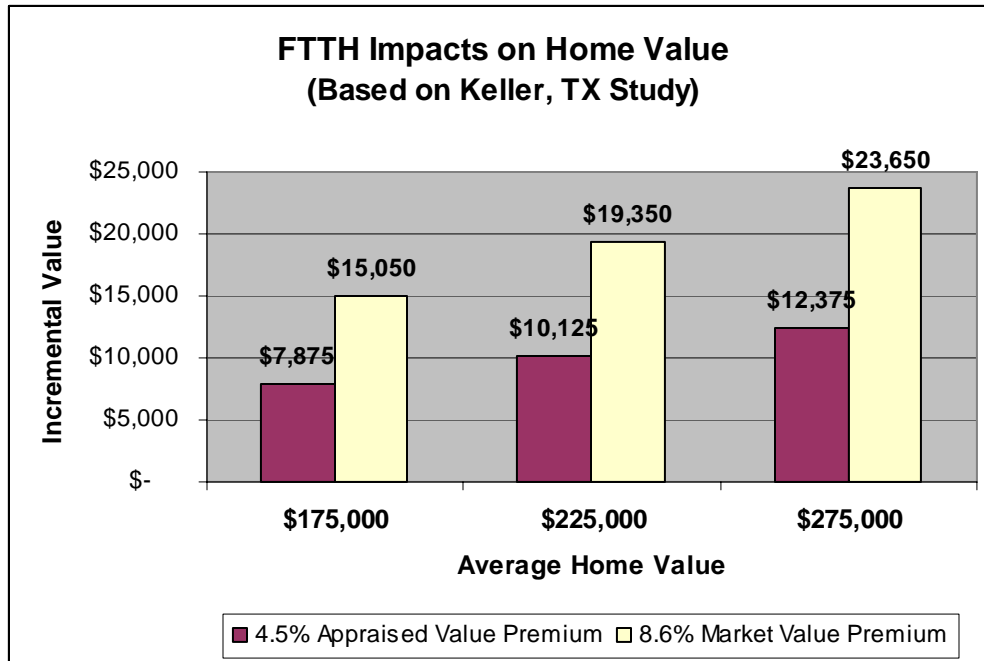
According to Michael Render, president of RVA LLC, a market research firm focused on the FTTH sector, surveys conducted over the past three years indicate that “those familiar with FTTH say they would spend 0.5 percent to 1.1 percent for a fiber-connected home if the choice came down to two similar homes, one with fiber and one without.” Based on the home values of those surveyed, says Render, this translates into \$2,000-\$4,600 per home.²⁴

According to an article in *TecHome Builder* magazine, developers have estimated that a fiber-connected residential lot will sell for a premium of \$5,500 to \$10,000 more than a lot without access to fiber.²⁵

A separate study suggests even greater gains in value when homes are connected via fiber optics. That study focused on Keller, TX, the first town in which Verizon deployed its FTTH network and also the first place Verizon introduced its FiOS video service. It considered the value of 50 homes with access to the FTTH network and another 50 that had access to only DSL. In selecting the homes to be included in the study, efforts were made to control for factors such as location, square footage, the number of bedrooms and bathrooms, etc.

The study found that:

- The average market price for homes with FTTH access was 8.6 percent higher than homes without FTTH access.
- The most recent appraised values of homes having FTTH access were 4.5 percent higher, on average, than homes without FTTH access.
- The homes with FTTH access all experienced increases in appraised value from 2005 to 2006, while none of the DSL homes increased during this same period of time.²⁶



Using the Keller study’s estimates of the percentage increase in value associated with fiber access, the table above estimates the dollar value of these increases across a range of home values.

For example, in an area with an average home value of \$175,000 (roughly the median sale price in the Midwest as of August 2008), the 4.5 percent appraised value increase suggested by the Keller study would be \$7,075, while the 8.6 percent increase in market price would be \$15,050.

If the average home value was \$225,000 (\$10,000 more than the August 2008 national median sale price), the study’s two measures of fiber’s incremental value would increase to \$10,125 and \$19,350, respectively.

If the average home value was \$275,000 (roughly the midpoint between the August 2008 median prices in the Northeast and West regions), the 4.5 percent increase in appraised value would jump to \$12,375, while the 8.6 percent increase in market price would be a whopping \$23,650.

