

Cost and Profitability Drivers for FTTH

By Patrick Garvey

Do you spend a lot of time researching information before you buy a car, scouring through several magazine evaluations and safety ratings before parting with your hard-earned money? If you put that much time into buying a \$25,000 car, what would you do if you had to spend \$70 million?

That amount is an approximate cost associated with building a fiber-to-the-home (FTTH) network for a medium-sized city in the United States. There are many different components that make up this cost and there are areas where you can influence the amount spent.

The cost of building the network is important, but this is only one part of the equation for a successful and profitable FTTH build. The ongoing expense to run the network and the revenues received for the services are other key elements that make a successful business case.

Building a Business Case Model

First let's look at a typical FTTH deployment in a mid-sized city such as Naperville, Ill., Flint, Mich., Sunnyvale, Calif., or Alexandria, Va. Each of these cities have a population of about 130,000 people and are all located near large metropolitan areas.

This optical fiber network would cover 36 square miles and pass approximately 30,000 houses/apartments and 2,400 businesses. The build would be complete in three years for installing a Passive Optical Network (PON) architecture where up to 32 homes are connected over a single strand of optical fiber. This would be an overbuild situation with 70 percent of the network cable deployed aerially and 30 percent buried.

The network would be designed to offer triple play services — Voice Over Internet Protocol (VoIP), high-speed data and IP video. Using the sophisticated Corning Business Case Model (BCM), an analysis was completed for such a typical FTTH deployment. Inputs to the BCM are parameters like network architecture, aerial or buried cable, housing units, businesses, time to build the network, inflation rate, price points for services and many more. Given the input data, the model calculates the cost of deploying the network and predicts the potential for profitability.

Network Costs

Using relatively conservative cost inputs, the BCM calculates the overall cost to build a typical network to be approximately \$67.6 million. This yields a much higher than expected cost per subscriber of about \$2,000. Figure 1 shows that FTTH installation costs per subscriber are typically in the \$1,200 range. These low installation costs are generally realized by larger builds where hefty discounts are applied and in-house expertise/resources are fully utilized.

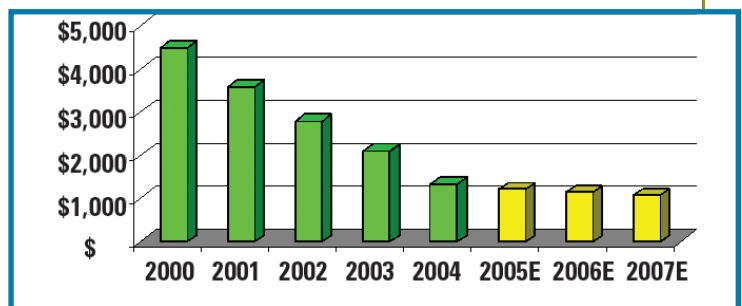
The costs are divided into categories. The largest portion is due to the Outside Plant (OSP) followed by Active Equipment and then Engineering & Project Management.

The OSP accounts for 45 percent of the total cost. OSP cost comprises labor and passive equipment cost (optical cable, cabinets with splitters, terminals and pedestals), of which labor is by far the largest contributor, totaling \$25 million. This is 84 percent of the OSP cost and 36 percent of the total network cost.

By contrast, the cost of passive equipment is \$4 million, which is 16 percent of the OSP cost and only 7 percent of the entire network cost. This is not really a surprise as the pricing for OSP components has dropped dramatically in the last three years. There are some factors that lower the labor cost of the OSP, such as installing more aerial cable than buried (except in a Greenfield build where trenching costs are shared among all utilities such as electric, sewer, gas, water and communications).

With labor being the largest factor in OSP cost, obviously the hourly wage and installation time will directly affect the total installation cost. In regions of low local wages, lower labor costs can reduce the overall build cost.

Figure 1: Approximate Cost of FTTH per Home Connected



New innovations like environmentally sealed and hardened pre-terminated drop cables, terminals and Network Interface Devices (NID) are reducing the cost to build the OSP.

