ctc technology & energy

engineering & business consulting

High-Level Assessment of the WiredWest Financial Model

Prepared for WiredWest
December 1, 2015

Columbia Telecommunications Corporation

10613 Concord Street • Kensington, MD 20895 • Tel: 301-933-1488 • Fax: 301-933-3340 • www.ctcnet.us

Contents

1 Introduction 3
1.1 Background 3
1.2 Findings 3
1.2.1 The Model's Required Take Rate Seems Feasible 4
1.2.2 The Communities' Early Funding Will Help Sustain the Model 5
1.2.3 The Project's Scale Will Result in Significant Savings 5
1.2.4 WiredWest Should Continue to Refine Certain Elements of Its Financial Models 5
2 Overview of Operational Expenses 7
2.1 Expenses Related to Services Offered 7
2.1.1 Video Services 7
2.1.2 Data Services 8
2.1.3 Voice Services 10
2.2 Expenses Related to Business Model Assumptions 10
2.2.1 Churn 10
2.2.2 Depreciation Reserve 11
2.3 Expenses Related to "Back-Office" Operations 11
2.3.1 Personnel 11
2.3.2 Billing and Processing 12
2.3.3 Vendor Maintenance Contracts 12
2.3.4 Pole Rental 12
2.3.5 Marketing 12
2.3.6 Vehicle Costs 13
2.3.7 Call Center 13
2.3.8 Insurance 13
3 Overview of Capital Expenses 14
3.1 Outside Plant (OSP) Materials and Labor 14
3.2 Consumer Premises Equipment (CPE) and Set-Top Boxes (STB) 14
3.3 Fixed Video Headend 15
3.4 Central Network Electronics 15
Appendix A: Over-the-Top Services 16
Appendix B: WiredWest Financial Modeling 20

Figures

Figure 1: Trends in Cable Broadband Speed and Price 9

1 Introduction

1.1 Background

WiredWest hired CTC Technology & Energy (CTC) to review and evaluate the WiredWest fiber-to-the-premises (FTTP) financial model, which was developed over the past few years by WiredWest and a range of consultants.[1] CTC was not involved in the modeling process and can therefore provide an independent evaluation based on its two decades of experience with network design and construction oversight, cost estimation, market assessment, business plan development, and financial modeling.

Our evaluation encompassed:

- Capital and operating cost assumptions
- The structure of the financial model
- The soundness of the business plan
- Pricing, market penetration, and revenue assumptions

After our initial analysis and feedback, WiredWest modified the model and updated the projections.

Per WiredWest's request, CTC's analysis is based primarily on data and assumptions provided to us by WiredWest and developed from work by contractors to the Massachusetts Broadband Institute. As contracted by WiredWest, CTC did not conduct original research or data collection. Rather, we evaluated the existing WiredWest financial model in order to raise concerns as necessary based on our experience. CTC does not warrant the analysis, the assumptions, or the success of the broadband business. CTC offers this report only as a means of providing consultative advice. There will usually be differences between the projected and actual results of a project such as WiredWest's initiative, because events and circumstances frequently do not occur as expected, and those differences may be material.

1.2 Findings

Based on our high-level analysis—which included only the financial documents provided by WiredWest, and did not include an engineering review or any additional research—we did not find anything "show-stopping." The WiredWest financial model has been well designed and depicts a reasonable portrayal of its business, given the model's underlying cost and revenue assumptions.

[1] See Appendix B for an overview of the WiredWest financial modeling process.

It is important to note that the model includes servicing the debt of the individual towns starting in year five. We understand that the WiredWest leadership is committed to covering this debt, even though it is not under a legal obligation to do so. In our analysis, we assumed that reaching positive cash flow means that WiredWest is able to cover its own expenses, as well as make payments to participating towns to cover their debt services.

1.2.1 The Model's Required Take Rate Seems Feasible

Compared to the take rates obtained by municipal networks that compete with cable modem and DSL offerings (i.e., "overbuilds"), the take rate required to sustain the WiredWest model appears high. However, the WiredWest communities do not have cable modem options. DSL is available, but service is limited. The aging copper lines used to deliver DSL have bandwidth limitation and likely cannot provide faster speeds without significant new investment. The correct take rate comparison is to greenfield builds. In this comparison, the required take rate to sustain the model is lower than one would expect to obtain. Therefore, we feel the WiredWest model is likely to be sustainable.

The fact that the WiredWest communities are underserved by broadband—cable modem service is non-existent, satellite cannot provide the capacity that students and teleworkers need today—is actually a positive element of the WiredWest financial model. If this were a traditional overbuild with competitive providers, the model would likely require significant ongoing financial support. However, the lack of competitive broadband services throughout the service area should allow WiredWest to reach positive cash flow and help the towns service their debts.

The initial model we reviewed required WiredWest to reach a 48 percent take rate to reach positive cash flow. Our initial review identified some missing costs. We brought these omissions to the attention of WiredWest representatives, and they adjusted the model accordingly. The additions increased the required take rate to 55 percent. Again, given the lack of competition, exceeding this take rate should be possible.

We have seen municipal offerings exceed 60 percent with an Internet-only offering when they have little competition for data customers. Further, with each participating town taking out its own General Obligation bond to finance its portion of the build, much of the market will have already learned about WiredWest prior to launch—"priming the pump" for the network's sales effort. As the result of WiredWest's pre-subscription campaign, in towns that have passed the bonds, 37 percent of potential customers have pre-subscribed for the service and put down a $49 deposit.

An additional $150,000 in annual costs makes the necessary take rate go up roughly 1 percent.[2] Given this, if the model still underestimates or omits some operating costs, it appears there is room to cover these expenses.

1.2.2 The Communities' Early Funding Will Help Sustain the Model

The WiredWest model addresses the difficulty of developing sufficient cash flow during startup. Each of the participating communities has committed to cover the debt service for bonding over the network's first four years. That will substantially help the network's financial picture in the early years when cash flow is hard to generate.

