Canadian Energy Research Institute

Capacity of the Western Canada Natural Gas Pipeline System

SUMMARY REPORT – VOLUME 2

Peter H. Howard P.Eng
David McColl
Dinara Millington
Paul R. Kralovic

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Authors:
Peter Howard
David McColl
Dinara Millington
Paul R. Kralovic

CANADIAN ENERGY RESEARCH INSTITUTE
#150, 3512 – 33 STREET NW
CALGARY, ALBERTA
CANADA T2L A6

TELEPHONE: (403) 282-1231

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CHAPTER 1
INTRODUCTION

The performance of the pipeline system in Western Canada will be a critical issue for the North American natural gas marketplace over the next decade as additional supplies from within the Western Canada Sedimentary Basin (WCSB) along with Canadian and US northern frontiers, transit the area.

This study is motivated by expected changes in the regional distribution of gas production within Western Canada, and by the introduction of new gas flows from northern sources—the Mackenzie Delta and the North Slope of Alaska. These changes are expected to have significant impacts on pipeline capacity utilization within and from Western Canada. Pipeline capacity utilization will also be impacted by changes in deliveries to accommodate increased gas requirements for planned oil sands projects in northeastern Alberta. Alternative scenarios will consider the timing and sequencing of natural gas volumes entering or bypassing the Canadian pipeline systems from a variety of potential supply sources.

This summary report consists of four chapters. Chapter 2 provides a brief description of the base case and possible flow scenarios as described in Volume 1 of the report. Chapter 3 describes the individual pipeline expansion scenarios and the possible increase or decrease in annualized tolls for several of the major pipelines. Chapter 4 contains several conclusions.

The report focuses the analysis on four scenarios that deal with transporting Alaskan gas to the mid continent area near Chicago.

- Scenario “3” examines the change in annual tolls as a result of transporting approximately 40 percent of the Alaskan gas volume by the Alliance Pipeline system and the remaining 60 percent by a combination of TCPL Alberta, Northern Border Pipeline, TCPL East and TCPL Northern Ontario. This equates to a split at Boundary Lake, Alberta of 1,890 mmcf/day to Alliance and 2,610 mmcf/day to TCPL Alberta.

- Scenario “3A” examines the change in annual tolls as a result of transporting approximately 60 percent of the Alaskan gas volume by the Alliance Pipeline system and the remaining 40 percent by a combination of TCPL Alberta, Northern Border Pipeline, TCPL East and TCPL Northern Ontario. This equates to a split at Boundary Lake, Alberta of 2,730 mmcf/day to Alliance and 1,770 mmcf/day to TCPL Alberta.

- Scenario “4” examines the change in annual tolls as a result of transporting 100 percent of the Alaskan gas by the Alliance Pipeline system.

- Scenario “5” examines the change in annual tolls as a result of transporting 100 percent of the Alaskan gas by TCPL Alberta, Northern Border Pipeline, TCPL East and TCPL Northern Ontario.

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CHAPTER 2
WESTERN CANADA EXPORT AND FRONTIER PIPELINES

2.1 Background

The existing pipeline infrastructure in Western Canada (Alberta and British Columbia) has an average annual export capacity of 14,890 mmcf/day (419,510 e^3m^3/day)[1] for the 2005/2006 design year. The average annual export capacity is a measure of 100 percent design capacity, taking into account seasonal temperature swings, minus a percentage to cover planned maintenance and unplanned outages. Figure 2.1 details the breakdown of this basin capacity into the contributing pipelines that export natural gas out of Alberta and British Columbia for deliveries to Eastern Canada and the United States.

Figure 2.1
Current Export Capacity by Pipeline

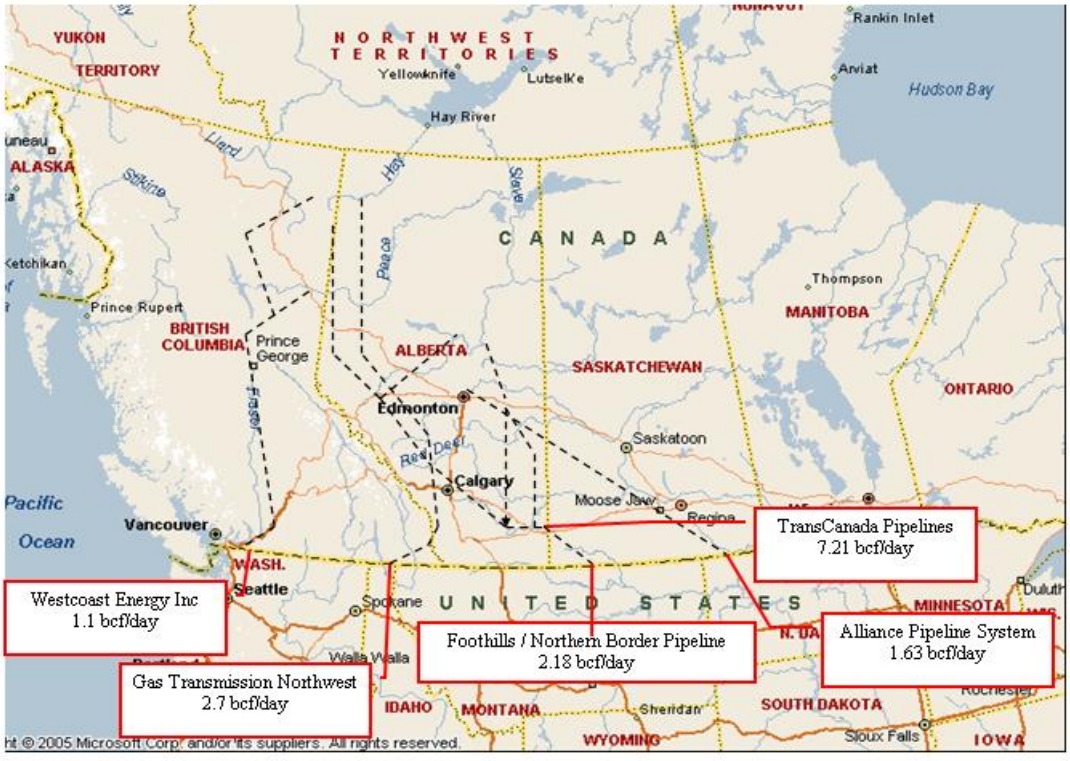


Table 2.1 compares the 2005/2006 design capacity with the 2005 annual average daily export volumes for the various export locations. The 2005 annual average daily export volume is 12,433 mmcf/day (350,290 e^3m^3/day).

[1] TCPL, Canadian Mainline Throughput Study, Appendix G, 2006.

Table 2.1
Existing Border Delivery Volumes

Pipeline	Border Point	2005/2006 Design Capacity (mmcf/day)	2005 Annual Average Daily Rate (mmcf/day)	2005 Average Utilization (%)
TCPL Eastern Mainline	Empress, Alberta	7,210	5,470	88[a]
	Suffield Pipeline		360	
	Transgas receipts		490	
Foothills/NBPL	Monchy, Saskatchewan	2,180	1,978	91
TCPL Western Mainline	ABC Border, Alberta	2,770	1,780	64
Alliance Pipeline	Elmore, Saskatchewan	1,630	1,605	98
Westcoast Energy Pipeline	Sumas, British Columbia	1,100	750	68
	Total	**14,890**	**12,433**	**83**

[a]TCPL East includes Empress, Suffield Pipeline (AB sourced gas) and Transgas receipts.

2.2 Base Case Forecast

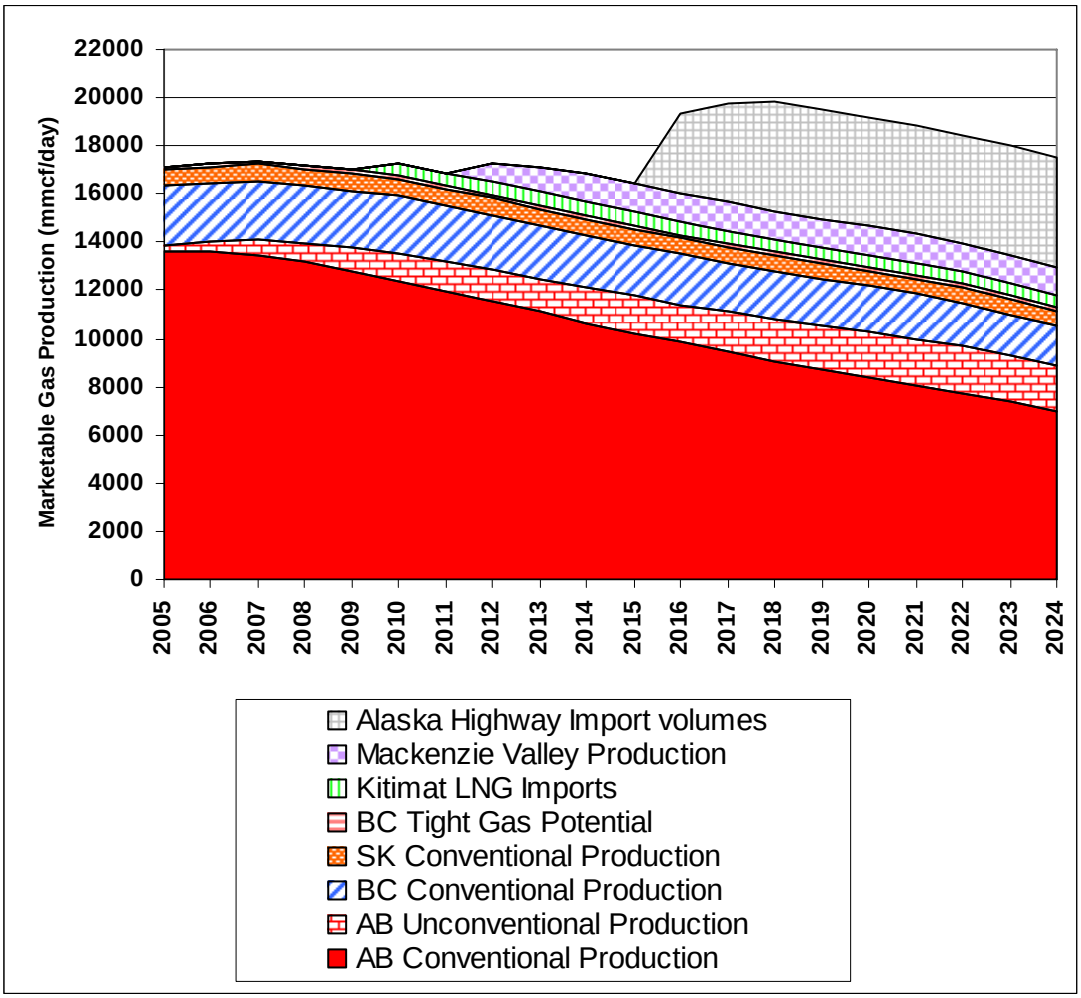
One of the goals of this study is to determine the spare capacity that could potentially exist in the future for the intra provincial and export pipelines. This spare capacity could be utilized to assist in transporting the volumes of gas from the Mackenzie Valley Gas Pipeline and the Alaska Highway Gas Pipeline to market. In order to determine the amount of spare export capacity, the study first forecasted the future supply of natural gas originating from the Western Canada Sedimentary Basin (WCSB). After accounting for projected demand for gas in Alberta and BC, the study subsequently determined the spare capacity for the intra Alberta, intra BC and export pipelines. Alberta production connected to the Suffield pipeline along with Saskatchewan-sourced production transported by TransGas, and delivered to TCPL, were connected to the TCPL East pipeline downstream of Empress.

