Transmission’s New Role – Beyond Reliability

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Executive Summary

AltaLink is Alberta’s transmission leader, owning and operating more than 11,000 kilometres of transmission lines and approximately 300 substations. Serving 85 per cent of Alberta’s population, the cost of using AltaLink’s grid has reduced by more than 40 per cent since the opening of deregulation in 1996, while generation capacity in Alberta has risen by 38 per cent and demand has risen by 21 per cent.

After more than 20 years without a significant upgrade to Alberta’s transmission system, the province is positioned to move forward with much needed transmission development for the benefit of Albertans. Transmission has a new role in the electrical industry beyond its cornerstone focus on safety and reliability; transmission can also act to reduce customer’s costs by increasing system efficiency, enhancing market effectiveness, expanding access to the lowest cost generation and protecting customers from price shocks by accessing the most diverse generation fuel sources available.

To fully realize the goals of deregulation, customers will need to access the lowest cost generation sources, reduce their reliance on expensive Transmission Must Run (TMR) generation, continue to develop supply diversity and synergy through interconnections with other regions, and reduce the barriers to transmission investment.

In some circumstances, future transmission development will save customers more than the costs of development through increased efficiency on the province-wide grid. In fact, transmission improvement may go well beyond grid efficiency savings, providing Albertans with substantial generation savings.

However, before beginning the critical investment in the transmission system, three barriers to investment must be broken. Encouraging non-conflicted, independent transmission service providers is the first step. Independent transmission service providers, like AltaLink, have no internal competition for investment capital. Transmission solutions are therefore brought forward without the risk of adversely affecting the profitability of other business lines within the same organization.
The creation of clear, focused government policies on the development of transmission within any electric system is the second essential component to increasing transmission investment. Policies like the Alberta Transmission Development Policy help to stabilize transmission development, thereby securing investors in all sectors of the industry.

Strong regulatory leadership is the third important component required to increase transmission investment. Regulators have the ability to create a stable investment climate by ensuring competitive equity returns for transmission facility owners, enhancing bondholder security and collaborating with transmission owners to provide appropriate technological incentives. Regulators must recognize the vital new role of transmission and secure it for both today’s and tomorrow’s electricity consumer.

Transmission is the backbone of the power system – “the electricity highway.” Yet, transmission represents a very small part of the average utility bill in Alberta – between five and ten percent or less than cent per kW/h. However, despite its relatively small cost, transmission development will significantly improve the Alberta electricity market, creating greater efficiency and effectiveness for Alberta consumers and saving them money.
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Transmission’s New Role – Beyond Reliability

Introduction
AltaLink is Alberta’s largest transmission service provider, serving 85 per cent of Alberta’s population. As the first stand-alone transmission facility provider in Canada, AltaLink owns and operates more than 11,000 kilometres of high-voltage power lines and approximately 300 substations. In an independent benchmarking study of 50 of North America’s top transmission providers, AltaLink was recognized as top quartile in terms of reliability and efficiency and number one in safety.

AltaLink currently holds more than $1 billion in assets. After the successful public offering of $425 million in Senior Secured Bonds in 2003, AltaLink is now a solid A credit stand-alone partnership.

Current Status
After almost 20 years without a significant upgrade to Alberta’s transmission system, the Government of Alberta has positioned the province to move forward with a transmission development policy that will protect and benefit consumers. In so doing, the Government has recognized that transmission has a new role in the electrical industry beyond its cornerstone focus on safety and reliability. Today, transmission can also act to reduce customer’s costs by increasing system efficiency, enhancing market effectiveness, expanding consumer access to the lowest cost generation and protecting customers from electricity price shocks by accessing the most diverse generation fuel sources available.

To strengthen Alberta’s transmission grid and realize the promise of an efficient and effective electricity market for customers, we will need to reduce the barriers to transmission investment, reduce reliance on expensive Transmission Must Run (TMR) generation, continue to develop supply diversity and synergy through interconnections with other regions and access the lowest cost generation sources.
In some circumstances, future transmission development will save customers more than the costs of development through increased efficiency on the province-wide grid. In fact, transmission improvement may go well beyond grid efficiency savings, also providing Albertans with substantial generation savings.

**Transmission Development has Fallen Behind**

The development of North America’s transmission system has fallen behind the development of generation sources. Alberta has seen a similar lag in transmission development as the growth of the province has created the demand for significantly more electricity (Figure 1). Instead of developing transmission, Alberta customers were forced to subsidize high cost generation alternatives to support weaknesses in the transmission grid. Transmission permitting times made these high cost generators our only choice.