1.2.3 The Project's Scale Will Result in Significant Savings

If each town were to build and operate its own networks, the total capital and operating expenditures would be far higher than they will be for WiredWest. The scale of the project will allow towns to save on many fixed costs, provide stronger purchasing power, and enable service options that would not be feasible for a single town to offer on its own. For instance, offering a video service requires significant headend costs. While no single town could afford to cover these costs on its own, WiredWest's aggregate customer base significantly reduces the investment on a per passing or per subscriber basis.

1.2.4 WiredWest Should Continue to Refine Certain Elements of Its Financial Models

That said, we identified three elements of the financial model that we believe WiredWest should re-evaluate and monitor as it refines its projections:

1. **Network construction costs may be too low:** The total network construction costs projected in the model were derived from financial modelling that Cartesian Consulting completed for the Massachusetts Broadband Institute (MBI). We believe Cartesian's total construction cost estimates may be too low. If the network's capital costs are higher than anticipated (which we think is a real possibility), WiredWest will face difficulties not only in terms of long-term sustainability, but also in terms of bonding and short-term cash flow. We recommend closely monitoring the early stages of construction to make sure actual costs are less than or equal to what the model predicts.

2. **Prices for 1 Gbps data service may decline over time:** The WiredWest financial model envisions the progressive migration of all data customers to the highest service level—first moving from 25 Mbps to 100 Mbps, then from 100 Mbps to 1 Gbps. The prices for these packages are fixed over the life of the model, so the projected revenue increases as customers move up in bandwidth.

[2] We calculated this amount based on the difference in net income in years 7 to 10 using 48 percent and 49 percent adoption rates. The precise amount will depend on which years are examined, and which adoption rates are compared.

We question both whether all customers will want to move up to the highest bandwidth option at a higher price, and whether it is realistic to assume that prices will stay the same over a decade. On the former, we do not know the answer—but we think it likely that some customers will prefer staying at a lower-priced, lower-bandwidth service. And if we look at the history of cable modem service, we see that prices have decreased over time as speeds have increased. So it is also likely that the 1 Gbps service will come down in price over 10 years (at least so far as market rates are considered).

In other words, rather than 100 Mbps subscribers migrating to a 1 Gbps service at a higher price, we believe the 100 Mbps consumers will migrate to a 1 Gbps service that is priced at a level similar to the current 100 Mbps service—and that the 1 Gbps customers will evolve to a 10 Gbps service that is priced at a level similar to the current 1 Gbps service.

In discussions with WiredWest and in working with the model, we see that decreasing the cost of data service by $10 increases the take rate necessary to maintain positive cash flow by 1 percent.

3. **WiredWest will incur some vendor maintenance expenses:** The original WiredWest financial model did not include vendor maintenance costs as part of operating expenses. Rather, the model anticipated that the network would stock its own spare electronics and existing staff would be trained to handle most maintenance needs.

   We agree that this approach will reduce the network's operating expenses, but caution that the network will still incur some vendor maintenance costs. Without sparing of core routers, we would expect the network to spend 10 percent to 20 percent of the network electronics costs annually on vendor maintenance; by maintaining inventory and leveraging existing labor, we would expect WiredWest to reduce that to about 5 percent of the total accrued value of core switches and routers. To account for these costs, WiredWest added $155,000 per year for vendor maintenance contracts in the new model.

WiredWest may see some estimates too low and other too high. Also, it may encounter unanticipated expenses. As previously mentioned, an increase of $150,000 in annual expenses results in a 1 percent increase in required take rates in order to maintain positive cash flow.

Please note that there will usually be differences between the projected and actual results of a project such as WiredWest's initiative. WiredWest staff will manage the business on a day-to-day basis and, based on their understanding of the dynamics of the business, will make educated decisions to respond to evolving conditions.

2 Overview of Operational Expenses

In this section, we provide our assessment of the operational expenses and related assumptions included in WiredWest's financial model. For ease of review, we have grouped the expenses into loose categories related to:

1. Services offered
2. Business model assumptions
3. "Back-office" operations

2.1 Expenses Related to Services Offered

2.1.1 Video Services

The model assumes that cable television services will generate positive net revenue each year it is offered, until it sunsets at 180 months. At service introduction, the price of cable television services is set to provide an approximate 10 percent contribution margin. The model itself does not include any escalators on service prices or content fees. However, from our conversation with WiredWest representatives, we understand that the model assumes that the service price will rise along with the rise in cable television programing costs to maintain the 10 percent contribution margin.

For small cable television service providers, programming fees are increasing at a rate of 10 percent or more per year. These rate increases are, at least in part, due to consolidation in content ownership. Large cable companies have an ownership stake in many of the content producers and are able to negotiate lower rates for themselves while pushing up the rates smaller providers must pay. Smaller providers have found that consumers are only willing to absorb the increased cost of programming up to a point, forcing the providers to shrink their margins or begin to lose customers to satellite or over-the-top (OTT)[3] competitors. In some competitive markets, providers are forced to offer cable television services at a loss.

WiredWest has the advantage of not having to directly compete with a cable television provider in most of its service area.[4] However, it will face competition from satellite providers, and increasingly from OTT video providers. The precise impact that OTT video services will have on cable subscription rates in the short and medium term is subject to a great deal of debate right

[3] "Over-the-top" refers to content that is delivered over a customer's broadband connection, rather than directly by a cable television operator. OTT often refers to video, but it can also refer to voice services delivered through an application over a customer's broadband connection rather than by a phone company. Appendix A includes a more detailed discussion of OTT.

[4] The few cable systems that do exist within WiredWest's service area are analog, and do not have the ability to deliver HD content or data services.

now, with some analysts arguing that earlier reports overestimated OTT's impact.[5] We provide a more in-depth analysis of the OTT video market in Appendix A.

Competitive pressure from satellite and OTT options will provide limits on service price increases. Customers in the WiredWest service area who are most interested in cable television likely already pay for satellite television—and may not be willing to switch, especially if rates are higher.