While it is too early to know which of these various estimates is most accurate, it’s worth noting that even the most conservative of them puts the incremental value of fiber connections in at least the same range as the capital cost to build an FTTH network. And the more aggressive estimates reflected in the Keller, TX study suggest that, in some parts of the country, the increase in home values could be as much as 10 times the cost of deploying an FTTH network. It also seems reasonable to expect that, as the variety and value of fiber-delivered services increases over time, this incremental value could increase even further.

Other Potential Benefits

In previous chapters we've shown that muni-fiber systems can 1) pay for themselves through user fees and; 2) benefit consumers, local businesses, government agencies, schools, healthcare providers and utilities, by delivering both higher quality services and lower prices than are available from incumbent cable and telephone companies.

In this chapter we consider potential benefits of muni-fiber related to two areas in which the U.S. faces serious and mounting problems:

- 1) the cost of motor vehicle transportation, which has been on a steep upward trajectory, and includes indirect costs such as pollution, global warming and time-wasting traffic congestion;
- 2) the cost and quality of U.S. healthcare, which on a per capita basis is more than double that of any other nation in the world, and accounts for 16 percent of the country's total Gross Domestic Product, on course to reach 20 percent over the next decade.

Though it makes intuitive sense that fiber networks have potential to help alleviate these critical problem areas, there is relatively little hard evidence with which to develop reliable quantitative projections of these benefits. This is especially the case for the healthcare sector, where the development and deployment of "telehealth" (a.k.a., "telemedicine) applications face a range of challenges beyond questions of function and technology, including issues related to insurance and reimbursement, liability and licensing.

Nevertheless, as the discussion below indicates, fiber's potential to help address these problems appears promising enough to include in our discussion of muni-fiber's benefits.

The fact that these types of benefit are potentially very large but also quite uncertain makes their development especially well suited to municipal fiber networks. Part of the reason for this is that, unlike profit-seeking access providers, the public entities that operate muni-fiber networks are motivated to maximize the value provided to their community, even if some of that value cannot be recouped by them in the form of revenue. These types of "public" benefit are often referred to as a "positive externalities."

Both healthcare and oil-consuming transportation involve significant amounts of externalities. The former partly because health is a human need so basic and impacted by so many factors (including many that are not well understood) that it is difficult to maximize through a price-based market, and also because our nation's healthcare system is characterized by an indirect compensation system that has little direct connection to the quality of care, let alone the quality of health.

For its part, oil-consuming transportation is characterized by a number of negative externalities, including pollution, the public cost of road construction and maintenance, time wasted sitting in traffic jams, and the impact this lost time has on both businesses and the individuals stuck in traffic.

Though improving the efficiency and quality of healthcare and reducing automobile travel would clearly be beneficial, the fact that their benefits (and harms) fall largely in the category of externalities means that they are very difficult to maximize via market mechanisms.

In fact, it would be very difficult (if not illegal) for a shareholder-owned access provider to justify significant investments targeting positive externalities whose value it could not monetize to the benefit of its shareholders. In sharp contrast, such “public infrastructure” investments are among the central roles of government.

The other key reason why municipal fiber networks are a good platform for “externality rich” applications is that, as we have shown, these networks can pay for themselves through the delivery of commercial services. This means they can provide a state-of-the-art communication infrastructure for developing, testing and deploying beneficial “telecommuting” and “telehealth” applications with relatively low risk and incremental investment.

Given the large and mounting problems associated with our transportation and healthcare sectors, including the huge strains they place on our economy and quality of life, it would be a shame if we failed to explore and develop these applications because American communities lacked the necessary communication infrastructure operating with an “externality-friendly” business model. The good news, as we have shown, is that muni-fiber provides a way to develop that infrastructure in a self-financing manner and at minimal financial risk.

Potential Transportation Savings

With the cost of gasoline skyrocketing and traffic congestion a growing problem for more and more American cities, its worth considering the extent to which FTTH networks can help ease these transportation-related burdens.