Pre-terminated drop cables, which even general laborers can easily connect at the Network Access Point (NAP), are reducing labor costs. Once connected, the drop cable is run to the house where the other pre-terminated end is effortlessly connected into the NID. By simplifying installation procedures and eliminating the need for highly trained splicing technicians with relatively expensive splicing equipment, such innovations are reducing both the installation time and the hourly rate. Reports have shown 40 percent reduction in time and 50 percent reduction in total cost for drop cable installation. New fibers that are bend insensitive or can accept higher launch power also may reduce cost by adding flexibility in network design or by enabling new products which reduce installation time.

Other significant costs in the model include the active equipment at 36 percent of the total network cost and project management at 18 percent. The economies of scale associated with the recent FTTH deployments by the Regional Bell Operating Companies (RBOCs) have drastically reduced the costs of active equipment and are therefore making FTTH networks continually more economical. Project management costs can be reduced if that expertise is possessed by the network owner. Most municipalities don't possess such expertise and therefore subcontract to engineering firms. The Head End (HE) and Central Office (CO) account for only a small percentage of the total cost.

Figure 2: Categories of Costs of a FTTH Network

Category	Cost (millions)	Percent of build
Outside Plant	\$29.8	45%
Active Equipment	\$24.4	36%
Head End	\$ 0.9	1%
Central Office	\$ 0.3	< 1%
Engineering & Project Management	\$12.2	18%
Total	\$67.6	100%

Operating Expense

Once any network is built and is in operation, there are continual costs associated with operating the network. This Operating Expense (OPEX) includes employees, network maintenance (spares, tools, vehicles, truck rolls), service promotion, office administration and power for CO/HE. In our FTTH example, OPEX over 20 years was \$60 million or \$3 million per year. The largest component of OPEX is associated with employees, which include Sales & Marketing, Customer Services, Circuit Provisioning Specialists, CO/Transport Engineers and field technicians. However, the OPEX strongly differentiates a FTTH network from a copper based network (twisted pair or coax). A passive optical network has no active electronics in the field. Therefore the maintenance cost is very low when compared to copper based networks. Field-based active components have an associated frequency of failure and continually require power. Consequently, the OPEX for an equivalent HFC or VDSL network will be 40 and 60 percent higher, respectively, than a PON network.

Profitability

Once the OPEX is determined, a business case analysis can be completed to evaluate profitability. One way of looking at this is to use Net Income. Net Income is defined here as:

$$\text{Net Income} = \text{Revenues} - \text{OPEX} - \text{Depreciation} - \text{Interest} - \text{Taxes}$$

The obvious goal is to have a high net income. This is mostly accomplished by having high revenues as the other parameters are mostly fixed once the network is built. Revenues are increased by having customers sign up for one of the services offered. The penetration rate is critical in determining the profitability of a communications network. Another way to increase revenues is to offer unique services valued by the community (such as security monitoring). In our example, the penetration rate reached 70 percent in three years and the net income over 20 years would be \$84 million or \$4.2 million per year. Positive net income is reached in approximately five years. Clearly, a 70 percent penetration rate may not be achievable in a highly competitive market. Penetration rates of 33 percent may occur if there are two well-established incumbents (CATV and telephone). The minimum penetration rate to break even on a FTTH investment of this size is — 30 percent.

We have just scratched the surface of understanding what makes a FTTH network profitable and successful. In addition, there are a few key areas where efforts should be focused to increase the success of the network. These areas are:

Engineering, design and reliability — To maximize reliability and inter-network compatibility, you must follow solid engineering practices and deploy a network design that uses high-quality products. It is also important to subcontract to a respectable engineering firm.

Customer Service — To reduce customer churn you must have a responsive, friendly customer service department to handle inquiries in a prompt, courteous fashion.

Sales & Marketing — The penetration rate is one of the vital factors influencing profitability. To maximize penetration, develop a marketing and sales plan that grabs people's attention and clearly communicates the services offered and the advantages of your network.

Competitive service offerings — To reduce customer churn and increase penetration, services should be on par with or better than the competitor's service offerings. For a high-speed data service, offer it with bandwidth that exceeds cable or DSL. For video, don't offer just basic cable with very few channel options. Offer unique services and unique service levels.

As a FTTH network and broadband service provider, if you don't concentrate on these key areas, your customers are not likely to be satisfied. Unhappy customers lead to churn and low penetration rates. Low penetration rates lead to lower profitability and ultimately a dissatisfied network owner.

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