Even if cable television does provide positive net revenues in the short run, we expect the contribution margin to disintegrate, hitting 0 percent long before the planned 180-month sunset.

We understand that cable television services might increase the attractiveness of WiredWest services as a whole, and may help achieve a higher take rate. We also understand that WiredWest is considering purchasing cable television programming from IPTV provider Vubiquity, which will help bring down the necessary initial investment and the ongoing administrative costs associated with video service.

Another option is to consider bundling an OTT video provider, such as Sling TV, which provides an OTT channel line-up. OTT services will require less initial investment, but have some drawbacks of their own, such as requiring users to purchase and install additional consumer electronics or purchase new Internet-ready televisions.

Market research may reveal that consumers in WiredWest's service area are not interested in switching to OTT video, and expect their data provider to also provide traditional cable television service. WiredWest representatives will need to weigh the cost and benefits of these different approaches to providing video service. As they do, we believe lowering the contribution margin of cable television service and decreasing the months until sunset will allow the model to more accurately reflect where we expect the cable television market to head in the near future. This reduction, however, should have minimal effect on the model's net revenue.

2.1.2 Data Services

According to the model, WiredWest will begin with three data tiers: a 25 Mbps service, a 100 Mbps service, and a 1 Gbps service. In our experience, limiting consumer choice to three data tiers helps prevent customers from being overwhelmed with too many service options.

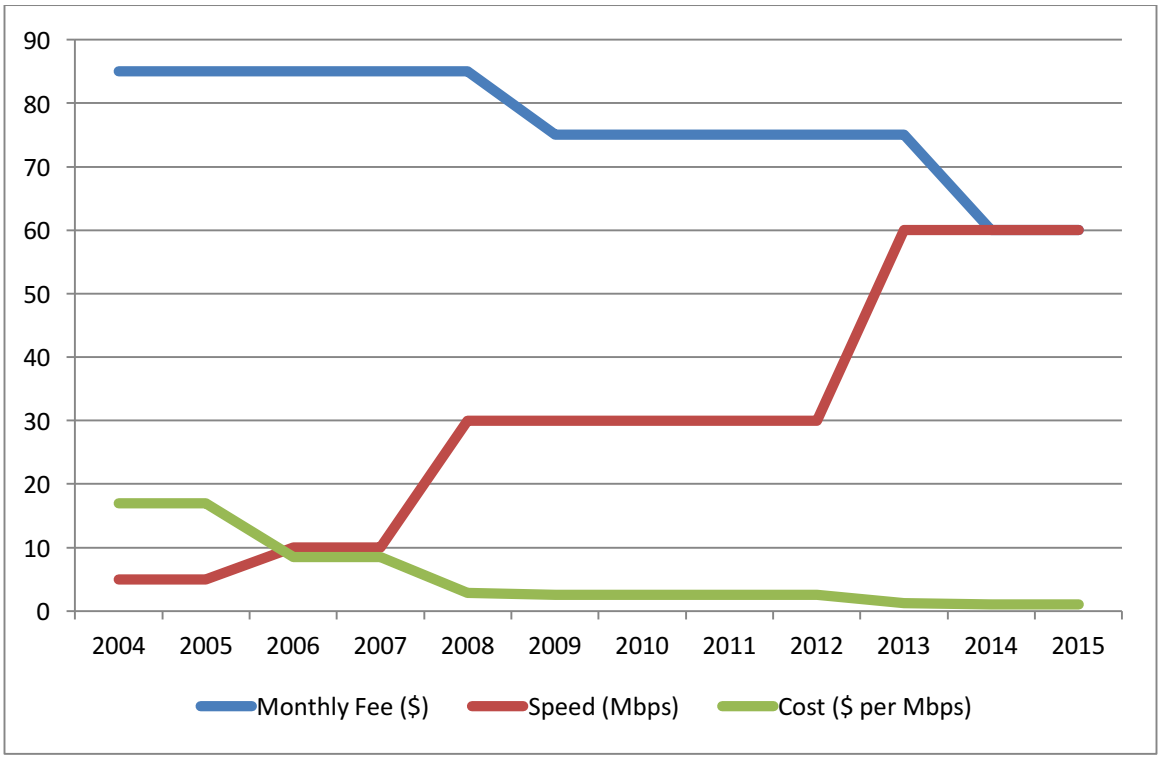
The model also does a good job reflecting the expected increase in demand for higher bandwidth data services over the next two decades. Although the majority of data subscribers initially will choose the 25 Mbps service option, the model assumes that customers will steadily migrate to

[5] Frankel, Daniel, "Cable's Strong Q3 Subscriber Trend has Analysts rethinking Cord-Cutting Trend," *Fierce Cable*, Oct. 29, 2015. http://www.fiercecable.com/story/cables-strong-q3-subscriber-trend-has-analyst-rethinking-cord-cutting-trend/2015-10-29, accessed Nov. 2015.

higher-bandwidth services (and that the 25 Mbps service will sunset at 120 months). The model then predicts that subscribers will migrate from the 100 Mbps service to the 1 Gbps service, with more than 90 percent of subscribers opting for the 1 Gbps service by the end of year 20.

While the model reflects a good understanding of where the data service market is headed, the plan to keep the price of these services constant over time goes against recent competitive market trends. As the graph below demonstrates, cable providers have increased their service speeds and lowered their service fees over the past decade, with service speeds increasing more rapidly than fees decreased. (This graph is based on service in a Midwestern region, but reflects the broader industry trend where competition exists.)

Figure 1: Trends in Cable Broadband Speed and Price



To some extent, the expected decrease in the network's bandwidth costs (i.e., what WiredWest will pay for bandwidth) will protect the overall contribution margin of data services, even if the price that WiredWest charges its customers decreases. WiredWest also has the advantage of a lack of other competitive data service providers across almost all of its service area.

