Alberta's Rural Broadband – Economics of the Digital Divide

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1. Executive Summary

Economics is the underlying driving force behind designing, building, and operating all communication networks. The revenue generated from the operation of the network must exceed the network's initial capital investment and the ongoing operating costs. The financial success of any communication network is based on the Revenue per Subscriber, that is, the subscriber density within a geographic area. Urban areas with high density have more opportunity to generate higher revenues than low density rural areas. It is for this reason, that rural communication providers focus on providing communication services to more highly populated rural areas creating an economic "digital divide" for lower density areas.

The financial success for low density rural areas requires selecting a broadband technology and network infrastructure that can support each subscriber's bandwidth requirements and still be financially viable over time. Different broadband technologies may be deployed in rural areas such as: Fibre (Point-to-Point, GPON), Digital Subscribers Line (DSL), Satellite, and Fixed Wireless. Each of these broadband technologies has its own economic benefits and drawbacks. As a result no single broadband technology is suitable for every rural location. The technology chosen to provide broadband access to a rural location should be based on near-term economic considerations. Can the chosen technology support a sustainable Return-On-Investment (ROI) for a three, five, and ten year period? A decision on technology alone in low density rural areas typically leads to poor coverage and inadequate communication services such as : Broadband, Mobility, and First Responders.

A lot of attention is being given to the lack of broadband access in rural areas. The problem is not just a rural broadband issue, it is a rural communications issue. Rural, low user density areas generally have inadequate communication services. But subsidizing communications through government funding in low density rural areas should not be through financing a single broadband network. Instead, for long term economic viability, investors should opt for the development of carrier-grade Rural Communications Networks (RCNs) that support all rural communication requirements.

RCN is a utility unlike power, water, and roads. When a rural municipality designs and builds a water system today, the water distribution network is built anticipating future demands. Rural municipalities, provincial, and federal governments must recognize that communications is also a utility and as such assist private enterprise to design and build communication networks fit for the future.

2. Rural Communications Network

There are four basic types of communication networks. Each network is designed and built to support a single or multiple communication services. (See Table 1: Communication Networks)

Table 1: Communication Networks

Network Type	Service
Public Switched Telephone Network (PSTN)	Voice, Video, Internet
Broadband	Internet, Voice, Video
Broadcast	Video, Voice, Internet
Mobility	Voice, Internet
First Responders	Fire, Ambulance, Police
Enterprise	Private

Each of these networks is typically designed, built, and operated by independent communication providers. Each provider invests capital into their network and then must generate ongoing revenue to operate and upgrade the network as required.

Rural areas currently have adequate availability to the Public Switched Telephone Network (PSTN) supporting voice communications. Voice communications in low-density rural areas is subsidized by the Canadian Radio Television and Telecommunications Commission (CRTC) enforced revenue contribution program. In 2000, the CRTC introduced a national contribution collection mechanism to replace the former per-minute mechanism. The Commission determined that Incumbent Local Exchange Carriers (ILECs), Competitive Local Exchange Carriers (CLECs), Long Distance Providers, Wireless Service Providers, Internet Service Providers (ISPs) and private line service providers are required to contribute to the fund based on their total Canadian Telecommunication Services Revenues (CTSR).

Other communication services in rural areas are not subsidized, and as a result, each provider is responsible for ensuring that there is adequate coverage and the network provides a sustainable Return-On-Investment (ROI). The end result of the poor economics of providing communication services to rural areas is inadequate coverage for all communication services including Broadband, Mobility, and First Responders. It is for this economic reason that government capital funding in rural areas should be invested in a single network infrastructure that supports all communication services.

Investing in a single Rural Communications Network (RCN) provides the ability to share initial capital investment and ongoing operating costs across all communication services.