In his 2006 book *America at the Internet Crossroads: Choosing the road to innovation, wealth, and a supercharged economy*, FTTH pioneer and muni-fiber advocate Mike Bookey considers this question.²⁷ He starts off by noting that fiber networks are uniquely well suited for symmetrical HD-quality video transmissions. This, in turn, allows them to support applications like HD-quality videoconferencing at penetration and usage levels that cannot be supported by the DSL and HFC networks operated by most cable and telephone companies.

To make his point about the value of such high-quality videoconferencing, Bookey quotes Microsoft CEO Steve Ballmer:

“If I want to know if a project’s on track, I have to look deeply into somebody’s eyes. When [videoconferencing] resolution is good enough that I can look into somebody’s eyes electronically, we won’t need more [motor vehicle] roads. But until that time, whether it’s our needs or the needs of many other businesses in this region, we’ve got to be able to get people around.”

According to Bookey:

A reasonable goal for the future is to get 30 percent of the workforce to telecommute an average of at least one day a week. This change would reduce commute trips in motor vehicles by close to 6 percent. That is significant when you consider it would measurably reduce traffic congestion during commute hours in many urban areas. According to a George Mason University study, for every 1 percent of the workforce that telecommutes in the Washington, DC region, there is a 3 percent reduction in traffic delays.

Bookey also considers potential impacts on shopping trips:

Online retailers that locate their electronic stores on a community’s [municipal fiber] network will be able to use high-resolution images [and], video... to sell their products and services. Given these new capabilities, we should expect that [municipal fiber networks] would further increase the attractiveness of electronic shopping and measurably reduce the number of motor vehicle trips to retail store sites.

According to Bookey, “[r]emote delivery of health care services to patients in their homes can also reduce the number of motor vehicle trips to doctor offices and other health care facilities.” In addition, he says, “two-way HD video communication using large-display monitors can replace some work-related motor vehicle trips, trips to visit friends and relatives, and other social and personal trips.”

While this will require significant changes in human and organizational behavior, the rising penetration of large-screen, flat-panel, high-definition video monitors, combined with the skyrocketing price of gasoline and jet fuel (both trends that are likely to continue) should help facilitate these changes. The latter will provide the financial “stick” that pushes businesses and consumers toward this change by relentlessly increasing the cost of travel. At the same time, the availability of relatively low-cost, high-resolution monitors, combined with fiber-grade broadband connectivity, can provide the functional “carrot” that enables two-way video communications to provide a viable alternative to travel.

"With all the possibilities of substituting electronic travel for physical travel," says Bookey, "it is reasonable to expect we can reduce the total number of motor vehicle trips by 10 percent."

Based on this assumption, Bookey attempts to quantify potential savings in the direct costs of operating motor vehicles, which he estimates at \$0.37 per mile. Using an estimate from the Federal Highway Administration (FHA) of approximately 2 trillion total miles driven annually by U.S. households, Bookey projects annual savings of \$74 billion, reflecting 200 billion "saved" miles at \$0.37 per mile. Factoring in a 2.5 percent annual increase in miles traveled, he estimates 10-year savings at \$829 billion.

Bookey's total savings estimate also considers the "social" cost of fuel use. This is estimated to be \$0.26 per gallon by the National Research Council, including costs related to pollution and America's dependence on foreign sources of oil. Including these costs adds another \$4.34 billion in annual savings, or \$48.6 billion over a ten year period.

It's worth noting that, if Bookey was estimating these direct and "social" costs of gasoline use based on today's prices and market conditions, the total savings would be substantially higher than they were in 2006, when *America at the Internet Crossroads* was published.

Bookey goes on to estimate the amount of personal time saved by avoiding 10 percent of the roughly 232 million car trips that, according to the FHA, American households made in 2001. Assuming that the average trip is 20 minutes, he calculates the total saved time at 7.7 billion hours, or 960 million eight-hour days of travel time a year.

Based on an average hourly wage of \$12.40, Bookey assumes that the time saved is worth half of that, or \$6.20/hour. The result is an annual savings of \$47 billion. Assuming a 2.5 percent annual increase in travel and no increase in the average wage, that comes to a 10-year savings of \$537 billion.