However, it may be unreasonable to expect the bulk of data customers to migrate from the 100 Mbps service (at $79 per month) to the 1 Gbps service at a higher price ($109 per month). Many customers will likely find that a $79 per month service meets their needs—so they will not want

to pay almost 40 percent more for the higher data rates. In order for adoption of the 1 Gbps service (or greater, as demand increases for more data) to steadily increase, as it does in the model, the price for 1 Gbps service may need to approach the $79 charge that most WiredWest customers will have grown accustomed to paying each month for 100 Mbps.

The model shows a small but steady increase in cash flow across the latter decade of the project. This increase is primarily due to the expected migration of customers to higher-margin, higher-speed data services over time. If WiredWest representatives are considering lowering the price of data services over time, we recommended building into the model at least one price decrease for data services, and checking how this decrease affects long-term cash flow. In reviewing the impact with WiredWest representatives, we see that decreasing the price of data services by $10 per month requires a 1 percent increase in take rates to maintain a positive cash flow.

2.1.3 Voice Services

The model assumes a 30 percent contribution margin on voice services before any bundling discounts. That margin is somewhat lower than we would expect, but it is entirely dependent on negotiated rates. We understand that WiredWest plans to put its name on a voice service from an existing VoIP provider. This will help reduce both the initial capital expense and the ongoing operating expenses associated with providing voice services. From the initial conversations WiredWest representatives had with a VoIP provider, it seems that the contribution margin from voice services could be higher than 50 percent.

Based on the CrowdFiber survey data, which indicated that roughly 60 percent of respondents are interested in purchasing voice services from WiredWest, the model assumes that initially 62 percent of customers will purchase voice services. In most markets, landline subscription rates have begun to dip below 60 percent, and WiredWest will face continued competition from the existing landline provider.[6] However, the lack of reliable mobile service[7] may force households to continue to maintain a landline subscription within this particular service area. Therefore, the model's initial voice subscriber rate seems reasonable.

2.2 Expenses Related to Business Model Assumptions

2.2.1 Churn

The model assumes a 2 percent residential churn rate and a 1 percent business churn rate. Given the lack of competition and that the communities do not have a high turnover, these assumptions are reasonable. We do not believe that churn will generate a positive cash flow in the future.

[6] The existing telephone outside plant is more than 60 years old and reported to be in poor condition. WiredWest representatives also report that Verizon seems to have little interest in making improvements.
[7] Cellular coverage is spotty and in some areas non-existent.

2.2.2 Depreciation Reserve

The model assumes that starting in year five, about $1.5 million per year is put into a depreciation reserve. The depreciation reserve fund appears reasonable. The model assumes that the network electronics will need replacement every seven years. Although technically not part of the planned equipment replenishments, we might expect some annual replacement costs of electronics installed at consumer premises. These costs might be a few thousand dollars per year.

2.3 Expenses Related to "Back-Office" Operations

2.3.1 Personnel

The initial model assumed that customer service staff makes $30,000 per year. This is slightly lower than we would expect. After WiredWest's review, this was increased to $35,000 per year.

The model adds an additional line-maintenance staff member for every 2,000 residential customers, and a technical staff member for every 5,000 customers. These ratios are reasonable.

Each line maintenance staff member is equipped with a bucket truck (and those vehicle expenses are now included in the model). It is envisioned that this staff would be supplemented by contractors. Depending on what damage actually occurs to the network (e.g., from squirrels and other sources), WiredWest's maintenance expenses may be higher than anticipated—but likely will not increase substantially enough to impact the model's sustainability.

The model eliminates residential sales staff in the fourth year and eliminates commercial sales staff in the sixth year. However, it does retain a single sales director. In a relatively uncompetitive environment, sales staff can be decreased over time, but the ongoing sales effort may exceed the capacity of a single sales director.

There is always some churn, and sales staff help sign up new customers and encourage existing customers to purchase higher tiers of service. WiredWest may add additional service offerings with revenue potential, like home security service, and new services always require a sales effort. WiredWest may also face competition from an Internet service provider (ISP) at some point in the future, and sales staff may be necessary to avoid losing customers. If WiredWest introduces new services, retention or addition of sales staff would likely be required. However, increased revenues from new services would offset these sales staffing costs.

The model does not allocate personnel to handle video programing administration. However, WiredWest's plans to purchase video programming from Vubiquity will simplify this task and should allow program administration to be a part-time responsibility of an office staff member.

The model does not allocate personnel for processing tickets and locates for underground fiber. As long as 99.9 percent of the build is aerial, these costs will be minimal, but they can quickly become significant if more fiber is buried.

2.3.2 Billing and Processing

We understand that WiredWest intends to take care of billing and payment processing internally, in order to enable the integration of billing, provisioning, and general ledgers systems. Accepting credit cards will include a fee, which was not included in the model. The updated model assumes that 50 percent of invoices will be paid by credit card and that WiredWest will be charged 2 percent for those transactions. We concur with this update.

The model does not specifically allocate personnel to manage billing and processing; these tasks may be part-time work for the office staff.

WiredWest intends to bill one month ahead, avoiding the potential of bad debt (often expected to be 1.5 percent).

2.3.3 Vendor Maintenance Contracts

Vendor maintenance contracts did not appear in the model. We understand that WiredWest plans to maintain equipment internally, and to have a tested hot spare of all necessary equipment. This will allow WiredWest to benefit from bulk-buying discounts and to save on monthly contract fees. However, it is not clear that spare equipment costs are in the model.

Further, even if most of the maintenance is done internally, it is unlikely that WiredWest will be able to entirely avoid vendor maintenance contracts. These will need to be added to the model as an ongoing cost. We would expect vendor maintenance to cost about 5 percent[8] of the accrued value of the network equipment. In response to our comments, an additional cost of $155,000 per year has been added to the model for maintenance contracts. This amount is within the range of what we would expect, but is on the lower end of the range.

