



Ontario Natural Gas Background Report

Prepared for Ontario Energy Board

March 2014

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1.0 Overview of the Ontario Energy Board Process

The Ontario Minister of Energy has asked the Ontario Energy Board (“OEB” or the “Board”) to prepare a report on TransCanada PipeLines Limited’s (TransCanada) proposed Energy East Pipeline project. Specifically, in a letter dated November 12, 2013, the Minister asked the Board to examine and report on the project from an Ontario perspective and to consider the implications of the following:

- The impacts on Ontario natural gas consumers in terms of prices, reliability, and access to supply, especially those consumers in eastern and northern Ontario
- The impacts on pipeline safety and the natural environment in Ontario
- The impacts on local communities and Aboriginal communities in Ontario
- The short and long-term economic impacts of the project in Ontario

To support the preparation of this report, the Minister has asked the Board to consult broadly and transparently with the people of Ontario, including local communities, stakeholders, and First Nations and Metis communities, focusing on the above issues and providing a forum for Ontarians to express their views on the proposed Energy East Pipeline project.

The key steps in the OEB’s planned process are illustrated in Figure 1 below:



Figure 1. The Ontario Energy Board’s Planned Process

Details regarding each of the steps will be issued in due course.

2.0 *Ziff Energy’s Role in the Ontario Energy Board Process*

The OEB has retained Ziff Energy to provide expert advice on the impact of the proposed Energy East Pipeline project on natural gas markets (i.e., demand, supply, inter-regional pipeline flows, and price).

Ziff Energy, a Division of HSB Solomon Associates Canada Ltd. (Solomon), is an international energy consulting firm, providing exploration and production cost benchmarking and North American gas forecasting services to a diverse client base.

Ziff Energy has been asked to prepare this Background Report on the proposed Energy East Pipeline project. This report will provide a brief overview of the Ontario natural gas market in the context of the North American market; a more detailed description of the Ontario gas market; a discussion on how natural gas prices are driven by changes in supply and demand over time, and by the changes in inter-regional pipeline flows; and a high-level consideration for, and potential impacts of, the Energy East Pipeline project on the above.

In addition to this Background Report, Ziff Energy will also prepare a second report entitled “Report on Potential Impacts on Ontario” (the Impact Report). The Impact Report will include information that TransCanada will file with the National Energy Board on the proposed project (see Section 4.0). The Impact Report will also include: a) a forecast of natural gas prices in Ontario that considers the potential impacts of the Energy East Pipeline project and b) a discussion of the potential impacts on Ontarians, including customers in northern and eastern Ontario.

All materials will be posted on the OEB’s website.

3.0 Regulatory Oversight of the Energy East Pipeline Project

The proposed Energy East Pipeline project falls under the jurisdiction of the National Energy Board (NEB), the federal regulatory agency that exercises jurisdiction over interprovincial and international oil and gas pipelines. Pipelines that are designed, constructed, operated, converted, or abandoned under NEB jurisdiction must comply with the requirements of the NEB Act and the NEB Onshore Pipeline Regulations (NEB OPR), which are spelled out in the NEB Act. In addition, adherence to the latest edition of Canadian Standards Association (CSA) standard CSA Z662 – Oil and Gas Pipeline Systems (CSA Z662) is a mandatory requirement as it is incorporated by reference in the NEB OPR. Both the NEB OPR and CSA Z662 include requirements for pipeline design, materials selection, installation, testing, operation and maintenance, abandonment, etc. Furthermore, new pipeline construction greater than 40 kilometers (km) in length requires an Environmental and Socio-Economic Assessment (ESA) under the NEB Act and an assessment under the Canadian Environmental Assessment Act, 2012 (CEA Act, 2012).

The NEB publishes a Filing Manual, which is a guide to the information required in an application. In some cases, a company may file a project description in advance of its formal application. The project description is not an application and as such, is not binding; rather, it provides preliminary information about an expected application. TransCanada filed its project description with the NEB on March 4, 2014, and indicated that it expected to submit its formal application in the third quarter of 2014. The formal application must outline, among other matters, the engineering design, construction, environmental, and pipeline safety considerations. The NEB will assess the application for compliance with the NEB Act, its regulations, and applicable standards. It may ask for further information during the application process to address any issues specific to the proposed project.

If the proposed project is approved, the NEB will monitor compliance during construction and operation by performing compliance verification activities such as inspections, compliance meetings, emergency exercises, audits, and investigations.