The final component of Bookey's travel-savings model is reduced road construction, which he believes would be the result not only of less car trips, but also of using a municipal fiber network to improve the efficiency of the public road system:

[Fiber optics] can link sensors and cameras imbedded in the motor vehicle road network to centralized computers for monitoring and controlling traffic... In the near term, we can improve the synchronization of traffic signals to speed the flow of vehicles through intersections and at freeway entrance and exit ramps. We can increase the number of cameras placed along the roadway and at intersections to quickly spot incidents like stalled vehicles and accidents. This capability would enable emergency services to clear accidents more rapidly, lessening the amount of slowed or congested traffic. The information gathered from these sensors and cameras can be instantly sent to drivers using... wireless transmitter/receivers. That information will give drivers the capability to make moment-to-moment decisions about the routes to take.

The use of [municipal fiber networks] and the application of computer intelligence to run the motor vehicle road network will slow the rate at which we add new road capacity. It will not fully remove the need to expand existing roadways and add new roads. But if we combine the efficiencies we gain from automating the running of the roadways and the new electronic travel options made possible by [fiber optics], we should be able to reduce the amount of new road capacity we would otherwise need to build by roughly 10 percent a year.

Citing FHA data that the U.S. as a whole spent \$64 billion to build new and expand existing state and locally administered highways and roads, Bookey estimates a 10 percent annual savings at \$6.4 billion. Assuming a 2.5 percent annual increase in road building expenses, this amounts to a 10-year saving of \$71.7 billion.

Potential Transportation Savings

Description	First Year	10-yr. Total*
Savings from fewer miles driven	\$74 billion	\$829 billion
Social savings from less gasoline consumption	\$4.34 billion	\$48.6 billion
Travel time savings	\$47 billion	\$537 billion
Road building savings	\$6.4 billion	\$71.7 billion
Total savings	\$127.7 billion	\$1.5 trillion

* Assumes 2.5% annual increase

Source: "America at the Internet Crossroads," by Michael Bookey

Including these various elements of transportation-related cost savings, Bookey's analysis yields \$1.5 trillion in total savings over a ten year period.

Potential Healthcare Savings

In 2007, healthcare expenses were estimated to account for roughly 16 percent of the entire U.S. gross domestic product (GDP), a percentage expected to rise to 20 percent over the next decade. Given the magnitude and growth rate of these expenses, and the massive inefficiencies in today's healthcare system, a question worth considering is whether fiber optic networks can help reduce healthcare costs.

Though developments in this area within our case study communities remain limited in scope and early in their development, there are preliminary signs that such savings are real and could be substantial.

Reedsburg, for example, reports that its FTTH network has reduced the cost and improved the accessibility and user-friendliness of sharing large documents, X-rays and other bandwidth hungry applications among the city's hospitals, clinics and doctor's offices and homes.

And in Virginia, BVU is part of an effort to create a statewide medical network that links hospitals, outpatient clinics and other facilities in various communities around the state.

In Vermont, Burlington Telecom has held discussions with local hospitals and faculty members at the University of Vermont about using its muni-fiber network to support innovative “telemedicine” projects. According to Tim Nulty, BT’s former director, there had not been sufficient network capacity available to support these projects until BT built its FTTH network.

In his book, Bookey takes an initial stab at estimating fiber’s potential impact on one very costly segment of healthcare expenses, care for the chronically ill. Though the latter account for a very small percentage of the population, their care generates a substantial share of total healthcare expenses.

Linking homes to medical facilities via high-capacity fiber links, says Bookey, would enable “[t]he use of home-based health monitoring stations, coupled with the ability of patients and health care workers to talk with one another over two-way HD video links.” These capabilities, he says, would lead to improved disease management for the chronically ill. In addition to improved quality of care, he says, there would be substantial savings in the cost of that care. These savings, he says, would be the result of “[reduced] response time needed to address patient health problems” as well as fewer visits to doctor offices, hospitals, and emergency rooms.

Bookey goes on to provide a rough estimate of these potential savings. He starts by noting that the country's 2003 health care expenses totaled \$1.5 trillion and is projected to rise to \$3.3 trillion by 2013.

To estimate the scope of potential savings, Bookey cites a 2001 study by Criterion Economics published by the Brookings Institute, entitled *The \$500 Billion Opportunity: The Potential Economic Benefit of Widespread Diffusion of Broadband Internet Access*.²⁸ The study estimated that chronically-ill patients represent just 1 percent of the U.S. population, but account for one-third of total healthcare costs. That amounts to \$500 billion in 2003 and more than \$1 trillion per year in ten years, assuming a 9 percent annual increase in healthcare expenses.