Figure 2.2 details the base case supply forecast for the WCSB including British Columbia, Alberta and Saskatchewan. It appends the estimated production forecasts for the Mackenzie Valley Gas Pipeline project, the Kitimat LNG terminal and the Alaska Highway Gas project.

The Alberta and British Columbia conventional supply curves represented in Figure 2.2 were determined through the use of a computer model that takes into account historical information to estimate initial production rates for new wells, current production rates for existing wells, and decline rates for all wells. Saskatchewan conventional supply,[2] British Columbia tight gas,[3] Kitimat LNG[4] and Mackenzie Valley supply[5] were determined from external sources and appended to the chart.

[2] NEB, Canada's Energy Future: Scenarios for Supply and Demand to 2025, July 2003.
[3] TCPL, Canadian Mainline Throughput Study, Keystone Pipeline Transfer Application, June 2006.
[4] Pan EurAsian Enterprises Inc, North American Terminal Survey, Liquefied Natural Gas Import and Regasification.
[5] Wright Mansell Research Ltd, An Evaluation of the Economic Impacts Associated with the Mackenzie Valley Gas Pipeline and Mackenzie Delta Gas Development, 2004.

Figure 2.2
Western Canada Gas Production Forecast
(Including Mackenzie Valley and Alaska Highway production)



The EUB,[6] CERI,[7] and the NEB[8] have forecasted an increase in industrial usage of natural gas in the Alberta oil sands sector. This coupled with a computer-modeled decline in production from conventional gas resources from Alberta will lead to reduced deliveries to the TCPL East pipeline. Although quantities of gas from coalbed methane (CBM)--most notably, Alberta's Horseshoe Canyon Coal seam--have grown over the past several years, this increase has just managed to hold the line on total marketable gas production from Alberta. In the future, further advances in CBM production will reduce the degree of production decline from the WCSB but will not be able to reverse the declining trend.

[6] EUB, EIB-ST98-2006, Alberta's Energy Reserves 2005 and Supply/Demand Outlook.
[7] CERI, Oil Sands Update: Production Outlook and Supply Costs 2006-2020, December 2006.
[8] NEB, Oilsands Industry Update: Production Outlook and Supply Cost 2006 to 2020, November 2006.

Figures 2.3 and 2.4 compare the base case border deliveries for seven specified years against the current indicated capacity (Capacity) along with any additional capacity that has been proposed (Add Capacity), minus any capacity reductions, (Rem Capacity) as in the case of the TCPL Keystone project.

The vertical axis on the left side of these diagrams relates to the capacity of the individual export pipelines and is shown as the boxed area spanning the individual bars. The vertical axis on the right side of the diagram relates to the average daily flow rate (mmcf/day) for the individual export pipelines and is shown as the individual vertical bars for the years 2006, 2012, 2014, 2016, 2018, 2019, and 2020.

Figure 2.3 shows that delivery volumes by the Alliance pipeline are held constant at 1,630 mmcf/day (45,925 e^3m^3/day), while the Northern Border, Gas Transmission Northwest (TCPL West Design Area) and TCPL East are declining as a result of declines in the basin projected supply. TCPL East also receives gas downstream of Empress by the Suffield Pipeline along with Saskatchewan-sourced gas delivered by TransGas Limited.

Figure 2.3
WCSB Export Pipelines: Alberta East Deliveries
Base Case Border Deliveries versus Export Capacity

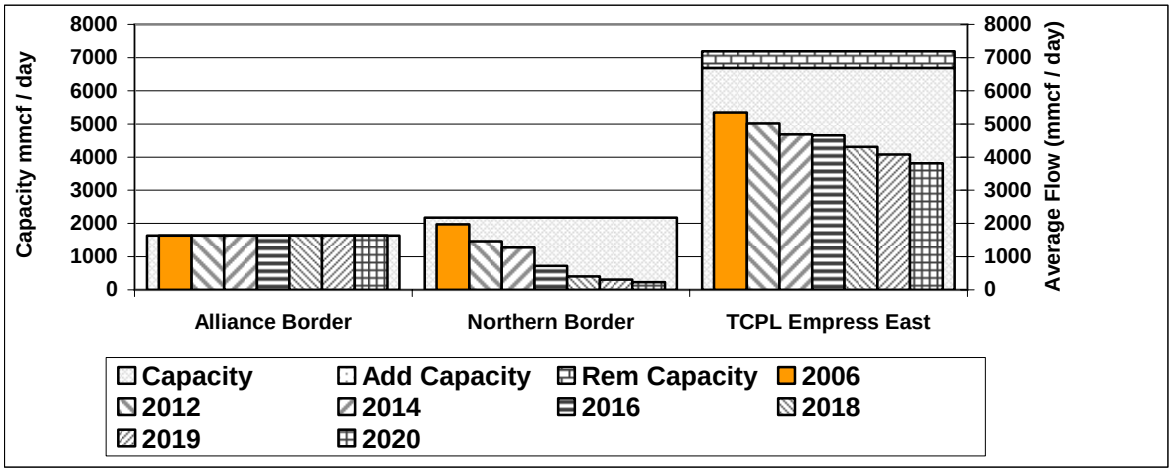
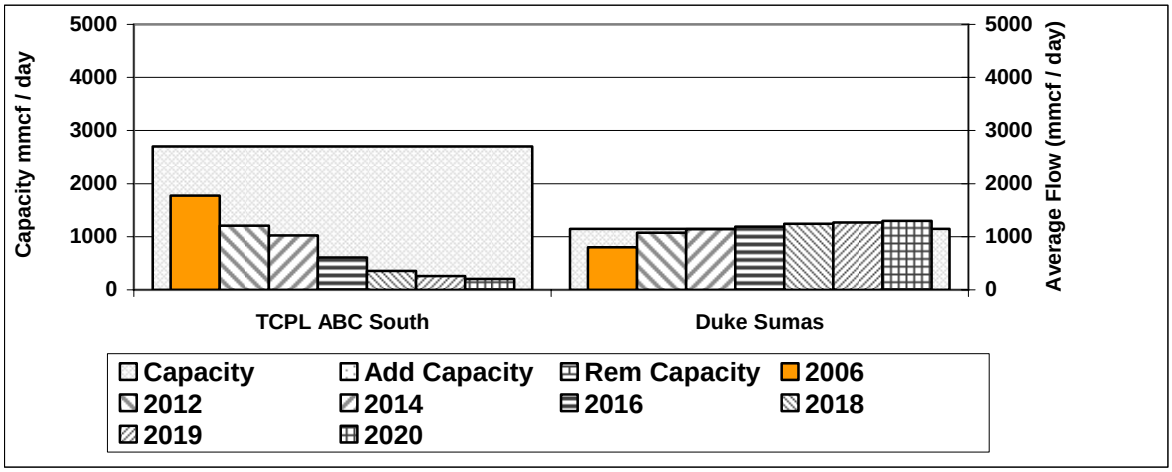


Figure 2.4 shows the deliveries to the GTN pipeline (TCPL ABC South), which delivers gas to the Idaho, Oregon and California markets, also declining as a result of the projected decline in supply from the Alberta portion of the WCSB. This figure also shows the projected deliveries from the Southern Mainline section of the Duke Gas Pipeline (Duke Sumas) in British Columbia. Increases in deliveries to the BC lower mainland and exports to the growth markets along the I5 corridor in Washington State are a result of increased development of new gas supplies in Northeast BC and the construction of the LNG terminal at Kitimat, British Columbia.

Figure 2.4
WCSB Export Pipelines: PNW Deliveries
Base Case Border Deliveries versus Export Capacity



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CHAPTER 3
COST AND TOLL PARAMETERS

3.1 Summary of Costs and Tolls for Northern Pipelines

A more detailed summary of the required facilities, flow volumes, capital costs and tolls for the Mackenzie Valley Pipeline and the Alaska Highway Pipeline is available in the main report.

Total capital cost for the Mackenzie Valley Pipeline section is estimated to be $7.82 billion Canadian dollars (2006 dollars) and the estimated average firm transportation toll for years 2 through 6 would be $2.28 per thousand cubic feet or $2.18 per million British Thermal Units (btus) assuming a heat content of 1,045 btu/cuft. In addition to the reservation charge, the variable charge for the fuel usage would be approximately $0.16 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf.

The Alaska Highway pipeline is divided into two sections, the United States section between Prudhoe Bay, Alaska and the Alaska/Yukon border, and the Canadian section between the Alaska/Yukon border and Boundary Lake, Alberta. The total capital cost for the Alaska section is estimated to be $14.5 billion Canadian dollars (2006 dollars) and the estimated average firm service toll for the first five years would be $1.13 per thousand cubic feet or $1.04 per million btus assuming a heat content of 1,090 btus/cuft. In addition to the reservation charge, the variable charge for the fuel usage would be approximately $0.09 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf.

The Yukon and British Columbia section of the Alaska Highway Pipeline is estimated to cost $16.4 billion Canadian dollars (2006 dollars), and the estimated average firm service toll for the first five years would be $1.36 per thousand cubic feet--or $1.25 per million btus--assuming a heat content of 1090 btus/cuft. In addition to the reservation charge, the variable charge for the fuel usage would be approximately $0.10 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf.