2.3.4 Pole Rental

The model assumed a pole rental fee of $10 per pole per year. We understand that Verizon and the local electric company quoted WiredWest a price of $12.50 per pole per year. The model was adjusted to reflect these higher fees.

2.3.5 Marketing

The model assumes an initial marketing budget of $30,000, followed by a monthly budget starting at $2,500 and growing slowly over time. This is lower than usual; however, WiredWest is in a

[8] The annual cost of vendor maintenance contracts often ranges from 10 percent to 20 percent of the value of the equipment, if the vendor maintains the core router and core switch spares.

unique situation given the massive, multi-year volunteer effort needed to bring the project to this point. Further, because of the current lack of broadband services, there is a pent-up demand, as demonstrated by the high pre-subscription rate.

Continued volunteer efforts could dramatically decrease the amount of marketing spending needed to achieve the necessary adoption rate. Also, much of the service area will learn about WiredWest as a result of the towns needing to take out General Obligation bonds to fund their portions of the build-out.

2.3.6 Vehicle Costs

There appeared to be something wrong with how the model calculates vehicle costs. In year seven, the vehicle operating expenses were $0 per month, even though one van and one bucket truck are set to be deployed at that time. Based on feedback, the model was corrected to accurately reflect operating expenses associated with vehicles.

2.3.7 Call Center

We understand that WiredWest intends to use a customer service call center between the hours of midnight and 8 a.m. WiredWest will incur an initial start-up cost for the call center, as well as an ongoing cost based on the number of WiredWest customer calls it receives. These costs are not currently included in the model. However, these costs should be minimal.

2.3.8 Insurance

The model does not specifically include the cost of liability insurance. Fiber liability is usually included in a network's general liability policy. Given the roughly $60 million value of the outside plant, we estimate annual liability insurance costs to be in the $60,000 to $80,000 range.[9]

After review with WiredWest, we found that the model allocates $250,000 per year for insurance costs, including liability, pole bonding, and other insurance. This cost estimate appears high; however, this is a blended cost of a number of different types of insurance costs. The insurance costs could be in the $100,000 to $150,000 range. We could more accurately comment on the cost estimate's accuracy if it were broken into separate components.

[9] Deductibles of $5,000 to $10,000 are typical.

3 Overview of Capital Expenses

CTC reviewed two separate models for this report—one built in Quantrix, the other developed by Cartesian Consulting.

Our analysis of operating expenditures focused entirely on the model built in Quantrix. Although this model was originally built for the Massachusetts Broadband Institute by the consulting firm Civitium, WiredWest representatives have continued to adjust and refine it.

The Quantrix model does not attempt to approximate the total network construction cost on its own, however. Rather, the Quantrix model was designed so that the total construction cost at 100 percent adoption matches the $80 million "Total Town Costs" predicted in the model that Cartesian Consulting built for the Massachusetts Broadband Institute.

Since both models use Cartesian's total construction cost estimates, our analysis of capital expenditures focuses primarily on the Cartesian model. We only note assumptions in the Quantrix model that differ from those used in the Cartesian model.

3.1 Outside Plant (OSP) Materials and Labor

The Cartesian model assumes aerial construction will cost between $0.20 and $0.46 per foot for materials and $1.50 per foot for labor. These prices are within the range of what we would expect aerial construction to cost, but they are on the low end of this range. Depending on the current demand for contractors' services and current materials cost, the prices could be higher than predicted.

For example, the two main materials in aerial construction are fiber optic cable and utility strand. Both of these materials can vary in cost, depending on the cost of the materials required to make them and the quantities in which they are procured. Requirements such as prevailing wages can also impact the labor costs associated with fiber optic construction.

Even a small increase in aerial construction cost per foot risks putting the total cost of construction above the $80 million that WiredWest has allocated for the project. Therefore, we recommend closely monitoring the cost of construction during the early stage of the build to make sure that the actual cost to build each town is less than or equal to the Cartesian model's predicted cost.

3.2 Consumer Premises Equipment (CPE) and Set-Top Boxes (STB)

We noticed a discrepancy between the CPE and STB costs in the two models. The Cartesian model assumes each CPE will cost $220, each HD STB will cost $220, and each HD DVR STB will cost $350. The Quantrix model assumes each CPE will cost $150, each HD STB will cost $100, and each

HD DVR STB will cost $300. This discrepancy has been corrected, with both models now using the higher unit costs.

3.3 Fixed Video Headend

While the Quantrix model's "Fixed Video Headend Costs" estimate omits significant expenses, such as core data switches and building renovations required for the headend, it does include a $3.3 million capital investment for cable television. This is significantly higher than we expect the actual cost to be, given WiredWest's plan to partner with the IPTV provider Vubiquity.

We understand that this is a purposefully conservative estimate, meant to create a financial buffer in case other capital costs come in higher than expected. However, we recommend updating the fixed video headend cost with as accurate an estimate as possible, to ensure it represents the investment necessary to enable video service.

The Fixed Video Headend Costs also do not include a video-on-demand (VOD) system. Given the available OTT options like Netflix and Amazon Prime, and the lack of traditional cable television options, we concur that VOD may not be required.

3.4 Central Network Electronics

The Quantrix model does not specifically break out the costs of central network electronics such as core routers, aggregation switches, and GPON optical line terminals (OLTs). While the costs for network electronics are included in the overall cost estimate, we recommend estimating individual unit costs, in order to help track these expenditures during the buildout, and to forecast network electronics expenditures as the size of the network and the take rate increase.

Appendix A: Over-the-Top Services

Over-the-top (OTT) or "value added" services have evolved more quickly in the voice market than in video, though OTT is not a new concept in either. Recent announcements of expanded OTT video offerings suggest that consumers are seeking alternatives to traditional video services, and the market is responding. Popular OTT video providers like Netflix and Amazon Prime continue to add content every month.