The reasons that transmission development has lagged are many, and include low rates of return on investment, long lead times required for transmission permitting that has made generation a more timely solution to transmission congestion, and past policy that was more reactive and short-term focused than proactive thinking on what will truly benefit customers.

![Transmission Investment vs. Generation Development](image)

*Figure 1*
The role of the grid is taking on a new importance beyond public safety. As seen during the August 2003 blackout that affected Ontario and a large portion of the Eastern United States, transmission development has proven crucial to the stability of a region’s economy. In 2003, four separate transmission large-scale blackouts impacted more than 112 million people worldwide. These blackouts underscore the economic and safety role a reliable transmission grid continues to play in our electronic society.

**The Cost of Electricity**

Electricity costs in Alberta have been a lightning rod for debate since the deregulation process began in 1996. Alberta consumers saw an increase in the cost of electricity of more than 75 per cent between 1996 and 2002, with a spike in 2000 due to the combination of skyrocketing natural gas prices and tight supply in the electricity market both in Alberta and across Western North America (Figure 2).

These costs have resulted largely from the increases in the costs of generating electricity. As Alberta has grown, the province has become more reliant on natural gas as a source of fuel for electricity generation. This reliance has left the electricity pricing largely subject to the factors that influence the price of natural gas.

While the overall cost of electricity has increased, the cost for transmission has actually decreased during the same period. The cost of running the AltaLink
transmission assets (Alberta’s largest) has been reduced by more than 40 per cent between 1996 and 2002 (Figure 3). During the same time period more than 3,000 MW of generation was added to Alberta’s grid, an increase of 38 per cent. The economic growth of the province has also created an increase in demand, especially in the southern region of Alberta. The annual peak demand for electricity has increased 21 per cent since 1996. The Alberta grid has been forced to transport significantly more power from an even larger number of geographically dispersed suppliers, and it has done so at a lower cost to consumers.

Despite the increase in both generation and demand, through prudent management transmission costs remain a very small portion of the average power bill. Today it represents between five and ten per cent – less than half a cent per kW/h – of an average electricity bill.

Examining the comparative costs of generation,
distribution, system and support services against the cost of transmission losses, TMR (and other transmission costs) and Transmission Facility Owner (TFO – such as AltaLink) wires costs demonstrates the relatively small contribution transmission makes to the total cost of delivered energy (Figure 4). And the cost of transmission facility ownership and grid operation is even smaller when the costs of transmission are broken down (Figure 5). As shown in this graph, the most volatile growth components of the overall transmission charge is the cost of Transmission Must Run (TMR) coupled with the costs of system losses.

**The New Role of Transmission**

Transmission in today’s marketplace can accomplish more than the provision of safe and reliable service. Transmission will serve the market in three other capacities: increased efficiency on the grid, enhanced market effectiveness and expanded access to the lowest cost, diverse fuel sources.

**Efficiency**

Transmission development has the ability to significantly increase the efficiency on today’s heavily loaded grids across North America. Because of the lack of transmission development during the past 20 years, the system is operating at close to its peak capacity today and as a result, transmission losses are increasing and costing consumers money.
As electricity is transmitted through the high-voltage system there is a natural loss of energy in the form of heat. Because customers ultimately pay for these “system losses,” the Alberta Electric System Operator (AESO) has a mandate to optimize system efficiency.

Losses can have a huge impact on consumers. From June 1998 to December 2002, more than 12 million MWh of electricity was released in the form of these losses (Table 1). That amounts to more than $880 million that consumers in Alberta were required to pay as part of their electricity rates. Transmission investment is the key to reducing this cost burden.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost of Losses (Based on Market Price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>$56,411,473</td>
</tr>
<tr>
<td>1999</td>
<td>$101,256,412</td>
</tr>
<tr>
<td>2000</td>
<td>$403,945,787</td>
</tr>
<tr>
<td>2001</td>
<td>$200,972,256</td>
</tr>
<tr>
<td>2002</td>
<td>$117,892,819</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$880,418,307</strong></td>
</tr>
</tbody>
</table>

*Table 1*

*Market Effectiveness*

Transmission is the single most powerful mechanism still available to consumers to ensure access to the lowest priced generation.