3.2 Alliance Pipeline Ltd.

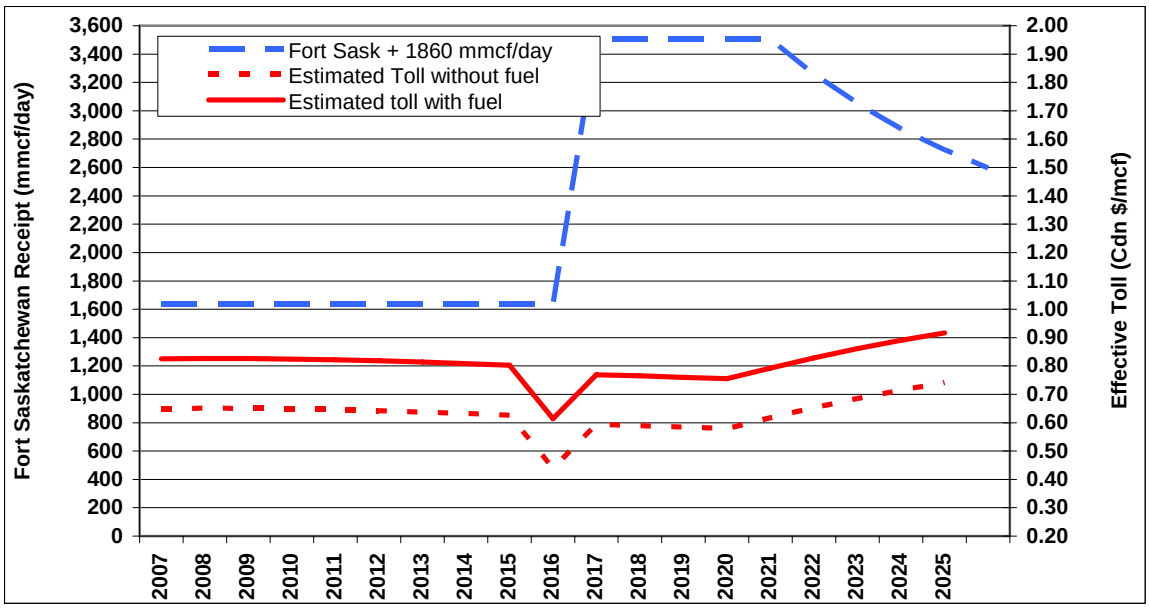
3.2.1 Alliance Pipeline Ltd.: Scenario #3 (Alaska Volume to Alliance = 1,890 mmcf/day)

The addition of twelve intermediate compressor stations and a complete 36 inch loop from Fort Saskatchewan to Aux Sable would boost the pipeline capacity to 3,505 mmcf/day (98,750 e^3m^3/day). This expansion would permit the pipeline to handle an additional volume of 1,875 mmcf/day assumed to be from the Alaskan gas pipeline. In addition, a connector pipeline consisting of 355 miles of 36 inch pipe and three compressor stations (each with a single 16 megawatt gas turbine) would be constructed to connect Boundary Lake, Alberta to Fort Saskatchewan, Alberta. The Boundary lake receipt volume would be 1,890 mmcf/day, with 1,875 mmcf/day delivered to the Alliance pipeline system at Fort Saskatchewan.

The connector pipeline is estimated to cost $1.6 billion Canadian dollars (2006 dollars) with an estimated average firm service toll for the first five years of $0.42 Cdn/mcf or $0.38 per million btus assuming a heat content of 1,090 btus/cuft. In addition to the reservation charge, the variable charge for the fuel usage would be approximately $0.05 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf.

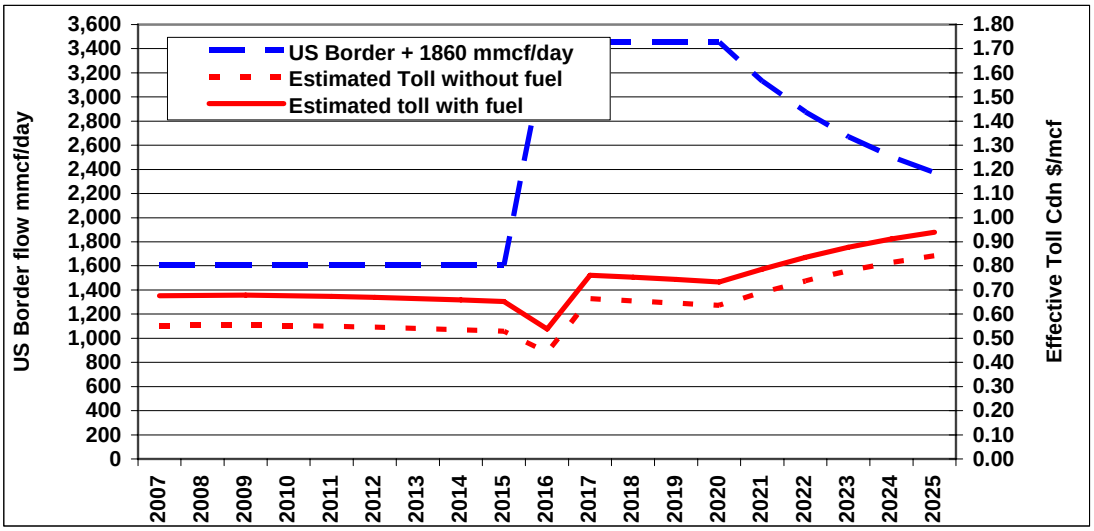
The expansion of the Alliance pipeline mainline between Fort Saskatchewan, Alberta and the US border at Elmore, Saskatchewan as well as the US border and Aux Sable, Illinois would cost $2.60 billion Canadian dollars and $3.60 billion Canadian dollars, respectively. Figures 3.1 and 3.2 indicate that the combined reservation toll for the Alliance pipeline for the 2017-2021 period would range from $1.25 to $1.30 Cdn/mcf.[9] In addition, the variable charge for fuel usage would be approximately $0.27 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf. This results in a total toll of $1.52 to $1.57 Cdn/mcf.

Figure 3.1
Alliance Pipeline: Scenario #3, Tolls
Fort Saskatchewan, Alberta to Elmore, Saskatchewan
(Alaska incremental flow volume = 1,890 mmcf/day)



[9] Tolls from Figures 3.1 and 3.2 must be summed to reflect the total Alliance Pipeline from Fort Saskatchewan, Alberta to Aux Sable, Illinois.

Figure 3.2
Alliance Pipeline: Scenario #3, Tolls
US Border to Aux Sable, Illinois
(Alaska incremental flow volume = 1,890 mmcf/day)



3.2.2 Alliance Pipeline Ltd.: Scenario #3A (Alaska Volume to Alliance = 2,730 mmcf/day)

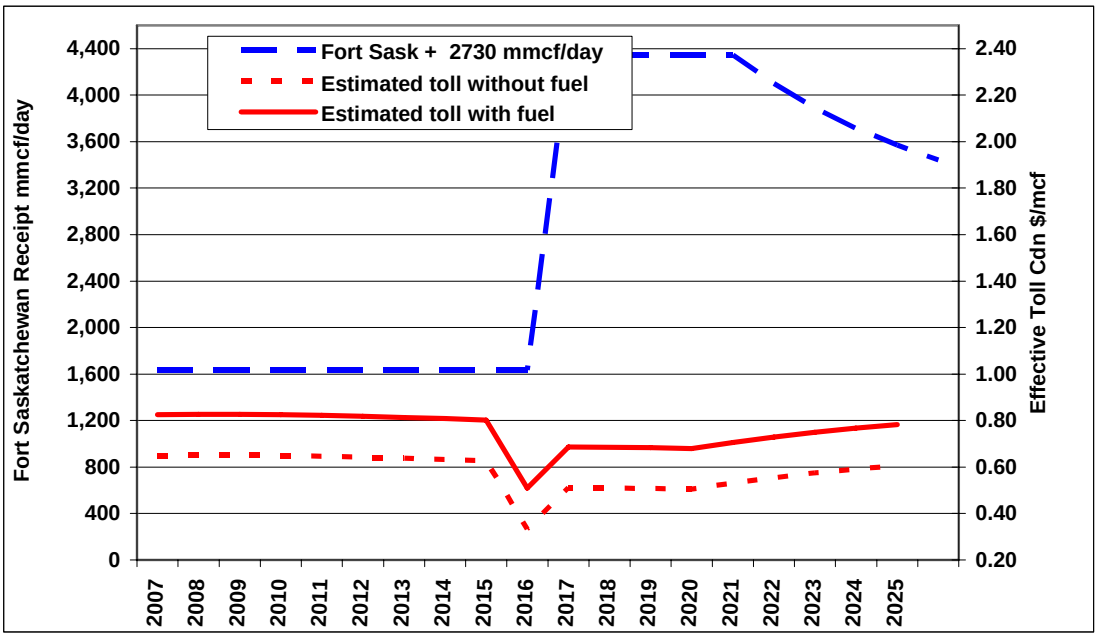
The addition of twelve intermediate compressor stations, expansion of all stations and a complete 36 inch loop from Fort Saskatchewan to Aux Sable would boost the pipeline capacity to 4,338 mmcf/day (122,218 e^3m^3/day). This expansion would permit the pipeline to handle an additional 2,715 mmcf/day of Alaskan gas volumes.

In addition, a connector pipeline consisting of 355 miles of 42 inch pipe and three compressor stations (each with a single 21 megawatt gas turbine) would need to be constructed from Boundary Lake, Alberta to Fort Saskatchewan, Alberta. The connector receipt volume would be 2,730 mmcf/day with 2,715 mmcf/day delivered to the Alliance high-pressure pipeline system at Fort Saskatchewan, Alberta.

The connector pipeline is estimated to cost $2.05 billion dollars, and the estimated average toll for the first five years is $0.36 Cdn/mcf or $0.33 per million British Thermal units (btus), assuming a heat content of 1,090 btus/cuft. In addition, the variable charge for fuel usage would be approximately $0.04 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf.

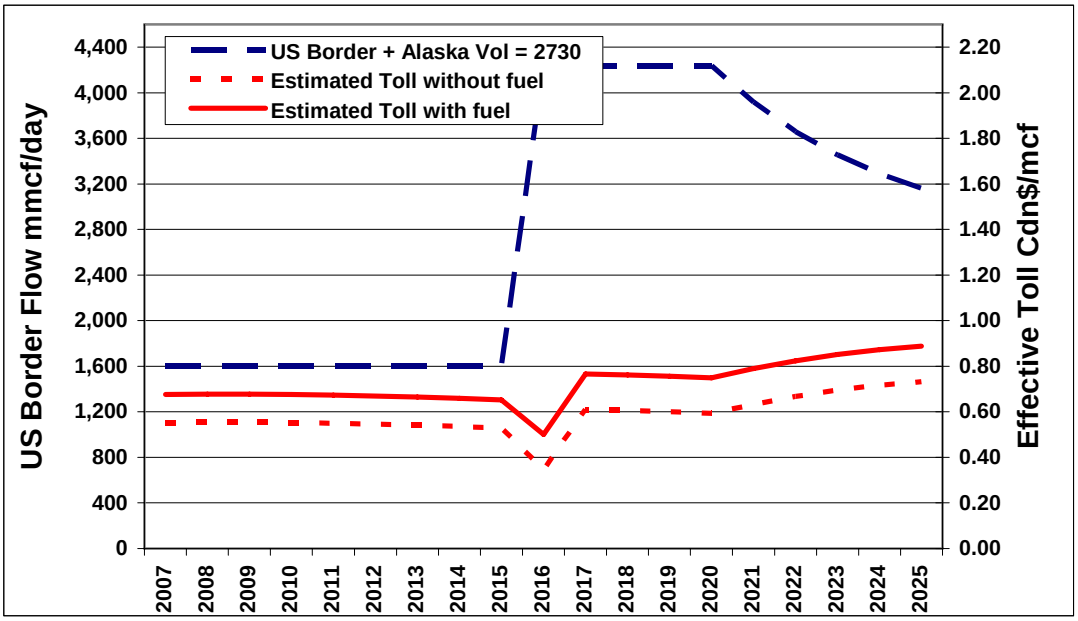
The expansion of the Alliance pipeline mainline between Fort Saskatchewan, Alberta and the US border at Elmore, Saskatchewan as well as the US border and Aux Sable, Illinois would cost $3.36 billion dollars and $4.78 billion dollars, respectively. Figures 3.3 and 3.4 indicate that the combined reservation toll for the Alliance pipeline for the 2017-2021 period will range from $1.12 to $1.16 Canadian dollars per thousand cubic feet.[10] In addition, the fuel component of the toll will be approximately $0.33 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf. This results in a total toll of $1.45 to $1.49 Cdn/mcf.