The changes in the landline telephone market over the past decade illustrate what is likely to happen with video content. Ten years ago, home telephones were still nearly ubiquitous, even in households where all members subscribed to wireless phone service. Yet data from a 2013 National Institutes of Health (NIH) report showed that more than 22 percent of households in Massachusetts (excluding Suffolk County) were wireless only, with no landline telephone.[10] In Suffolk County, 37.5 percent of households were wireless only, with no landline telephone.

Nationally, landline usage has continued to decline—January through June 2014 was the first six-month period during which a majority of U.S. children lived in households with wireless-only telephone service.[11] This decline was possible due to increasingly accessible and affordable cellular and wireless service, along with other alternatives to landlines—applications like Skype and Google Voice, services like Vonage and Lingo, and technology like magicJack and Ooma.

The cable television industry may be poised to see a similar shift toward nontraditional technologies, applications, and services that allow consumers greater flexibility and choice. An increased desire for OTT offerings could have a significant impact on the industry, though this will likely be more gradual than changes to the voice industry, because of cable content owners' great degree of control. Major industry shifts have been predicted,[12] but cable industry changes have been slower to materialize than those in the voice industry.

To understand why the shift may be gradual, consider Google Fiber's entry into the Kansas City market in 2011 as an example of the firmly rooted power of cable. Google Fiber found that a data product alone was not strong enough to obtain the market share necessary to make its endeavor viable. If it wanted to get people to switch broadband providers, Google Fiber *had* to offer cable, deviating from its original plan and introducing more cost and complexity than the simple data service it intended to offer.

---

[10] National Institutes of Health, (2014), "Wireless Substitution: State-level Estimates from the National Health Interview Survey, 2012 (Report No. 1250)," retrieved from http://www.cdc.gov/nchs/data/nhsr/nhsr070.pdf.

[11] National Institutes of Health, (2014), "Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, Jan.-Jun. 2014," retrieved from http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201412.pdf.

[12] "TV Is Dying, And Here Are The Stats That Prove It," *Business Insider*, Nov. 24, 2013, http://www.businessinsider.com/cord-cutters-and-the-death-of-tv-2013-11, accessed Nov. 2015.

Google Fiber has necessarily continued its traditional cable offerings in subsequent markets. If OTT video options with a broad range of content had been widely available when Google Fiber entered the Kansas City market, it might have found that offering traditional cable television was unnecessary. It will likely eventually phase out its traditional cable offering, as more OTT content becomes available and consumers seek other, less costly alternatives to traditional cable.

Smart mobile devices, which enable users to download or stream content over cellular or Wi-Fi networks, add another layer of complexity to the cable operators' long-term planning. As more non-traditional content providers emerge, greater programming variety becomes available via OTT, network choice grows, and network operators offer a wider variety of pricing plans, the demand for alternative access to content may increase. In addition, consumers are watching a lot of video on mobile devices, and Wi-Fi in the home enables them to use those mobile devices to stream video without paying extra for cellular service.

Consumer demand and expectation is another potentially key driving factor that may facilitate change in the industry. Due to the always-on and at-your-fingertips nature of applications and services that are supported by access to the Internet, consumers have come to expect "on-demand" services and control over their choices in ways that have not previously existed.[13] Consumers who are used to having Internet access—especially digital natives[14]—are accustomed to quickly and easily receiving the goods and services they desire. By simply engaging an app on a smartphone or clicking a mouse on a laptop, consumers expect instant access to goods, services, and content.

Further, in part because of the growth of "cloud" services (i.e., applications and services delivered over a broadband connection rather than stored on a consumer's smartphone or computer), there is an increased consumer desire for simplicity and integration among services and content. And because of technological advancements and "cheap computing power,"[15] the costs associated with what would have been luxuries for the rich only a few years ago are now attainable for the average household.

Since the start of this year, the market has begun to shift more dramatically with the emergence of additional OTT content. Dish Network launched an OTT service in early 2015 that offers sports programming such as ESPN, as well as other programming and popular TV channels, without a

[13] "The 'On-Demand Economy' Is Revolutionizing Consumer Behavior — Here's How," *Business Insider*, Jul. 13, 2014, http://www.businessinsider.com/the-on-demand-economy-2014-7, accessed Nov. 2015

[14] "What does it mean to be a digital native?," CNN website, http://www.cnn.com/2012/12/04/business/digital-native-prensky/, accessed Nov. 2015

[15] "Workers on tap," *The Economist*, Jan. 3, 2015, http://www.economist.com/news/leaders/21637393-rise-demand-economy-poses-difficult-questions-workers-companies-and, accessed Nov. 2015.

cable subscription. The service, called Sling TV, is streamed over the Internet.[16] It does not require any additional hardware and is enabled by installing an application on a device such as a smartphone, tablet, laptop, or Internet-connected television. Sling TV currently is priced at $20 per month with no long-term commitment, but it is complex and comes with limitations and restrictions.[17] Traditional cable content providers' attempts at OTT have seen varying degrees of success, but it is significant that those providers even acknowledge the need for OTT services.

In addition to recent entrants to the OTT market, there are numerous established services and applications that will likely continue to promote change in the cable industry and drive an increase in consumers' desire for greater choice and control over how they access content.

Standalone media-streaming boxes like Apple TV and Roku have enabled consumers to stream content with applications such as YouTube, Netflix, Amazon Prime, and Hulu without a cable subscription since 2008. These services provide more comprehensive video-on-demand viewing options than traditional content providers have ever been able to offer. Increasingly, "cord-cutters" cancel their cable subscriptions in favor of accessing their favorite content via applications and services streamed over the Internet. An ever-increasing percentage of consumers are getting these services using mobile devices.

Since the debut of Apple TV and Roku, similar devices like the Chromecast, Google Nexus, and Amazon Fire TV have entered the market, allowing consumers greater choice. Further, consumers can now purchase Internet-enabled smart TVs, which come with preinstalled platforms that support streaming applications. These devices require no additional hardware—with only an Internet connection, consumers can stream music, TV shows, and movies, and even play games.