Potential Healthcare Savings

Description	First Year*	10-yr. Total**
U.S. healthcare expense	\$1.5 trillion	\$22.8 trillion
Expense for chronically ill	\$500 billion	\$7 .6 bil.
Savings from remote monitoring of chronically ill	\$175 billion	\$2.7 trillion

* Based on 2003 costs

** Assumes 9% annual increase in healthcare expenses

Source: "America at the Internet Crossroads," by Michael Bookey

Bookey cites estimates in the Criterion Economics study indicating that the costs of providing healthcare to chronically ill patients can be reduced by 35 percent to 40 percent if they are monitored remotely in their homes. Using the 35 percent figure, he estimates potential annual savings of \$175 billion using 2003 costs, and ten-year savings of \$2.7 trillion.

Since they assume that all chronically ill patients would be monitored remotely in their homes, Bookey's estimates represent a high-end of possible savings from such monitoring. But even if only one-tenth of this potential was realized, the 20-year savings would be roughly \$540 billion, more than enough to finance the cost of extending FTTH networks to the vast majority of American home and business.

Whereas Bookey attempts to model the potential benefits associated with home monitoring of the chronically ill, a recent study conducted by the University of Texas Medical Branch (UTMB) and the Center for Information Technology Leadership (CITL) focused on a different aspect of healthcare.

Published in May 2008 and entitled "The Telehealth Promise: Better Health Care and Cost Savings for the 21st Century" the study focused on telehealth applications "in which there are health care providers at both ends of the clinical teleconsults," an area in which UTMB has direct experience. Since 1994 it has provided prison inmates with over 250,000 remote consultations at a net savings to taxpayers of about \$780 million.

UTMB, which undertook the study to "test its belief that its successes had broader implications for national health care" concluded that similar forms of teleconsultation would yield net annual savings of \$4.28 billion if instituted on a national basis. It described this as a conservative estimate of telehealth savings, since it did not include potential savings related to "telehealth technologies used on inpatient units, home monitoring [Bookey's main focus], interpretive services (telepathology and teleradiology), or continuing medical education."²⁹

Since it is based largely on UTMB's own experience, this study's estimated cost savings seem less speculative than Bookey's projection of potential home monitoring savings. Though much smaller than the latter, the former's \$4.28 billion in annual savings could make a significant contribution to the financing of high-capacity fiber optic links connecting the nation's hospitals, clinics, doctors' offices and other health-care facilities. And, as noted above, if even one-tenth of Bookey's estimated savings from home-monitoring turned out to be realistic, these savings would be enough to finance the extension of fiber to individual homes and businesses.

Though admittedly speculative, these two estimates of potential telehealth savings suggest a potentially important role for municipal fiber networks in addressing our nation's runaway healthcare costs. And while such healthcare-related savings are not needed to cost-justify a muni-fiber investment, they do offer a potentially rich source of added benefits that could be pursued once a muni-fiber network was in place.

Supporting Mobile Broadband Services

Having a fiber optics network in place can also help a community extend broadband's benefits to the mobile arena. This is because fiber is especially well suited for interconnecting the radio base stations used to provide mobile communication services and linking them back to centralized switches and routers. This function is known in the industry as "backhaul."

Wireless backhaul is already a valuable use of fiber optics today, but will become especially so in the future, as mobile communications continues its evolution from voice to ever-higher speed data and multimedia applications. Whereas 1.5 Mbps T-1 circuits have been widely used in the U.S. for wireless voice backhaul, these circuits will fall far short of the bandwidth requirements needed to support future wireless broadband applications. In sharp contrast, fiber is the ideal medium to support ever-expanding backhaul traffic generated by next-generation mobile broadband services.

Today the major wireless carriers are deploying what is known as 3G (third generation) technology. Over the next several years, they will begin deploying newer and even higher-speed 4G technologies. These will include WiMAX, the technology preferred by a partnership owned 51 percent by Sprint. AT&T and Verizon, the nation's two dominant wireless carriers favor a competing technology known as LTE (Long Term Evolution). Both of these technologies are designed for use mainly in licensed spectrum bands. In addition, unlicensed Wi-Fi technology has already been used to deliver broadband wireless service, including by some municipalities, and the FCC is considering opening up large swaths of unused broadcast spectrum for further unlicensed use.