Figure 3.3
Alliance Pipeline: Scenario #3A, Tolls
Fort Saskatchewan, Alberta to Elmore, Saskatchewan
(Alaska incremental flow volume = 2,730 mmcf/day)



[10] Tolls from Figures 3.3 and 3.4 must be summed to reflect the total Alliance Pipeline from Fort Saskatchewan, Alberta to Aux Sable, Illinois.

Figure 3.4
Alliance Pipeline: Scenario #3A, Tolls
US Border to Aux Sable, Illinois
(Alaska incremental flow volume = 2,730 mmcf/day)



3.2.3 Alliance Pipeline Ltd.: Scenario #4 (Alaska Volume to Alliance = 4,500 mmcf/day)

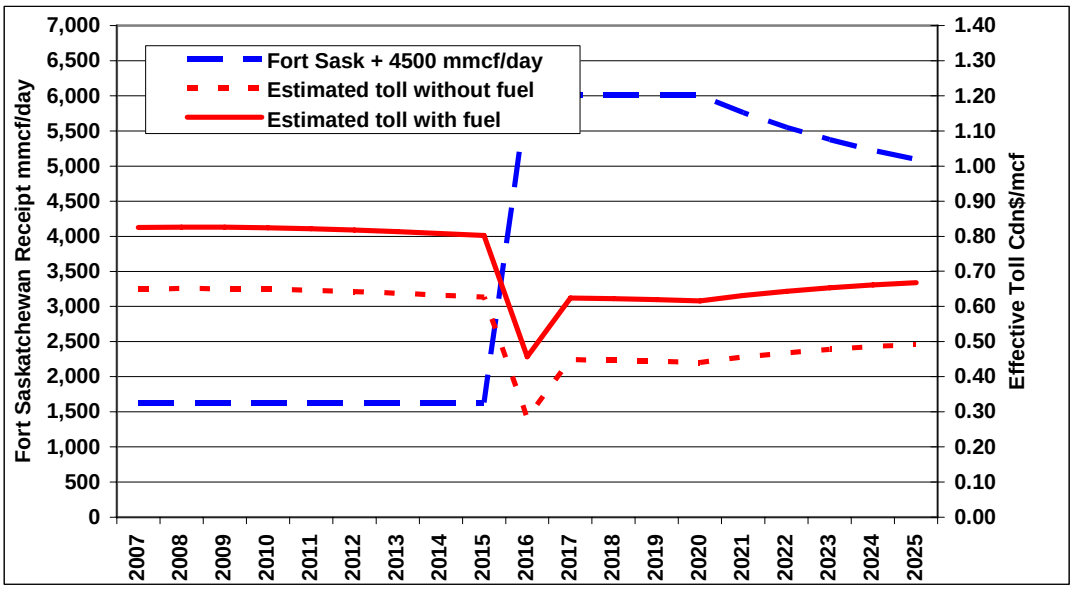
The addition of twelve intermediate compressor stations, expanding each compressor station, and a complete 48 inch loop would boost the pipeline capacity to 6,094 mmcf/day (171,692 e^3m^3/day). This expansion would permit the pipeline to handle an additional 4,500 mmcf/day of Alaskan gas volumes available at Boundary Lake.

In addition, a connector pipe consisting of 355 miles of 48 inch pipe and three compressor stations (each with a single 23 megawatt gas turbine) would need to be constructed from Boundary Lake, Alberta to Fort Saskatchewan, Alberta. The connector receipt volume would be 4,500 mmcf/day with 4,470 mmcf/day delivered to Alliance at Fort Saskatchewan, Alberta.

The connector pipeline is estimated to cost $2.59 billion dollars (2006 dollars) and the estimated average firm service toll for the first five years would be $0.27 Cdn/mcf or $0.24 per million btus assuming a heat content of 1,090 btus/cuft. In addition, the variable charge for fuel usage would be approximately $0.04 Cdn/mcf based on a fuel gas price of $6.50 Cdn/mcf.

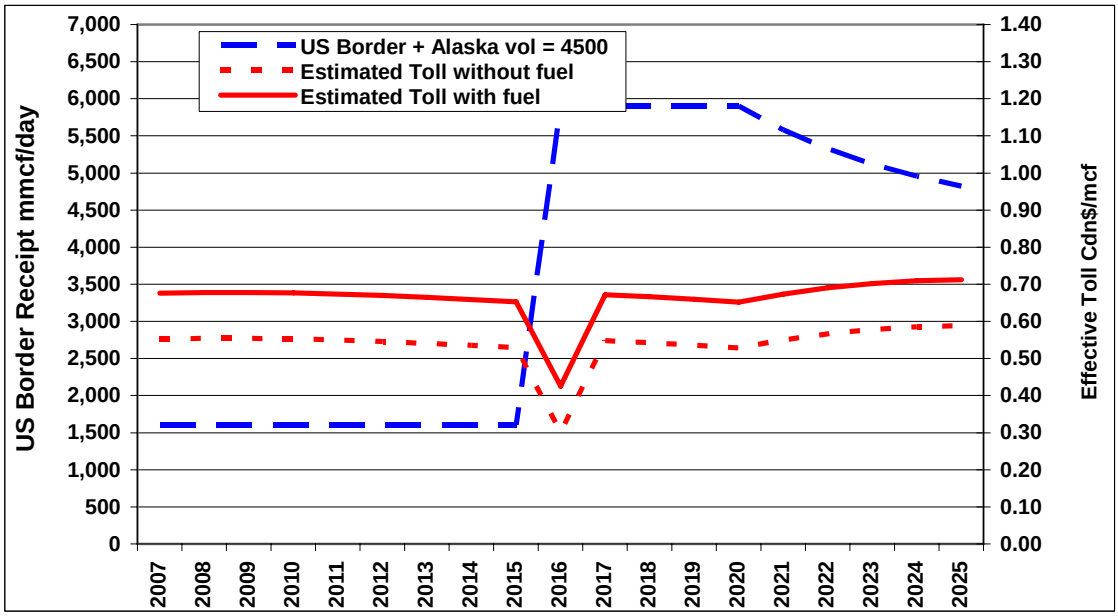
The expansion of the Alliance pipeline between Fort Saskatchewan, Alberta and the US border at Elmore, Saskatchewan as well as the US border and Aux Sable, Illinois would cost $4.58 billion dollars and $6.47 billion dollars, respectively. Figures 3.5 and 3.6 indicate that the combined reservation toll for the Alliance pipeline for the 2017-2021 period would range from $0.98 to $1.00 Cdn/mcf.[11] In addition, the variable charge for fuel usage would be approximately $0.30 Cdn/mcf, based on a fuel gas price of $6.50 Cdn/mcf. This results in a total toll of $1.29 to $1.30 Cdn/mcf.

Figure 3.5
Alliance Pipeline: Scenario #4, Tolls
Fort Saskatchewan, Alberta to Elmore, Saskatchewan
(Alaska incremental flow volume = 4500 mmcf/day)



[11] Tolls from Figures 3.5 and 3.6 must be summed to reflect the total Alliance Pipeline from Fort Saskatchewan, Alberta to Aux Sable, Illinois.

Figure 3.6
Alliance Pipeline: Scenario #4, Tolls
US Border to Aux Sable, Illinois
(Alaska incremental flow volume = 4,500 mmcf/day)



3.3 TCPL Alberta Integrated System

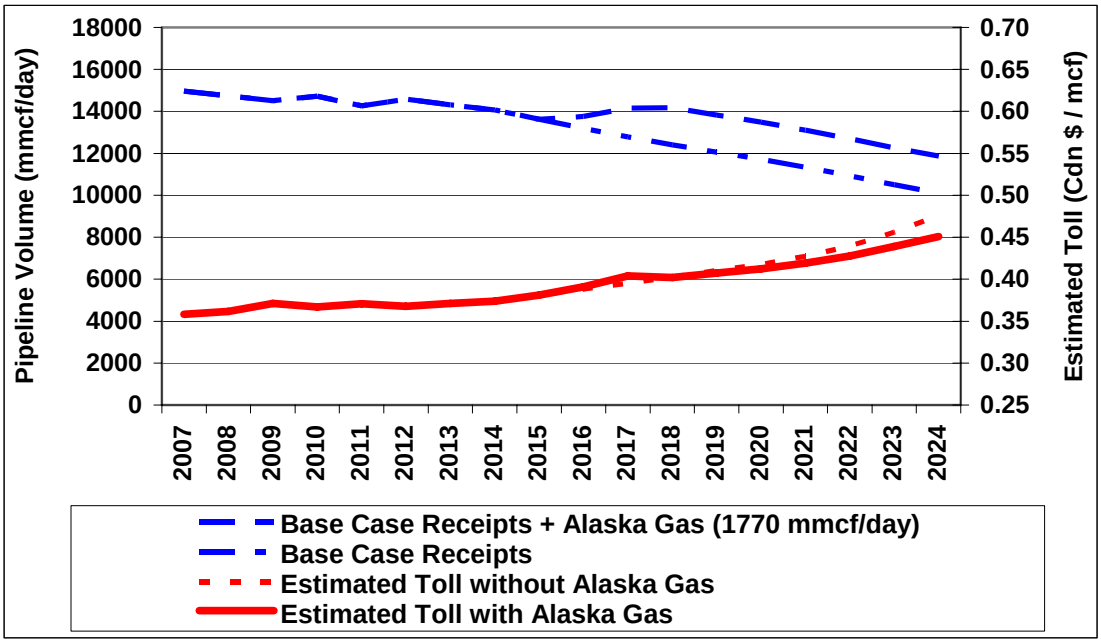
3.3.1 TCPL Alberta Integrated System: Scenario #3A (Alaska Volume to TCPL= 1,770 mmcf/day)

The Alaska volume delivered to Boundary Lake, Alberta will start in 2016 and reach the 4,500 mmcf/day level by 2018. After accounting for the volume transferred to the Alliance Pipeline, the remaining gas would be transported on the TCPL Alberta system from Boundary Lake, Alberta, south to James River, Alberta and then east to Empress, Alberta or south to the ABC border. Scenario 3A assumes that for the years 2018 and beyond, the transfer volume to the Alliance Pipeline would be 2,730 mmcf/day resulting in a volume delivered to the TCPL Alberta system equaling 1,770 mmcf/day.