4.0 Overview of TransCanada's Energy East Pipeline Project

TransCanada's existing natural gas transmission system consists of several parallel natural gas pipelines stretching more than 14,000 km from the Alberta-Saskatchewan border east to the Québec-Vermont border. TransCanada's Energy East Pipeline project will convert one of these pipelines from carrying natural gas to carrying crude oil. The proposed crude oil pipeline is approximately 4,500 km in length and would carry roughly 1.1 million barrels per day of crude oil from Alberta and Saskatchewan to refineries in eastern Canada.

The proposed Energy East Pipeline project would include the conversion of approximately 3,000 km of existing natural gas transmission pipeline to the carriage of crude oil, the construction of up to 1,500 km of new pipe in Alberta, Saskatchewan, Manitoba, eastern Ontario, Québec, and New Brunswick to link up with the converted pipe, and four new oil terminals: one near Hardisty, Alberta, one near Moosomin, Saskatchewan, one near Rivière-du-Loup at Cacouna, Québec, and another in the Saint John, New Brunswick area. The project also includes marine tanker loading facilities in the Cacouna and Saint John areas.



Figure 2. Energy East Pipeline - Proposed Route

As illustrated in Figure 2, the Energy East Pipeline project is comprised of three pipeline segments. First, new pipeline would be built from Hardisty, Alberta to Burstall, Saskatchewan. Second, the converted pipeline would run from Burstall, Saskatchewan to a point near Cornwall, Ontario. Finally, new pipeline would be built from Cornwall, Ontario to Saint John, New Brunswick. The Energy East Pipeline project would deliver oil to existing refineries in Montréal, near Québec City, and in Saint John, as well as the marine loading facilities.

The project is expected to parallel the Trans-Canada Highway for the majority of the route.

Approximately 70% (i.e., 3,000 km/4,500 km) of the proposed Energy East Pipeline project is already in the ground and, of the remaining 30% new build portion, more than half will parallel existing rights-of-way.

Subject to regulatory approval from the NEB, construction is anticipated to begin in early 2016. The exact route being proposed will be determined after the NEB completes its public consultation and regulatory review process.

5.0 *Natural Gas Delivery Infrastructure*

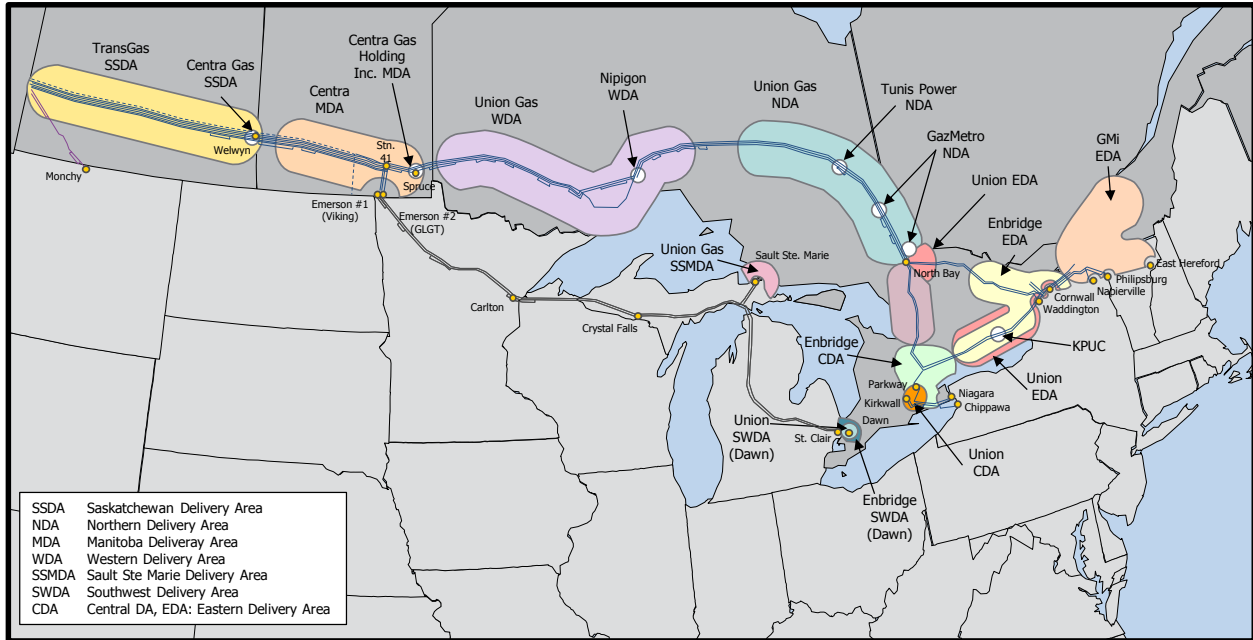
This section provides a description of the TransCanada Pipeline System, the Dawn Hub and other natural gas delivery infrastructure.