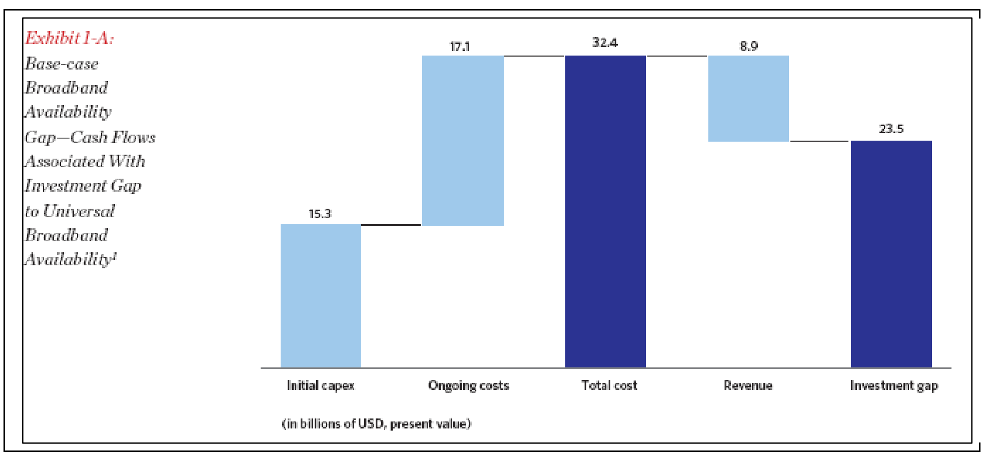
3. Rural Broadband Economics

The traditional business case to provide broadband breaks down in rural areas where the population densities are lower and the cost of implementing a broadband network exceeds potential revenues. To provide affordable broadband service in rural areas, it is necessary to develop a sustainable economic model that proves the business case for a three, five, and ten year period.

Different access technologies may be deployed in rural areas to support broadband services including; Fibre (Point-to-Point, GPON), Digital Subscribers Line (DSL), Satellite, and Fixed Wireless. Each of these access technologies has its benefits and drawbacks, no single technology will be suited to every rural location. The technology chosen for a rural location will primarily based on economic considerations. Can the technology chosen support a sustainable Return-On-Investment (ROI) for three, five, or ten years?

As an example, a recent FCC study stated that it would cost $23.5 billion to deliver broadband services to $14 million estimated unserved rural residents using a combination of DSL and Fixed Wireless, and $62 billion to deploy fibre. Fibre would be the ideal broadband access technology to deploy in both urban and rural areas. The primary drawback to deploying rural fibre is the high cost required to design, build, and operate the network. The FCC report and study is available at: http://download.broadband.gov/plan/the-broadband-availability-gap-obi-technical-paper-no-1.pdf

The report contains an example of a fibre based economic model. The model assumes that fibre is deployed to 7 million homes. The following figure provides a breakdown of the Capital Expenses, Ongoing Operating Costs, Estimated Revenues, and Investment Gap.



The figure shows an initial capital expenses (Capex) of $15.3 billion, Ongoing Costs of $17.1 billion with a total cost of $32.4 billion. The estimated revenue is estimated at $8.9 billion with an investment gap of $23.5 billion. In most cases the Investment Gap exceeds the Initial Capital Investment to design and build the network. As a result a fibre-based rural broadband network must be subsidized either by ongoing government funding or bundled with value-added services such as Internet TV.

The report states that the most economical broadband access technology that can eliminate the investment gap and demonstrate a positive cash flow for the provider is fixed wireless access. The drawback to implementing fixed wireless access versus Fibre or DSL is the access bandwidth available to each subscriber.

4. Total Cost of Ownership (TCO)

A broadband network's Total Cost of Ownership is calculated by estimating both the capital and operating costs over a period of time.

Total Cost of Ownership (TCO) = Capital Costs + Operating Costs/Time

The Total Cost of Ownership must be less than the total revenues if it is to be financially feasible and sustainable for a period of time. If the Total Cost of Ownership is greater than the total revenues the network may have to subsidized with either initial or ongoing government funding.

Total Cost of Ownership (TCO) < Revenues + Funding/Time

Table 2 provides a breakdown of the Total Cost of Ownership of a broadband network.

Table 2: Total Cost of Ownership (TCO)

Total Costs		**Revenues**		
Capital Costs	**Operating Costs**	**Revenues**	+	**Funding**
Design	Operation/Maintenance	Total subscribers		Initial Funding
Implementation	Backhaul (Middle Mile)	Revenue per subscriber		Ongoing Funding
Replacement	Transport (SuperNet)			

The sustainability of a rural broadband network is based upon market forces and the potential need for government funding. The market forces are directly correlated to a rural area's population density. There are three types of rural economic areas:

Type 1: Areas that can be, or are, served by market forces
Capital Costs + Operating Costs ≤ Total Revenues

Type 2: Areas that will need assistance with initial funding to become self-sustaining
Capital Costs + Operating Costs ≤ Total Revenues + Initial Funding

Type 3: Areas that cannot become self-sustaining and will require initial and ongoing funding.
Capital Costs + Operating Costs ≤ Total Revenues + Ongoing/Initial funding

Each type of rural area has a different broadband economic model. The requirement for initial and ongoing funding will be dependent upon Total Cost of Ownership and population densities in each area.