In the Base Case, it was assumed that the North Central Corridor (NCC) would be constructed prior to 2012 with a receipt capacity of 700 mmcf/day. This connector pipeline would permit gas volumes to move from the Upper Peace River area to the Upper Bens Lake area to assist in supplying natural gas to the oil sands projects. In order to minimize the addition of facilities between Boundary Lake, Alberta and Edson, Alberta (Central and Lower Peace areas), the study assumed the NCC connector would be expanded to a capacity of 1,700 mmcf/day. For this scenario, this level of development of the NCC connector minimizes the facilities required in the Lower Peace River, Edson mainline and the eastern and western mainline systems within Alberta. The cost of the original construction of the NCC prior to 2012, the expansion of the NCC to handle the additional volume, and the expansion facilities in the Peace River area were included as rolled in costs in order to determine the resultant toll for the Alberta System (Figure 3.7).

Figure 3.7 indicates that the addition of 1,770 mmcf/day of Alaska volumes to the base case volumes for TCPL Alberta, commencing in 2016, results in a savings of two to three cents per thousand cubic feet in tolling charges for 2021 to the end of the forecast.

Figure 3.7
TCPL Alberta: Scenario # 3A, Flows and Tolls
Boundary Lake, Alberta to Empress, Alberta
(Alaska incremental flow volume = 1,770 mmcf/day)

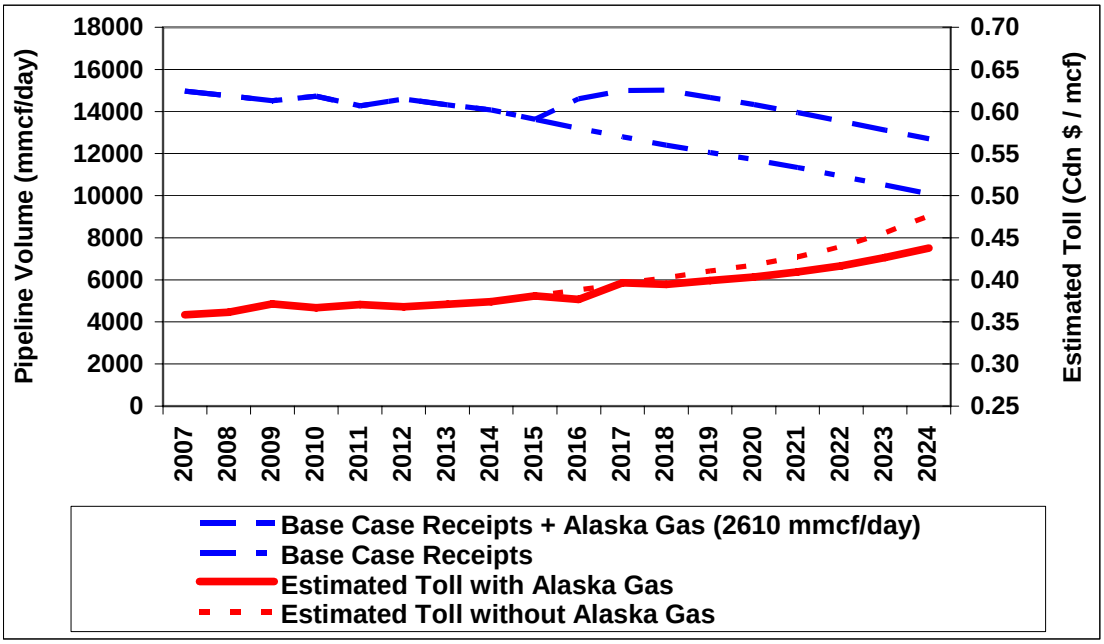


3.3.2 TCPL Alberta Integrated System: Scenario #3 (Alaska Volume to TCPL= 2,610 mmcf/day)

Scenario 3 assumes the transfer volume at Boundary Lake to the Alliance Pipeline system would be 1,890 mmcf/day. As a result of this assumption, the gas volume delivered to TCPL Alberta would be 2,610 mmcf/day. In the Base Case, it was assumed that the NCC would be constructed prior to 2012, with a capacity of 700 mmcf/day. In order to minimize the addition of facilities between Boundary Lake, Alberta and Edson, Alberta (Central and Lower Peace areas) the study assumed the NCC connector would be expanded to a capacity of 2,100 mmcf/day. For this scenario, this level of development of the NCC connector minimizes the facilities required in the Lower Peace River, Edson mainline and the eastern and western mainline systems within Alberta. The cost of the original construction of the NCC prior to 2012, the expansion of the NCC to handle the additional volume and the expansion facilities in the Peace River area were included as rolled-in costs in order to determine the resultant toll for the Alberta System (Figure 3.8).

The addition of 2,610 mmcf/day of Alaska volumes to the base case volumes transported by TCPL Alberta, commencing in 2016, results in an average savings of two to three cents per thousand cubic feet in tolling charges (Figure 3.8) for the 2018 to 2021 time period. This savings grows to five cents per thousand cubic feet near the end of the forecast.

Figure 3.8
TCPL Alberta: Scenario # 3, Flows and Tolls
Boundary Lake, Alberta to Empress, Alberta
(Alaska incremental flow volume = 2,610 mmcf/day)

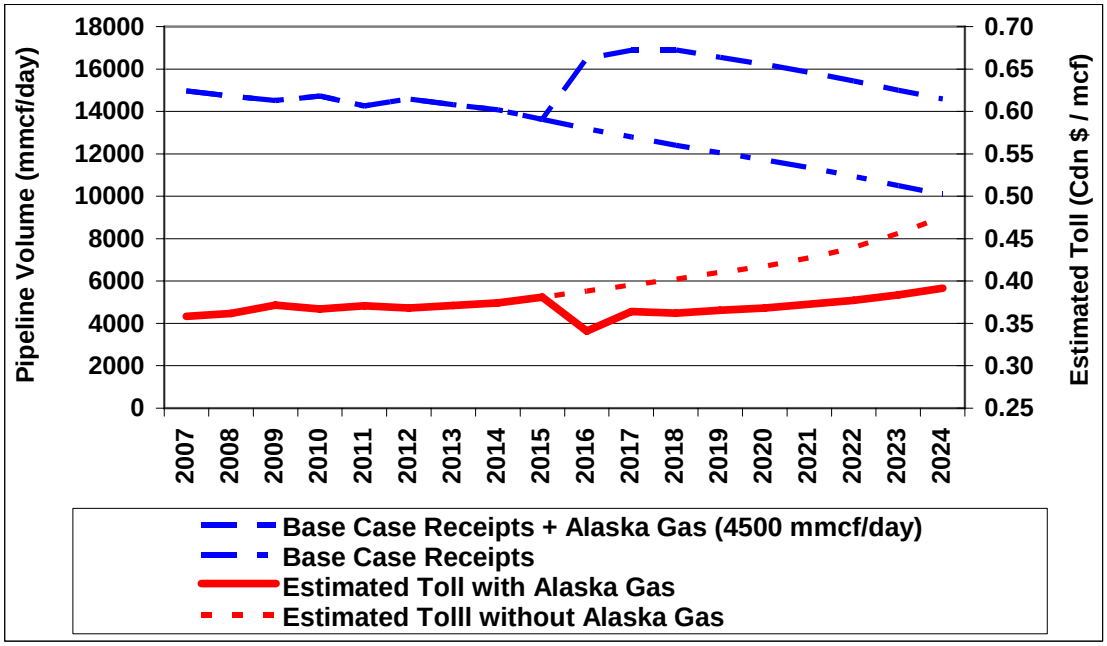


3.3.3 TCPL Alberta Integrated System: Scenario #5 (Alaska Volume to TCPL= 4,500 mmcf/day)

Scenario 5 assumes the total volume of Alaska gas would be delivered to TCPL Alberta at Boundary Lake. In the Base Case, it was assumed that the NCC would be constructed prior to 2012, with a capacity of 700 mmcf/day. In order to minimize the addition of facilities between Boundary Lake, Alberta and Edson, Alberta (Central and Lower Peace areas) the study assumed the NCC connector would be expanded to a capacity of 2,300 mmcf/day. For this scenario, this level of development of the NCC connector minimizes the facilities required in the Lower Peace River, Edson mainline, and the eastern and western mainline systems within Alberta. The cost of the original construction of the NCC prior to 2012, the expansion of the NCC to handle the additional volume, and the expansion facilities in the Upper Peace River area were included as rolled in costs in order to determine the resultant toll for the Alberta System (Figure 3.9).

The Alaska Highway pipeline is assumed to commence operation in 2016 with an initial flow volume of 3,300 mmcf/day. It is further assumed that the pipeline will reach its design flow level of 4,500 mmcf/day, delivered to Boundary Lake, in 2018. The addition of 4,500 mmcf/day to the transported volume by TCPL Alberta, commencing in 2018, results in an approximate savings of five to seven cents per thousand cubic feet in tolling charges (Figure 3.9) for the 2018 to 2021 time period. This savings grows to almost ten cents per thousand cubic feet by the end of the forecast.

Figure 3.9
TCPL Alberta: Scenario #5, Flows and Tolls
Boundary Lake, Alberta to Empress, Alberta
(Alaska incremental flow volume = 4,500 mmcf/day)



3.4 Empress/McNeill to Chicago

Volumes of gas delivered to the Empress/McNeill export location can be delivered to the mid-west area of the United States by means of the TCPL East system, the Northern Border Pipeline System, or a combination of the two.

The TCPL East system transports Alberta gas received at Empress, Alberta, along with additional volumes from the Suffield pipeline and TransGas connections, to a point south of Winnipeg, Manitoba where the flow can follow two separate paths. At the Winnipeg bifurcation point, gas can be transported by the Great Lakes Gas Transmission System (capacity 2,200 mmcf/day) for delivery to the Michigan markets, St. Claire area and connection with the Dawn hub, or by the TCPL Northern Ontario System (capacity 4,500 mmcf/day) and TCPL Eastern Zone for delivery to the Toronto area and connection with the Dawn hub. Exchange volumes on the Union Gas Dawn/Parkway system, the Vector Pipeline,[12] and ANR Pipeline systems[13] would result in gas being delivered to the Chicago area markets.