Regardless of which spectrum or 4G technologies are employed, and whether or not a municipality chooses to provide retail mobile service itself, the huge capacity available on a muni-fiber network will have growing value as a backhaul medium as wireless usage continues its migration to 3G and 4G platforms. This value will manifest in the form of high-capacity mobile broadband services delivered to local citizens and businesses, as well as public agencies like police and fire departments that rely heavily on mobile communications. For example, in Jackson, JEA is working with local law enforcement to integrate its fiber network with the police wireless network to improve response times.

While a municipality may choose to make some or all of these wireless services available for free as a public service, it could also charge fees for some of them. It should also be able to generate significant wholesale revenues from backhaul services provided to unaffiliated wireless service providers, given the growing demand for high-capacity backhaul links.

As has been the case with wireline network upgrades, large wireless carriers are expected to concentrate most of their backhaul upgrade investments in larger and denser metro markets. As a result, smaller communities without their own fiber networks risk being left behind in the migration to next-generation broadband mobile services, since the ability to support these services will depend in large part on the capacity of their backhaul links.

This means that a muni-fiber network can do double duty in the nation's smaller and underserved communities. In addition to providing the kind of fiber-delivered services discussed in this report, it can also provide the high-capacity backhaul links needed to bring state-of-the-art mobile services to these communities.

And since, as this report has shown, a muni-fiber network can reach positive cash flow even without revenues from next-generation wireless services, the latter can be added to the fiber network's service and revenue mix with minimal incremental investment and risk.

Conclusions and Recommendations

The future of too many American communities is being held hostage by the fact that they do not meet the rate-of-return requirements for investments in next-generation networks by private service providers.

This report analyzes the growing body of evidence indicating that municipal fiber networks can be financially sound and strategically important investments for communities whose broadband needs are not being met by current market dynamics. Based on this analysis, the report concludes that municipal fiber networks:

- 1) can support operating expenses and debt service from direct revenues, with the potential to generate a surplus that can be reinvested in the local community;
- 2) can generate significant and measurable cost savings and other direct benefits to local businesses, government agencies, schools, healthcare providers, utilities and residents and;
- 3) have the potential to generate social value far beyond these direct benefits, including helping to address the skyrocketing costs of transportation and healthcare.

Based on this evidence, we advise local leaders to seriously consider municipal fiber as an investment in their community's future welfare. And we recommend that, as they do so, they look to the muni-fiber pioneers whose experiences are summarized in this report for lessons and models.

Among the key lessons learned from these pioneers is that well-planned and well-managed muni-fiber operations can pay for themselves. In fact, it is reasonable to expect that financial success will be even easier for future projects, given that FTTH construction costs have already fallen by as much as 40% from the prices paid to deploy the first generation of muni-fiber networks.

As this report has shown, investments in municipal fiber networks are not only able to generate enough revenue support their costs. Perhaps more importantly, they can provide a 21st century electronic equivalent of the 20th century public road network.

Like that road network, which was funded as a long-term investment in public infrastructure, municipal fiber networks can increase efficiency, reduce costs, expand opportunity and help America's public and private institutions better serve its citizens. And, in doing so, they can help revitalize local and regional economies, enhance the quality of life in American communities, and help these communities compete in a global marketplace in which other nations have taken an early lead in leveraging fiber's power.

If you've taken the time to read this far, you probably have a sense that your community stands at an historic crossroads, a fork in the road where one path leads to strong economic growth and a better quality of life, while the other risks economic decline and even extinction as the global economy marches forward without your participation.

For the sake of your community—your family, friends, neighbors and co-workers—we urge you to build on the knowledge base provided by this book. Learn more, talk to the pioneers, the experts, the vendors and lenders, and, most of all, to your fellow citizens, those whose futures rely on the wisdom and courage of those they look to as leaders. If you do, the stakes and the options will become increasingly clear, and you will enjoy the privilege of leading your community toward a brighter future, perhaps one lit by the power of fiber optics. The way you respond to the broadband challenge may very well spell the difference between the community you call home succeeding or failing.

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