5. Rural Broadband Business Models

Prior to the deployment of a fixed wireless broadband network a rural municipality should have a complete understanding of the different rural broadband business models. The model selected will ensure the network is economically feasible over the long term. There are three fixed wireless broadband business models:

5.1 Single Partnership Model

The rural municipality issues a Request-For-Proposal (RFP) to select a Wireless Internet Service Provider (WISP) partner to provide broadband access in the unserved areas. The WISP partner would be responsible for designing, building, and operating the broadband network. The municipality would be responsible for the initial capital investment and would apply for capital funding from either the provincial or federal governments.

Advantages

- Reduces the WISP capital investment improving their overall cash flow
- Provides basic connectivity to the unserved areas

Disadvantages:

- Reduces market forces in the unserved regions which may ultimately increase costs and reduce services
- WISP may have to be subsidized on an ongoing basis to maintain cash flow
- Ownership of the network infrastructure transfers to the WISP which does not provide the County a long term asset

5.2 Utility Broadband Model

A broadband network has two parts: 1. Access Network (First Mile), and 2. Backhaul Network (Middle Mile). Implementing this model the municipality designs, builds, and owns but does not operate the backhaul network in the unserved broadband areas. This backhaul network designed to extend the Alberta SuperNet into the unserved areas.

An independent backhaul partner would be selected to operate the backhaul network. Multiple WISPs would be allowed to collocate on each of the backhaul towers. The business model is based on collecting collocation revenue from the WISPs which would the subsidize the ongoing operating costs.

A utility broadband model has a capital cost less than the single partnership model because the capital cost of the access equipment becomes the responsibility of the WISP. The municipality would be responsible for the initial capital investment and would apply for capital funding from either the provincial or federal governments.

Advantages

- Lower initial capital investment than the single partnership model
- Reduces the WISP capital investment improving their overall cash flow
- Enhances market forces the unserved broadband regions and will ultimately improve services and reduce costs
- Collocation revenue income subsidizes the monthly operating costs
- Municipality will be able to control which unserved broadband areas get a higher priority

Disadvantages

- More complex implementation than the single partnership model
- Will require ongoing resources to work with WISPs and backhaul partner

5.3 Utility Communications Model

The utility communication model is similar to the utility broadband model, except that it provides structural separation between the backhaul network and multiple communication providers. This backhaul network is designed to support all rural communications including Broadband, Mobility, and First Responders.

Using this model the municipality will design, build, own but does not operate the backhaul network in the unserved broadband and mobility areas. Multiple communication providers would be allowed to co-locate on each of the municipality owned towers. The co-location revenue would subsidize the monthly operating costs of the backhaul network.

The utility communications model network has a higher capital cost of approximately twice that of the utility broadband model. This is due to the higher tower, facility, and backhaul capital costs. The municipality would be responsible for the initial capital investment and would apply for funding from either the provincial or federal governments.

Advantages

- Supports carrier-grade communications in both the broadband and mobility unserved areas
- Eliminates initial capital investment for the backhaul network by each communications provider
- Enhances market forces the unserved regions and will ultimately improve services and reduce costs
- Collocation revenue will subsidize the monthly operating costs
- Municipality will be able to control which unserved regions get a higher priority

Disadvantages

- More complex implementation than the utility broadband model
- Will require ongoing resources to work with access and backhaul partner
- Higher initial capital costs than the utility broadband model

6. Recommendations

1. Rural municipalities need to recognize that rural communications is a utility but differs significantly from water, power, and roads.

2. Planning and deployment of Rural Communications Networks should be based on economic outcomes taking into consideration: topography, population density and projections, future communication demands and the unique features of alternative technologies.

3. Government policies should be harmonized in the development of carrier-grade Rural Communications Networks:
   - Enabling all forms of communications including broadband, mobility, and first responders.
   - Anticipating future demand, warranting design of networks that are scalable.