[12] Vector Pipeline extends from south of Chicago to the St. Claire connection with Union Gas Pipeline and the Dawn, Ontario hub.
[13] ANR Pipeline transports natural gas from Texas and the Gulf of Mexico to Illinois, Michigan, Indiana, Ohio and the St. Claire connection with Union Gas.

3.5 Foothills Saskatchewan Pipeline

The Foothills Alberta Pipeline parallels the TCPL Alberta pipeline system from Caroline, Alberta to Empress, Alberta. Transportation tolls for this section of the Foothills Pipeline system (Zone 6) are included in the TCPL Alberta integrated toll under the financial item "Transportation by Others" (TBO). At Empress the flow stream is processed by five straddle plant operations (capacity 8,700 mmcf/day) before being directed to the TCPL East mainline and the Foothills Saskatchewan pipeline. The Foothills Saskatchewan pipeline operates as one tolling zone (Zone 9) within Foothills Pipe Lines Ltd. and transports gas from the McNeill Border to Monchy, Saskatchewan. Custody of the natural gas is passed to Northern Border Pipelines Ltd. at this point.

As described previously, delivery of gas to the Empress/McNeill border points is forecasted to decline as a result of declining basin production and demand increases in the oil sands sector in Alberta. The net result of this situation is an increase of pipeline spare capacity in the export pipelines, which leads to an increase in transportation tolls for those pipelines. Transporting Alaska volumes to the US midwest would involve utilizing part, or all, of the spare capacity on the TCPL East, TCPL Northern Ontario, TCPL Eastern Zone, Great Lakes Transmission, and Northern Border pipelines. In order to estimate a suitable split in the flows directed to each of the export pipeline systems, a range of incremental flow volumes was investigated and the resultant tolls were compared. Figure 3.10 shows the volume profiles on the Foothills Saskatchewan Pipeline as a result of adding incremental flows of 400, 600, and 1,200 mmcf/day. It also shows the volume profile, assuming the incremental Alaska volumes reach the capacity level of each pipeline. Figure 3.11 shows the effect on future toll structures as a result of varying the flows transported by this pipeline.

From these curves it can be estimated that in order to minimize the effect of reduced flows and increasing tolls, a minimum volume of 1,200 mmcf/day should be directed to the Northern Border pipeline. Under Scenario 3A, 1,200 mmcf/day would be directed to NBPL, and 430 mmcf/day to TCPL East. Under Scenario 3, approximately 1,200 mmcf/day would be directed to each pipeline. Finally, under Scenario 5, approximately 1,750 mmcf/day would be directed to NBPL and 2,620 mmcf/day to TCPL East. This effectively reflects the operation of these pipelines at their capacity levels for several years until the continued decline in the WCSB basin flows again causes the load factors to fall.

Figure 3.10
Foothills Pipe Lines (Saskatchewan)
Base Case plus Incremental Flow Comparison

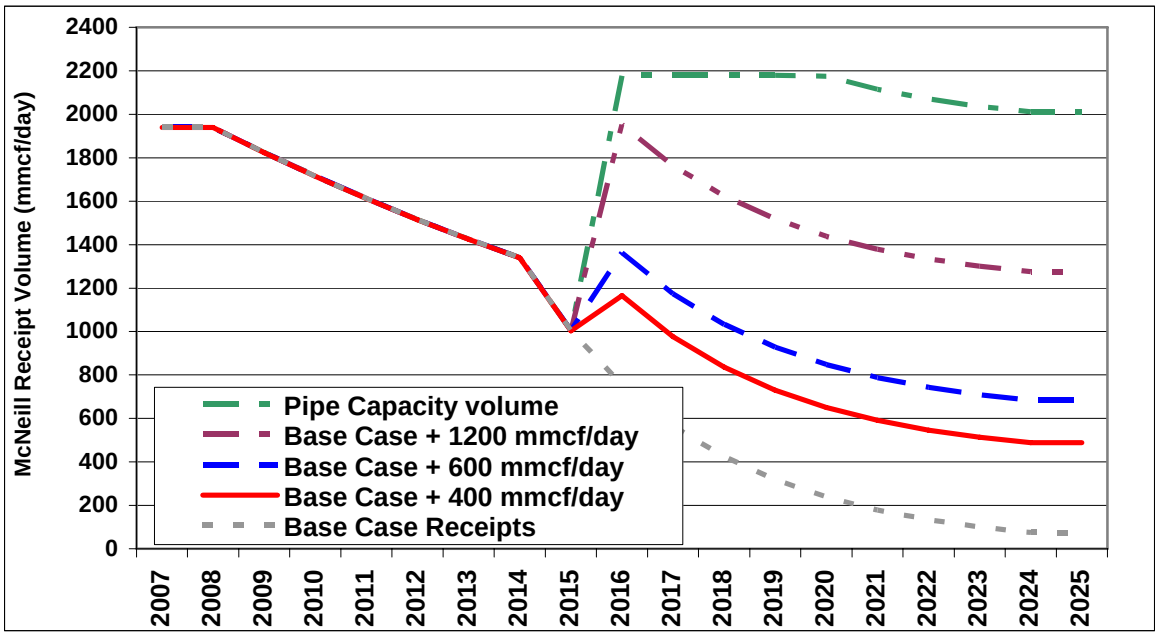
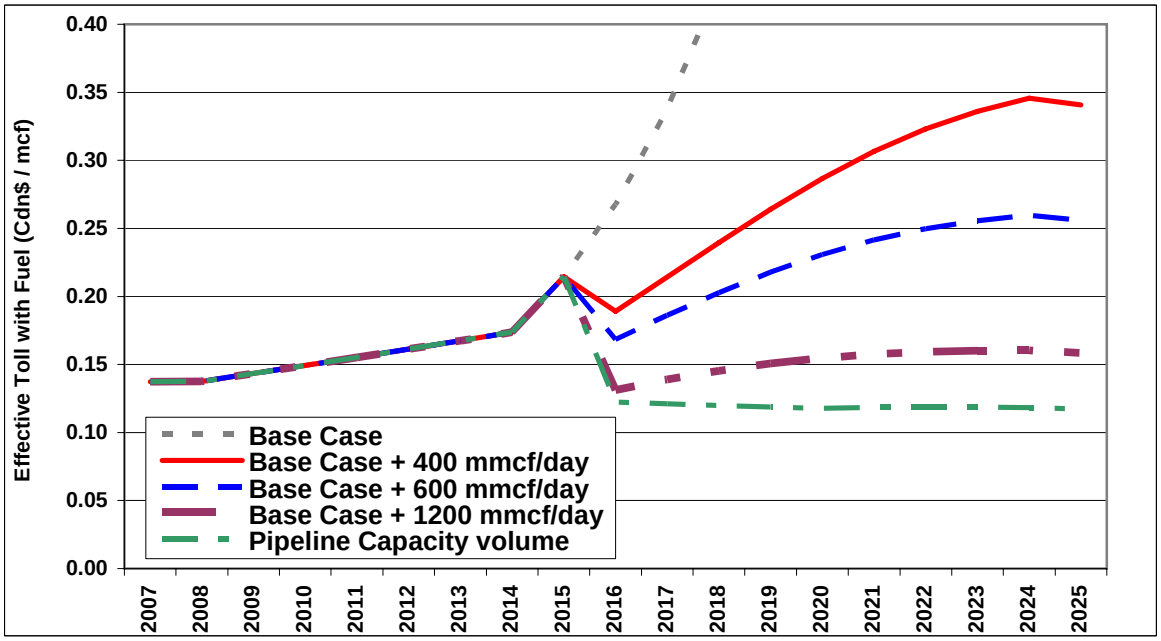


Figure 3.11
Foothills Pipe Lines (Saskatchewan)
Base Case plus Incremental Toll Comparison



3.6 Northern Border Pipeline (NBPL)

The Northern Border Pipeline receives the majority of its transport volume from the Foothills Saskatchewan pipeline near Monchy, Saskatchewan and transports that volume to Iowa, Illinois and Indiana, where it interconnects with several interstate pipelines.

Figures 3.12 and 3.13 show the annual receipt volume and expected toll as a result of directing quantities of Alaska gas to the Foothills Saskatchewan pipeline for delivery to the Northern Border Pipeline.

The assumptions used for the Foothills Saskatchewan pipeline are replicated in these figures to estimate the level of flow that would minimize the combined toll for use of these pipelines and the TCPL East, and TCPL Northern Ontario pipelines.

Figure 3.12
Northern Border Pipeline: Monchy to Chicago
Base Case plus Incremental Flow Comparison