In Alberta, the lowest cost generation resources are distant from the load centres, and will only be developed if physical and policy constraints relating to transmission are removed. Alberta’s Transmission Development Policy (TDP) is designed to help remove some of these constraints, enabling Albertans to access the low cost generation wherever it may be located.

Transmission will link these low cost generators to the customer load centres in the province, reducing the regional market power of individual generators and thereby providing customers with true choice. By introducing more generators to the market from low cost power regions like Fort McMurray’s large co-generation capacity or the large
coal-burning thermal plants in central Alberta, transmission creates downward pressure on electricity prices, reducing the ultimate cost to customers.

Bringing low cost electricity to the market will also help to alleviate Alberta’s reliance on costly, customer subsidized Transmission Must Run (TMR) generation. TMR generation was brought in to southern Alberta because the demand for electricity in the southern region of the province was growing faster than the existing transmission system could support. The solution was for consumers to subsidize otherwise uneconomic natural gas generation plants close to the load centres – a solution that today continues to cost Albertans money.

**Fuel Diversity**

Alberta is uniquely positioned in the Pacific Northwest as one of the only electric systems built primarily on thermal generation. In 2002, coal and natural gas fueled 91 per cent of Alberta’s electricity generation. However, Alberta is located adjacent to a huge hydro generating system in British Columbia and connected to the larger U.S. Pacific Northwest grid, which generates approximately 32,000 MW from hydro sources. Diagram 1 reveals the fuel diversity in the Pacific Northwest.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>22%</td>
<td>62%</td>
<td>3%</td>
</tr>
<tr>
<td>Hydro</td>
<td>85%</td>
<td>29%</td>
<td>60%</td>
</tr>
<tr>
<td>Gas</td>
<td>10%</td>
<td>9%</td>
<td>15%</td>
</tr>
<tr>
<td>Other</td>
<td>5%</td>
<td>9%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Alberta is currently heavily dependent on natural gas generation to produce its electricity, which in itself is not bad, however it does leave customers at the mercy of natural gas
pricing trends that will impact the price of electricity. When electricity prices spiked in 2000, the primary cause was record high natural gas prices and tight generation supply that drove electricity prices up some 400 per cent over 1996 prices. High and volatile prices have had an impact on Alberta’s electricity consumers. An example of the price fluctuation can be seen in Figure 6.

Not unlike diversifying one’s investments, transmission can reduce Alberta’s reliance on thermal production by increasing the diversity of fuel sources to be accessed by the grid. Interconnection of Alberta’s wind-generating resources will also help to provide more diversity of electricity fuel costs in the province. By using interconnections with British Columbia in abundant water years, Alberta can capitalize on the resulting relatively low cost hydro-generated electricity during times of high gas prices.

Accessing a greater diversity of generation sources will reduce the price volatility that has seen electricity prices rise and fall with the price of natural gas. This stability will help to alleviate consumer concerns about the electric industry and its seemingly constantly fluctuating prices.

![Hourly Pool Price - Oct. 19 - Oct. 25, 2003](image)

**Figure 6**

**How Do We Strengthen the Grid?**

Almost twenty years have passed since the last upgrade to Alberta’s core transmission grid. Since then, significant increases in demand and generation capacity have put
pressure on the grid to continue to perform at a safe and reliable level. The grid needs to be reinforced to ensure Albertans have the safe and reliable power supply while realizing the gains of an efficient and effective electricity market. There are four key areas of focus to accomplish this: reduce the barriers to transmission investment; reduce Alberta’s reliance on TMR generation; continue to develop regional interconnections; and, increase access to the lowest cost generation.

Reduce Barriers to Transmission Investment
Transmission investment has lagged behind the development of generation across North America. For years, barriers to growth have made transmission the less attractive investment opportunity in the development of the electric system. These barriers include: low rates of return on investment; the lengthy permitting process for transmission projects; the uncertainty for investors of their ability to cover costs; and, the lack of incentives to take technological risk.

Breaking these barriers to investment will help to strengthen the grid in Alberta. Encouraging non-conflicted, independent transmission service providers is the first step. Independent transmission service providers, like AltaLink, have no internal competition for investment capital. Transmission solutions are therefore brought forward without the risk of adversely affecting the profitability of a generation business within the same organization.

Clear, focused policies on the development of transmission within an electric system are the second essential component to reducing the barriers to transmission investment. The Alberta Government’s Transmission Development Policy (TDP) is a key to securing the future benefits for today’s and tomorrow’s customers, promoting as it does:

- Proactive planning for transmission projects;
- A congestion-free grid under normal conditions;
- Specific time limits on permitting processes; and
- Regional interconnections that benefit all customers.
Policies like the TDP help to stabilize transmission development, thereby securing investors in all sectors of the industry. Generators have greater assurances that transmission will be available to meet their needs, and investors have the security of knowing that transmission development will continue to be a priority in Alberta.