5.1 **TransCanada Mainline System**

The TransCanada Mainline connects the western Canada gas supply region with markets across the Canadian prairies, U.S. Midwest, Ontario (including northern Ontario), Québec, and the U.S. Northeast. As discussed in Section 4.0, the TransCanada Mainline consists of five parallel natural gas pipelines, or loops¹, that stretch from Alberta to Manitoba. In Manitoba two of these natural gas pipeline loops head south to the U.S. border and three pipeline loops continue to Ontario. In 2000, the TransCanada Mainline shipped 6.2 Bcf/d from Empress, located on the Alberta-Saskatchewan border. This volume represented almost 40% of western Canada production (and just under 9% of North American demand). The subsequent construction of alternative pipeline systems and growth of supply in the U.S. Northeast market area have reduced gas flows (i.e., throughput/volume) on the TransCanada Mainline. In 2013, gas flows dropped 68% from 2000 levels averaging only 2.0 Bcf/d or just less than 3% of 2013 North American demand. As shown in Figure 3 (page 5-2), the TransCanada Mainline includes three sections:

1. Prairie – 945 km from Empress (AB/Sask Border) to Station 41 just south of Winnipeg. This section consists of five parallel natural gas pipeline loops with an approximate capacity of 6.5 Bcf/d. From Station 41, near the City of Winnipeg, two pipeline loops head south to the Canadian border point of Emerson and three loops continue east.
2. Northern Ontario – three natural gas pipeline loops continue east from Station 41 for 1,700 km to North Bay Ontario with an approximate capacity of 3.7 Bcf/d.
3. Eastern Triangle – the facilities south and east of North Bay are referred to as the Eastern Triangle (see Section 5.1.1).

¹ When one pipeline is laid parallel to another along a right-of-way (much like adding additional lanes along a highway) this is called pipeline looping. Pipeline looping increases the ability to flow natural gas along a pipeline right-of-way.



Source: TransCanada Canadian Mainline Sales and Marketing 2011 Map
Map is representative not to scale

Figure 3. TransCanada Mainline System

5.1.1 The Eastern Triangle

Figure 4 (page 5-3) shows the TransCanada Mainline “Eastern Triangle” (highlighted in yellow). The Eastern Triangle connects gas supplies to urban demand centers serviced by Ontario Gas Distributors². As Ontario natural gas demand is seasonal in nature, Gas Distributors store excess gas production³ in the summer for consumption in the winter months. Pipeline capacity must be available to safely deliver gas to consumers on peak days, when electric power is required or when temperatures plummet. The Eastern Triangle facilities are located south and east of North Bay:

- The Barrie Line is comprised of two pipeline loops which run 300 km south of North Bay to Maple (near Toronto) with approximately 1.6 Bcf/d of throughput capacity
- The North Bay shortcut includes two pipeline loops which run 425 km east of North Bay to Iroquois Junction (near Cornwall) with about 2.4 Bcf/d of throughput capacity
- The Montreal Line includes two pipeline loops beginning 385 km from Maple to Iroquois Junction and three pipeline loops beginning 100 km from Iroquois Junction into Québec
- From the Dawn Hub (see Section 5.2) to Maple, TransCanada relies on a combination of proprietary pipeline and facilities leased from Union Gas Limited via a TBO (“Transportation by Others”) Agreement.

² Further detailed in Section 7.1.

³ Most of Ontario’s natural gas storage is located near the Dawn Hub.

With the decline of Western Canadian production, the Eastern Triangle has become increasingly important as Gas Distributors and other large gas consumers have sourced more of their gas via the Dawn Hub rather than relying on western Canada supply.