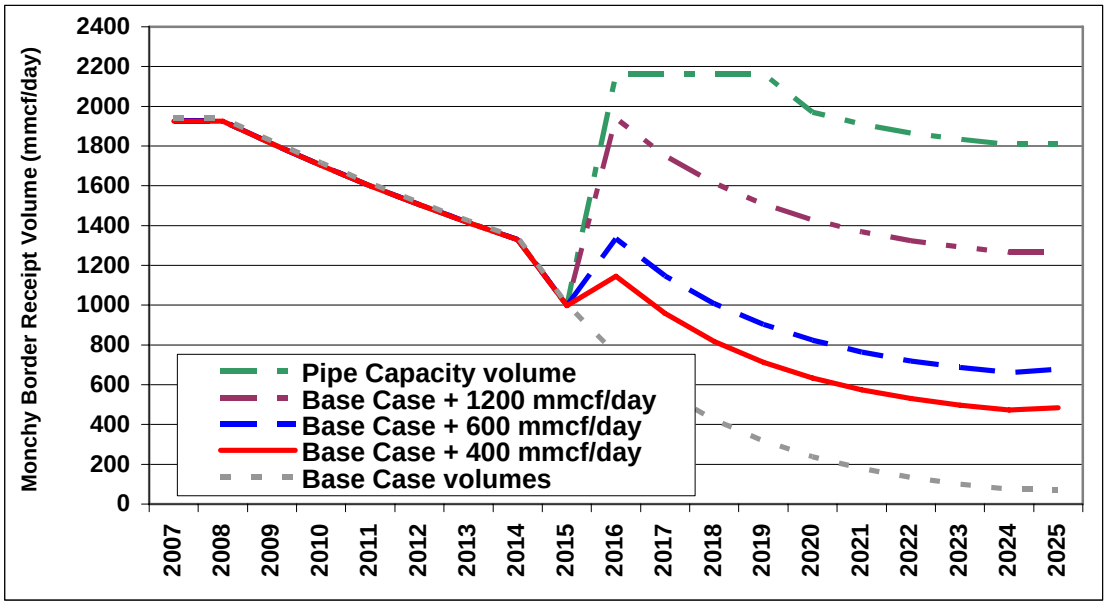
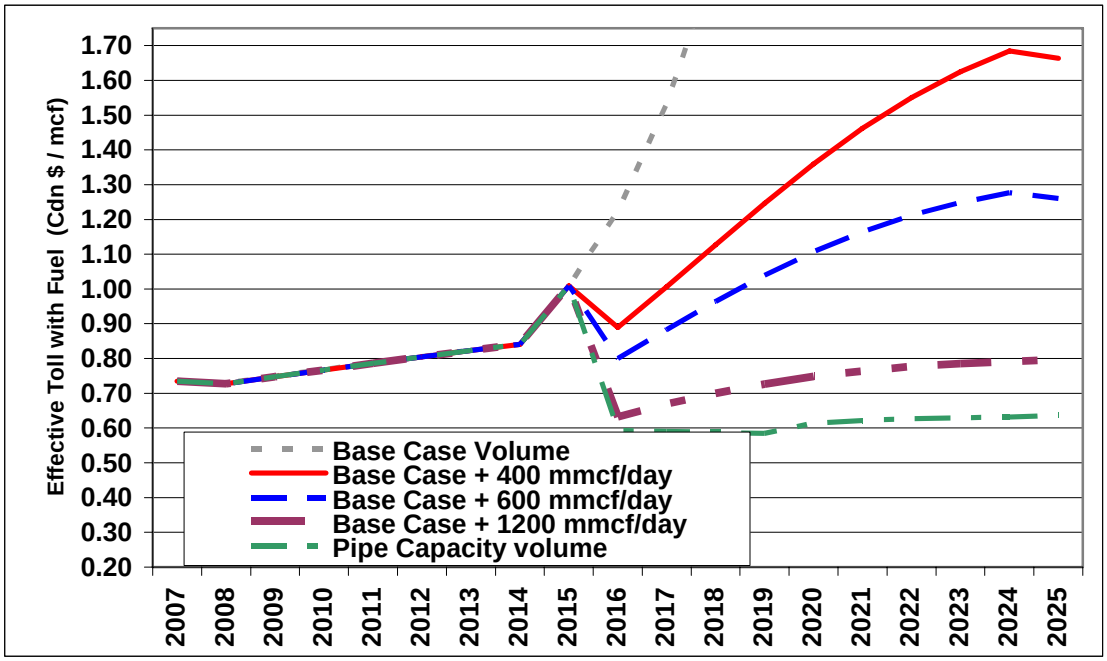


Figure 3.13
Northern Border Pipeline: Monchy to Chicago
Base Case plus Incremental Toll Comparison



3.7 TCPL East Mainline

The TCPL East mainline delivers gas to the Ontario/Quebec markets and to the US border at Emerson, Manitoba. The Viking Gas Transmission pipeline (capacity 400 mmcf/day) receives gas at Emerson, Manitoba and delivers gas to the Chicago area through a connection with the ANR Interstate pipeline. The Great Lakes Gas Transmission pipeline (capacity 2,200 mmcf/day) receives gas at Emerson, Manitoba and delivers gas to the Michigan market and southern Ontario by way of the import connection near St. Claire, Ontario.

The assumptions used for the Foothills Saskatchewan pipeline and Northern Border pipeline are replicated in Figures 3.14 and 3.15 to estimate the level of flow that would minimize the combined toll for use of both pipelines.

Figure 3.14
TCPL East: Empress, Alberta to Emerson, Manitoba
Base Case plus Incremental Flow Comparison

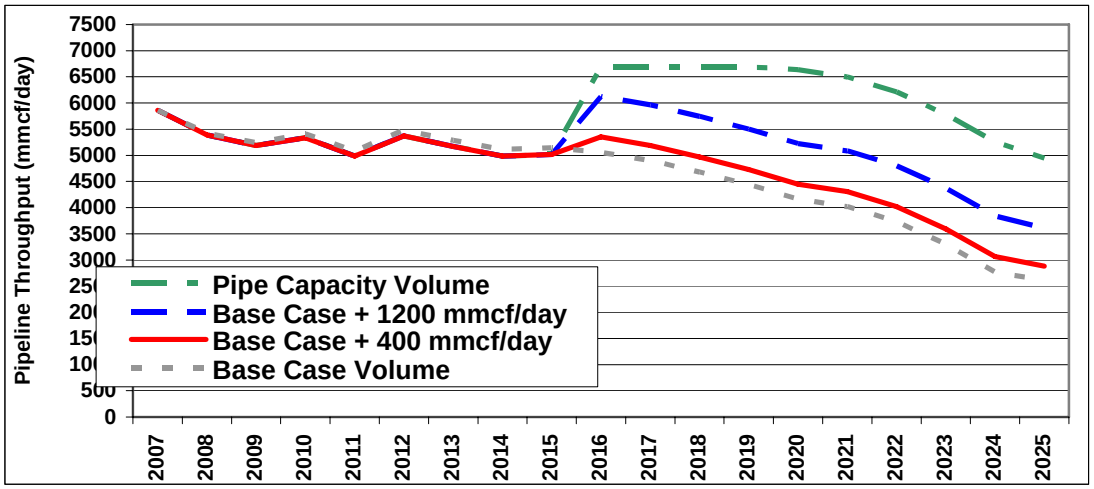
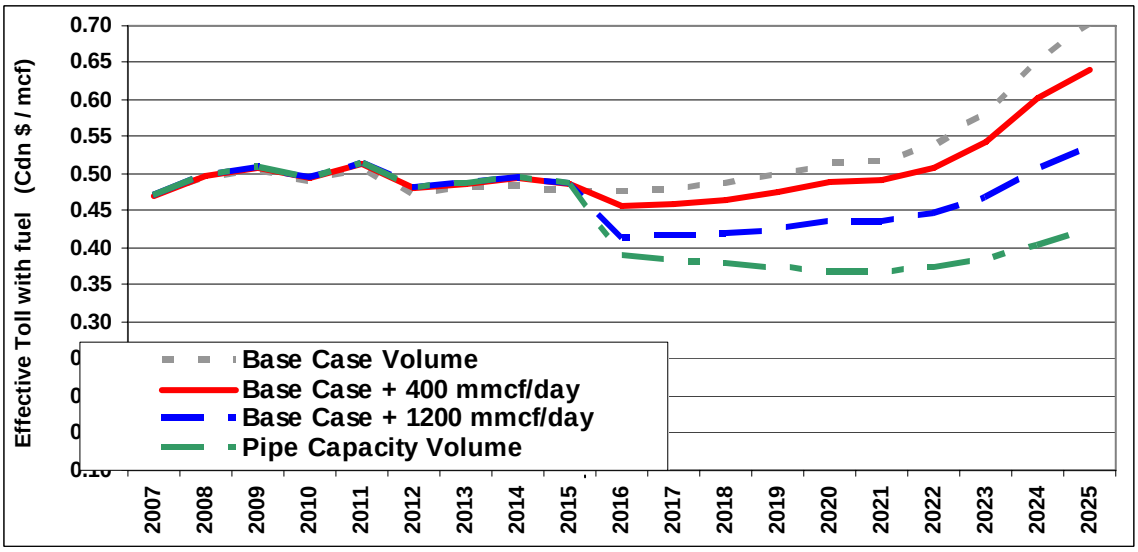


Figure 3.15
TCPL East: Empress, Alberta to Emerson, Manitoba
Base Case plus Incremental Toll Comparison

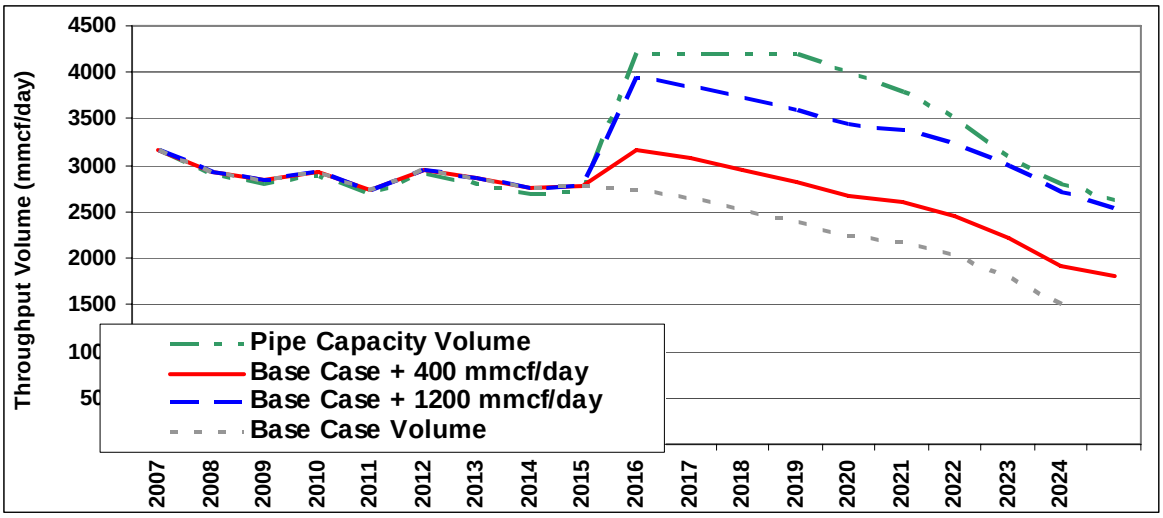


3.8 TCPL Northern Ontario Mainline

The TCPL Northern Ontario mainline transports gas from the Winnipeg bifurcation point.[14] northeast over the Great Lakes to the Central Ontario delivery area and the Dawn gas trading hub. Gas from the Great Lakes Pipeline is re-imported into the area at the St. Claire River, and the Union Gas connection (Dawn Parkway) allows gas to move towards the Quebec markets exporting to the United States by the Iroquois Pipeline, Empire State pipeline, Portland Natural Gas Pipeline, and others.