Strong regulatory leadership is the third important component required to reducing the barriers to transmission investment. Regulators have the ability to create a stable investment climate by ensuring competitive equity returns for transmission facility owners, enhancing bondholder security and working with transmission owners to develop appropriate technological incentives. It is now critical to focus on investment stability and cost efficiency as we move into a new capital-intensive build cycle in Alberta and across all North American markets. Regulators must recognize the vital new role of transmission and secure its value for both today’s and tomorrow’s electricity consumer.

*Reduce Reliance on TMR generation*

Significant higher cost Transmission Must Run (TMR) generation was introduced to the Alberta market to support the over-burdened transmission system caused by the expanding demand of the southern region of the province. These generators were able to proceed through the permitting and construction processes much faster than the transmission development that could have satisfied the demand. Because of the urgency of the demand and the time required to obtain necessary transmission development approvals, Albertans were ultimately forced to sacrifice value for speed of development.

Today, Alberta consumers continue to subsidize those same TMR generators. The cost of subsidizing TMR generation that has been passed on to Alberta consumers totals some $143 million since 2001 (Table 2). More than 750 MW of higher cost customer subsidized TMR generation is already in place in Alberta. In addition to their high cost, these generation subsidies interfere significantly with the effectiveness

<table>
<thead>
<tr>
<th>TMR Costs</th>
<th></th>
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<tbody>
<tr>
<td>2001</td>
<td>$75.5 million</td>
</tr>
<tr>
<td>2002</td>
<td>$34.3 million</td>
</tr>
<tr>
<td>2003</td>
<td>$33.6 million</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$143.4 million</strong></td>
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</table>

Table 2
of the market. Transmission development is a more reliable solution that can strengthen the grid by limiting the role that costly TMR generation plays in our system.

**Interconnections – Value and Security**

During Alberta’s last significant transmission build cycle, the 500 kV interconnection with British Columbia opened Alberta’s thermal market up to the value of being connected to the adjacent hydro facilities in British Columbia. The result was increased security and lowered costs as Alberta has been able to import less expensive “stored” electricity during times of high thermal prices, relieving the burden on the consumer.

Because Alberta electricity is primarily fueled by thermal generation, the ideal generation companion to Alberta is a hydro-based system. Large thermal generators operate most efficiently when run continuously, whereas hydro generation can more easily be brought online or taken offline during times of shortage or excess. The resulting partnership between the two allows for hydro generation to deliver its stored electricity to Alberta, providing a lower-cost source of electricity during times of high demand. When demand is low, hydro stations can shut down and “store” the water, while consumers can rely on power from Alberta’s continually running thermal system to support their needs.

Interconnections, such as the 500 kV tie between Alberta and British Columbia, also increase the number of generators available to a market, helping to lower overall costs. Accessing more low cost generators not only reduces the average cost of electricity, it also significantly helps to lower volatility of power prices in Alberta by adding another fuel source.

**Unlocking Access to Low Cost Generation**

No longer is transmission required solely to ensure reliable supply. It is now vital to have sufficient, fairly priced transmission to ensure the efficiency and the effectiveness of the competitive market. In other words, transmission is vital if consumers are to be provided with access to choose the lowest cost generation in the most efficient manner possible. For example, if transmission capacity into a region is constrained, generators in the
constrained region can exert market power at opportunistic times. Investment in transmission will eliminate this inefficiency and ensure the market works for the benefit of all consumers.

Alberta’s lowest cost generation sources are distant from its load centres. Coal-fired generation in central Alberta and high efficiency co-generation from northern Alberta produce some of Alberta’s lowest priced electricity while Alberta’s primary load centres are in the southern region of the province. Because of the congestion that exists on the grid, consumers are forced to pay high losses costs and premiums for higher priced, regional generation sources.

Transmission is the electricity highway between generation and load. Through transmission development and the reduction of congestion on the grid, low cost generation will be positioned to better meet Albertans growing demand for electricity.

**The Time for Transmission**

Alberta has not seen significant transmission development since the early 1980s. Since that time, the province has experienced large increases in generation capacity and demand. To continue to reliably meet the needs of Albertans, and to ensure that the electricity market functions effectively and efficiently, transmission development is a must.