Although the video industry has been slow to change, traditional content providers have begun efforts in recent years to provide OTT content to keep up with consumer demand for greater flexibility, and to compete with companies like Netflix, Amazon, and Hulu. Comcast's own recent developments show that this understanding is beginning to resonate with even the largest providers.

While Comcast's own attempt at OTT content through its "Streampix" offering was not a huge success,[18] that pursuit illustrates the cable giant's understanding of streaming as the future of content delivery. The fact that its broadband subscriptions surpassed its cable subscribers this

---

[16] "The Best of Live TV – Like ESPN," Sling website, https://www.sling.com/, accessed Nov. 2015

[17] "Sling TV channel guide: All the programming, and all the restrictions, all in one chart," *PCWorld*, Apr. 16, 2015, http://www.pcworld.com/article/2909572/sling-tv-channel-guide-all-the-programming-and-all-the-restrictions-all-in-one-chart.html, accessed Nov. 2015.

[18] http://www.lightreading.com/video/ott/comcast-turns-off-streampix/d/d-id/711098, accessed Nov. 2015.

year[19] further puts to rest the notion that the video industry can move forward without embracing new and innovative content delivery mechanisms. Further, Comcast has begun to offer a new streaming service,[20] and it is reportedly in talks with "nontraditional" content and media providers.[21]

Verizon FiOS announced earlier this year its Custom TV, which allows consumers to choose from bundled packages that include fewer unwanted channels.[22] While this is not a true OTT application, it demonstrates the recognition within the incumbent market that consumers are dissatisfied with traditional content delivery and are seeking alternate choices.

HBO announced plans in 2014 to offer its own OTT service;[23] it began offering HBO NOW on a variety of platforms and devices in mid-2015.[24] Access to premium programming, like sports and HBO, has been a stubborn barrier to customers who want to eliminate their cable subscriptions (and to competitors that want to disrupt the market). Often, consumers would happily give up cable service in favor of more streamlined, inexpensive services—but they do not take the leap because they want specific programming that is only available over cable. It is significant when a content powerhouse like HBO acknowledges the importance of change in the industry.

Companies that hope to compete in the video market will likely find that they must adjust their business models, marketing strategies, and understanding of consumer demands and desires. WiredWest representatives plan to survey video customers to see what programming they care most about, then offer a "skinny package" with the most desirable channels. WiredWest intends to purchase its content through the IPTV provider Vubiquity, which will help keep the necessary capital investment and ongoing operational costs associated with providing video content relatively low. This is critically important given that the contribution margin of video services will likely erode rapidly over the next few years.

---

[19] Emily Steel, "Internet Customers Surpass Cable Subscribers at Comcast," *The New York Times*, May 4, 2015, http://www.nytimes.com/2015/05/05/business/media/comcasts-earnings-rise-10-driven-by-high-speed-internet.html?_r=0, accessed Nov. 2015.

[20] "Introducing a New Streaming TV Service from Comcast," Comcast website, Jul. 12, 2015, http://corporate.comcast.com/comcast-voices/a-new-streaming-tv-service-from-comcast, accessed Nov. 2015.

[21] Amol Sharma, "This Chart Shows Why Comcast Would Be Interested in Vice Media and BuzzFeed," *Wall Street Journal*, Jul. 24, 2015, http://blogs.wsj.com/cmo/2015/07/24/this-chart-shows-why-comcast-would-be-interested-in-vice-media-and-buzzfeed/, accessed Nov. 2015.

[22] Jon Brodkin, "Verizon's new 'Custom TV' is small step toward a la carte pricing," *ArsTechnica*, Apr. 17, 2015, http://arstechnica.com/business/2015/04/verizons-new-custom-tv-is-small-step-toward-a-la-carte-pricing/, accessed Nov. 2015.

[23] Cynthia Littleton, "HBO to Launch Standalone Over-the-Top Service in U.S. Next Year," *Variety*, Oct. 15, 2014, http://variety.com/2014/tv/news/hbo-to-launch-over-the-top-service-in-u-s-next-year-1201330592/, accessed Nov. 2015.

[24] "Your Shows, Your Movies, Your Way," HBO website, https://order.hbonow.com/, accessed Nov. 2015.

Appendix B: WiredWest Financial Modeling

WiredWest Financial Modeling Process

WiredWest's leadership team has been refining financial modeling for our towns' cooperative fiber network since our first feasibility study in 2010. It has been a valuable, iterative process that has subjected the model to exhaustive due diligence and modification by credible industry and local sources. The model today represents conservative, yet accurate projections for the construction and sustainable operation of a regional municipal fiber-optic network in the consortium of WiredWest member towns that are looking to invest in robust and affordable broadband infrastructure for their residents.

CONTRIBUTORS

Input into the model and its assumptions have come from extensive work with the following:

- Nationally-recognized telecommunications network consultants
- Operating fiber-to-the-home networks, both municipal and private
- Fiber network engineers and builders
- Massachusetts Broadband Institute and its consultants
- Telecommunications industry analysts

WiredWest's Finance Chair, Jim Drawe, has overseen the financial model work on behalf of the towns. Drawe had a career in the finance industry, and is currently a Hampshire County Commissioner and a 25-year veteran of his town's Select Board, as well as a past member of his Finance Committee. To supplement his existing knowledge, Jim has spent the last five years in discussions with municipal fiber network financial and operational professionals, on best practices, budgeting and forecasting considerations, as well as network assumptions, to build a credible financial model for WiredWest.

Additionally, feedback on the latest version of the model was solicited from WiredWest member town Select Boards, Finance Committees and other institutional stakeholders.

MODEL FORMAT, INPUTS AND REFINEMENT

The model has evolved from a collection of excel spreadsheets into a comprehensive, dynamic model that accounts for the complexities of operating a municipal fiber-optic network and enables robust testing of various scenarios.