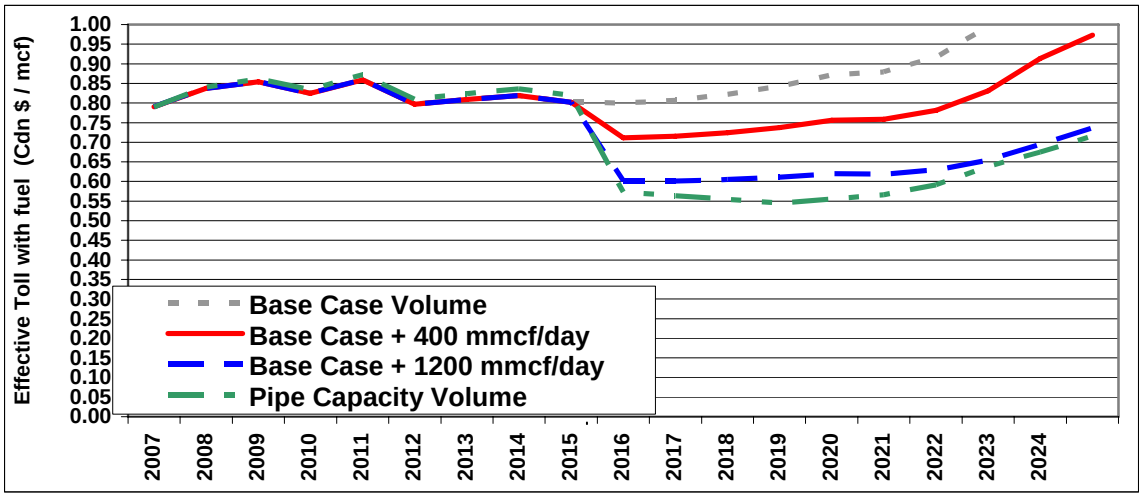
The assumptions used for the Foothills Saskatchewan pipeline and Northern Border pipeline are replicated in Figures 3.16 and 3.17 to estimate the level of flow that would minimize the combined toll for use of both pipelines.

Figure 3.16
TCPL Northern Ontario Mainline:
Winnipeg, Manitoba to Southern Ontario Delivery Area
Base Case plus Incremental Flow Comparison



[14] TCPL Compressor Station 41, south of Winnipeg, Manitoba. Prairies Throughput splits with approximately 35 percent of flow directed south to Emerson export point and 65 percent directed to Northern Ontario mainline.

Figure 3.17
TCPL Northern Ontario Mainline:
Winnipeg, Manitoba to Southern Ontario Delivery Area
Base Case plus Incremental Toll Comparison



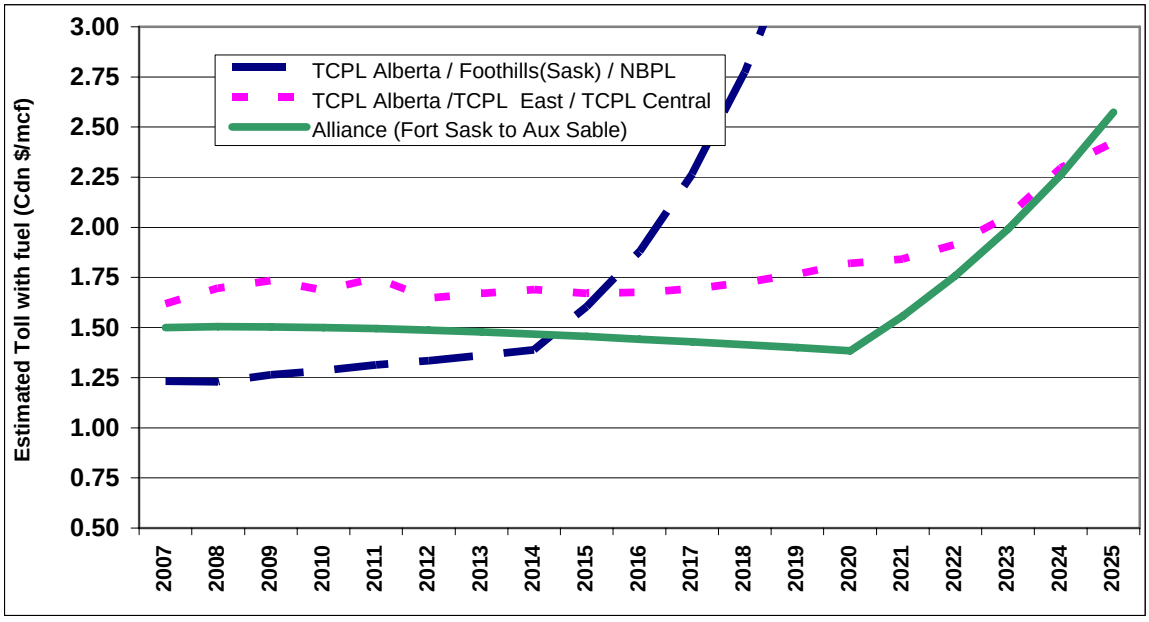
CHAPTER 4
CONCLUSIONS

1. The estimated cost of constructing the Mackenzie Valley Pipeline from the exit of the Inuvik gas processing plant to the Alberta Northwest Territories (gas pipeline only) would be $7.8 billion (2006 Canadian dollars). Based on a receipt volume of 1,230 mmcf/day at Inuvik, Northwest Territories, the transportation toll for the Inuvik volumes would be $2.28 Cdn/mcf along with a fuel charge of $0.16 Cdn/mcf based on a fuel price of $6.50 Cdn/mcf.

2. The estimated cost of constructing the Alaska Highway pipeline from Prudhoe Bay, Alaska to Boundary Lake, Alberta would be $30.9 billion (2006 Canadian dollars). Based on a receipt volume of 4,635 mmcf/day at Prudhoe Bay, the transportation toll for the Alaskan volumes would be $2.49 Cdn/mcf along with a fuel charge of $0.19 Cdn/mcf based on a fuel price of $6.50 Cdn/mcf.

3. The estimated tolls for the Alliance (Alberta to Chicago), TCPL East (TCPL Alberta to Toronto) and Northern Border (TCPL Alberta to Chicago) pipelines using the assumed base case flows as shown in Figure 4.1 are as follows:

Figure 4.1
Base Case Pipeline Tolls



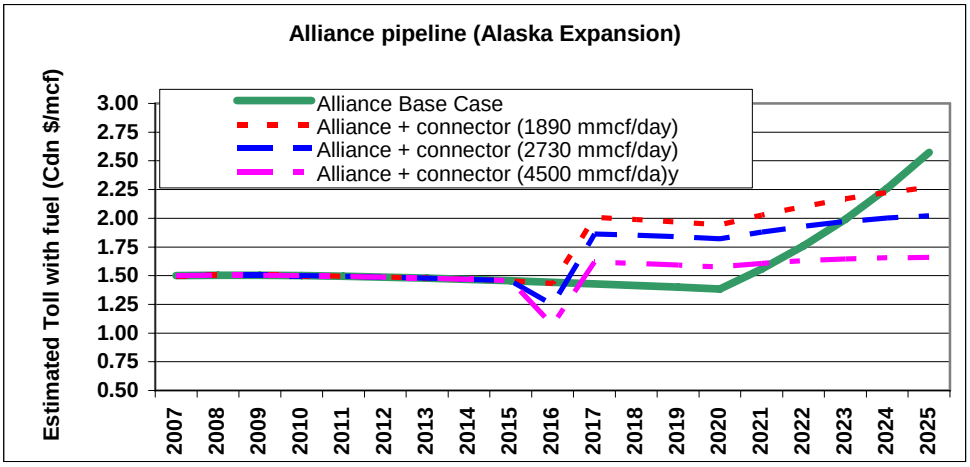
4. The estimated cost of expanding the Alliance Pipeline system to handle Alaska Gas volumes based on the scenarios assumed in this study are as follows:

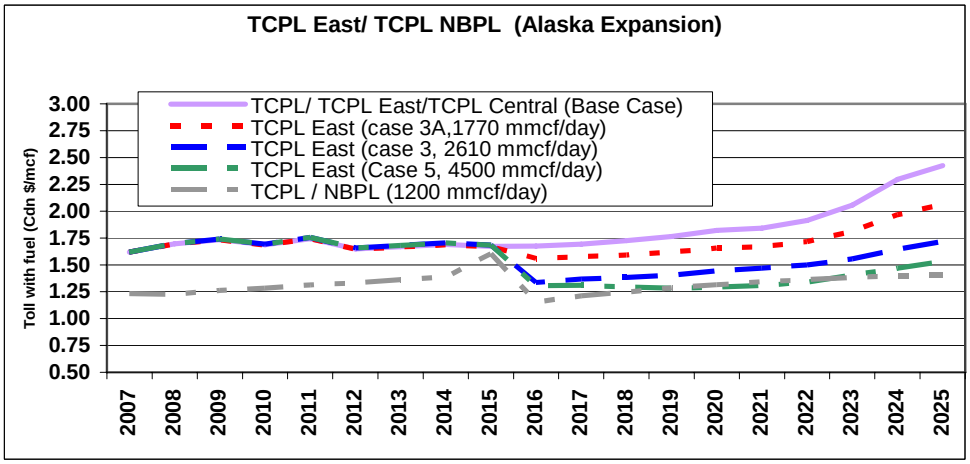
Scenario	Volume	Boundary Lake to Fort Saskatchewan	Fort Saskatchewan to US Border	US Border to Aux Sable	Total
		million Cdn $	million Cdn $	million Cdn $	million Cdn $
3	1890 mmcf/day	$1,609	$2,465	$3,450	$7,524
3A	2730 mmcf/day	$2,047	$3,358	$4,783	$10,188
4	4500 mmcf/day	$2,595	$4,579	$6,470	$13,644

5. The estimated cost of expanding the TCPL System to handle Alaskan gas volumes based on the scenarios assumed in this study are as follows:

Scenario	Volume	TCPL Alberta	Northern Border	TCPL East	Total
		million Cdn $	million Cdn $	million Cdn $	million Cdn $
3A	1770 mmcf/day	$1,136	$0	$0	$1,136
3	2610 mmcf/day	$1,471	$0	$0	$1,471
5	4500 mmcf/day	$1,789	$0	$0	$1,789

6. Based on the scenarios that were investigated in this study, the variance in tolls for the Alliance pipeline would either increase by five cents per mcf (Scenario 3A) or decrease by fifteen cents per mcf (Scenario 4). The increase in toll is primarily due to the escalated costs countering the economies of scale that are normally envisaged by a pipeline expansion. The addition of the connector pipeline from Boundary Lake, Alberta to Fort Saskatchewan would add an additional thirty to forty cents per mcf to the Alaska gas transportation toll depending on the flow volume. By comparison, the combined toll for the TCPL Alberta, TCPL East and TCPL Central pipeline systems would see a reduced toll of between five cents (Scenario 3) and twenty-five cents (Scenario 5). In this case, the utilization of the spare capacity in the existing pipeline system overshadows the escalated costs for the incremental facilities.





7. Utilizing the existing infrastructure of the TCPL Alberta pipeline system and the connections with the Gas Transmission Northwest (GTN), Northern Border (NBPL), Iroquois, Empire and TCPL East pipeline systems provides the Alaskan Gas shippers access to multiple markets in the Pacific Northwest, California, eastern Canada, Chicago, and the Northeast United States. It is difficult to quantify the value of access to multiple markets, but these connections would permit shippers to optimize flow direction, and market deliveries and, ultimately, product value.

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