Transmission by its very nature is developed in a cyclical pattern. Not unlike our valuable highway system, initial construction costs may seem high; however the long life span of transmission assets (30 to 40 years) and their ability to attract more electricity generators makes transmission development a cost-effective solution to Alberta’s electricity needs. Albertan spends between $3 and $5 billion per year on electricity. Even a very large $1.5 billion transmission build-out will cost (excluding transmission benefits) only two per cent of what consumers will pay for their electricity over the next 20 years.
As shown in Figure 7, Alberta’s load has increased on a steady plane while cumulative transmission investment has grown in stages during the same time – a fact that does not change in a regulated or deregulated environment. Transmission is developed in these cyclical “lumps” in investment followed by long periods where the system meets the needs of consumers. The long life span of transmission assets balances the initial cost of development.

Can the Grid Pay for Itself?
Inefficiencies on Alberta’s transmission system create opportunities for transmission development to make immediate, significant impacts to the electricity market. In fact, one such proposal that has been extensively studied is AltaLink’s North-South Upgrade project.

Upgrading the Edmonton-Calgary transmission system is the critical first step in deploying transmission solutions to facilitate an efficient and effective electricity market. The existing transmission system between the Edmonton and Calgary regions is near its transfer limit, and the growing demand for electricity in Southern Alberta will drive a reliability reinforcement of this system within the next few years. The North-South Upgrade will:
Substantially reduce the amount of transmission losses;
Increase the capacity to transfer power;
Better enable customers to access more competitive generation; and
Increase the reliability of electrical service in Southern Alberta.

The North-South Upgrade project will bring considerable net benefits to Albertans. As shown in Table 3, the full lifetime cost of the project will be approximately $230 million. Compare that with an estimated $320 million reduction in the Alberta Electric System Operator’s (AESO) revenue requirement for transmission losses alone, and the project has clear benefits for Albertans.

In addition to reducing the AESO’s revenue requirement, the North-South Upgrade project is also expected to reduce energy prices for consumers. Generators bid their hourly costs, including losses, into the power pool. Since the North-South Upgrade project reduces transmission losses, generators’ input costs will be reduced. These lower input costs should result in lower bids, and therefore lower power pool prices for the benefits of all consumers (See “Additional Pool Price Savings to Consumers” in Table 3). Assuming the AESO’s current practice of allocating transmission losses to generators is continued, the total estimated direct benefit of the project rises to $775 million, as shown in Table 3. This translates into an estimated net benefit to consumers of $545 million over the life of the project.

<table>
<thead>
<tr>
<th>Costs</th>
<th>Present Value 2003 $Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital, operating &amp; losses during construction</td>
<td>$230</td>
</tr>
<tr>
<td><strong>Direct Benefits</strong></td>
<td></td>
</tr>
<tr>
<td>Reduced AESO Revenue Requirement for transmission losses</td>
<td>$320</td>
</tr>
<tr>
<td>Additional Pool Price Savings to Consumers</td>
<td>$455</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$775</td>
</tr>
<tr>
<td><strong>Net Benefits</strong></td>
<td>$545</td>
</tr>
</tbody>
</table>

*Table 3*
While AltaLink has not quantified benefits beyond those detailed in Table 3, the North-South Upgrade project will also facilitate greater market effectiveness, including improved access for consumers to lower cost generation, no new subsidies to TMR generation, increased reliability and reduce greenhouse gas emissions. The effect of these additional benefits is illustrated in Diagram 2.

**Transmission is the Key**

Transmission plays a more critical role in today’s electricity market than ever before. It is the final step in unlocking the value in Alberta’s deregulated generation market. Beyond providing safe and reliable service, transmission provides the opportunity for an efficient and effective system that provides benefits to consumers – benefits that include increased access to low cost generators, lower prices for electricity and reduced price volatility.

Alberta’s transmission grid can be strengthened by: reducing the barriers to transmission investment, reducing Alberta’s reliance on costly, consumer-subsidized TMR generation, developing valuable interconnections with other electric systems, and expanding access to the lowest cost generation.

Transmission represents a very small part of the average utility bill in Alberta – between five and 10 percent or less than half a cent per kW/h. However, despite its relatively small cost, prudent transmission development can significantly improve the Alberta electricity market, by creating greater efficiency, reliable and secure supply while saving
Alberta consumers money. This is the value we are all looking for in our homes, businesses and on our power bills.