The current model utilizes Quantrix software, a sophisticated, corporate cloud-based tool for integrated budgeting, planning and financial forecasting. The model was built in Quantrix by Massachusetts Broadband Institute (MBI) consultant, Civitium, who compiled inputs from various sources, including their own extensive knowledge of municipal fiber network financial modeling, before presenting the first draft to WiredWest in 2014.

Background work that contributed to the Quantrix model included an exercise with WiredWest and MBI, with MBI consultant, Communications Media Advisors, that compared each group's models, discussed and resolved differences, and created a consensus model.

That consensus model became part of the next last-mile modelling exercise pursued by MBI, known as the "Kitchen Cabinet." With this next effort, a group that included several nationally-renowned consultants on various aspects of building and/or operating fiber networks, that included WiredWest, worked on finalizing estimates for the last-mile model, comparing and / or using estimates from the various MBI consultants. The estimates used from this group included: costs for construction of fiber networks in the towns; estimated subscription rates; and costs for construction and operation of a modern TV/video component of the system. Most of these estimates were included in the current model in Quantrix.

In 2014, WiredWest worked closely with MBI's consultant, Civitium, and with municipal financing expertise to refine the model's assumptions as follows:

- Better represent construction costs for a rural build in our region specifically (as opposed to the urban assumptions the model was previously based upon) and matched with engineering information WiredWest had collected in its comprehensive GIS map database.
- Capture economies of scale of a regional build (as opposed to the aggregate cost of each town building independently as previous estimates were based upon)
- Accurately represent town household counts, which impacts cost per town (note that those household counts towns submitted in March have not been made available by MBI, so are not yet reflected in the model and per town cost estimates)
- Include pricing, product mix and take rates that were supported by:
    - WiredWest's market research study
    - WiredWest's two demand aggregation efforts
    - Pricing, product mix and take rates in areas with similar competition
    - The model's financial sustainability
- Reflected an optimal financing strategy municipal financial advisors would likely employ, including planning timing of bonding and types of financial instruments used to ultimately reduce interest costs and defer the onset of maximum town borrowing to better close the gap between the time of borrowing and when revenues from service would be generated.

The revised model was presented to Finance Committees and Select Boards in late 2014 and early 2015. Although the MBI temporarily suspended modelling work with their consultant in early 2015, WiredWest continued working on it with input from WiredWest member town Select Boards, Finance Committees and other stakeholders. Some revisions were made based on their feedback. The model will continue to be open to input from experts in municipal finance and fiber networks with proven operational records.

MODEL ASSUMPTIONS

Pricing

Initial price ranges were developed by the MBI Kitchen Cabinet, and then modified in conjunction with projected take rates by Civitium and WiredWest Chair Monica Webb, who has extensive market analysis experience. The basis for pricing included a market study that used conjoint analysis for pricing optimization and determination of corresponding subscription rates. The study was conducted by the nationally-renowned market research firm, Market Street Research, on behalf of WiredWest.

Take Rates
Take rates for fiber networks in areas with similar types of competition (i.e., rural areas without cable), were compared and found to be in the 70% range. Additionally, our market research projected take rates in the same range, and the demographics of the region indicate take rates would likely be higher than the average. However, to be conservative, WiredWest opted to stick with a long-term take rate of 48% in the model, which is well under what we expect, but still ensures sustainability of the regional network.

Product Mix
The product mix again relied on our market research, as well as the tallies of requested services from residents in WiredWest's two demand aggregation efforts – the Support Card campaign and the Fiber Town campaign. Additionally, operating fiber networks were consulted on their product service levels and types of products offered. Statistics on pricing and product mixes were reviewed from all local broadband service providers as well as municipal fiber networks around the country.

We were strongly advised by cable industry consultants and successful fiber networks that provide television service, that although the margins were low, TV was a necessary offering in order to capture higher take rates and get more subscribers to internet services. Additionally, large private sector fiber network providers such as Verizon FiOs, and new entrants Google Fiber and Ting Internet, are, or will be offering TV products. Now is the best possible time to be developing customized TV bundles, as video is increasingly being delivered online, offering greater choice for consumers.

Internet speed tiers were based on what other networks around the country were offering, as well as analysis by WiredWest into projected bandwidth demands by U.S. in the Cisco Visual Networking Index projections. Graduation of customers to higher tiers of service over time was calculated by Civitium.

The resulting price points, product mix and take rates were plugged into the model to determine which combinations ensured network sustainability, in order to minimize any risk to our communities.

Vertically-integrated business model
The vast majority of municipal fiber networks in the United States operate as their own internet service providers, meaning they provide broadband services directly to their customers. The advantage of that model is that it enables networks to utilize the higher margins from providing internet service to repay the debt on the network, or for expansion. When a municipality partners with a private provider, particularly in a rural area with higher capital costs, it means the town typically forgoes being able to access revenues to pay the debt, but rather allocates that margin to the private sector partner, who has no stake in debt repayment.

IN SUMMARY

WiredWest was formed by the towns, for the towns, to ensure the best interests of the towns were represented in the financing, construction and operation of a municipal fiber network. Consequently, WiredWest's goals with the financial modeling have been to control or reduce capital and operational costs to mitigate the financial risk to towns, and make fiber to the home networks accessible to as many of our small towns as possible. WiredWest has continually advocated for specific cost-control strategies, including:

- Creating a locally-operated, regional cooperative to capture economies of scale and aggregate a large group of subscribers to support costs
- Designing the network to share fixed assets more efficiently

- Pushing for cost assumptions relevant to our region, instead of standard urban cost assumptions
- Reducing the number of unnecessary connections to the MB123 network to reduce backhaul cost
- Proposing legislation and regulation to streamline make ready costs
- Advocating for state funds to be spent first, to reduce interest expense to towns
- Advocating for strong local oversight of state expenditure of town funds during construction
- Developing the most cost-effective model to operate, and to return profits to towns

QUESTIONS?

If you have further questions about WiredWest's financial modelling, please contact Jim Drawe at jim@wiredwest.net. You can also find additional project reference in formation at www.wiredwest.net.

4