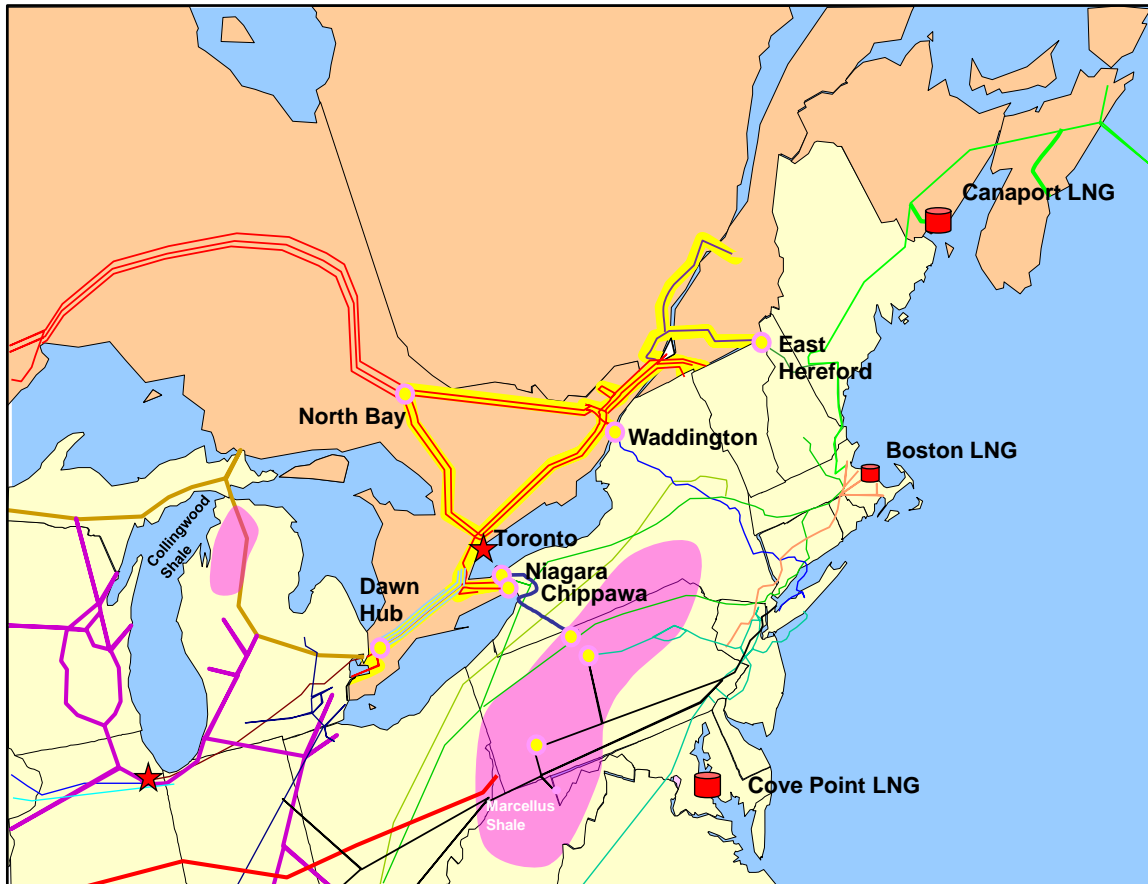


Figure 4. TransCanada Mainline 'Eastern Triangle'

5.2 Dawn Hub

To meet consumer demand Ontario must import natural gas from areas outside the province via gas pipelines, including the TransCanada Mainline. Several pipeline systems connect Ontario to other supply basins including Great Lakes Gas Transmission, Vector, MichCon, and CMS. These pipelines can also transport gas from Dawn-area storage fields back to Michigan.

The seasonal nature of gas markets in eastern Canada and U.S. northeast led to the development of natural gas storage in Ontario, primarily located near Dawn, in Lambton County. Natural gas is injected into depleted reservoirs during low demand periods and withdrawn when demand increases. Dawn area storage is designed to meet peak winter demand within Ontario and in downstream markets in both the U.S. and Canada.

The availability of underground natural gas storage, combined with access to pipelines connecting supply from several different supply areas, and pipelines delivering to several market regions, led to the development of the Dawn Hub. The Dawn Hub is the major trading point for natural gas in Ontario. It is one of the most active trading points in North America with the ability to pool supplies from multiple sources (western Canada, U.S. northeast, mid-continent, and Gulf Coast) and deliver to markets in eastern Canada and the U.S. The gas price at Dawn is a good benchmark for the price of natural gas in Ontario.

Ontario also has outbound pipeline connections to deliver gas to downstream markets in both Canada and the U.S.

Figure 5 illustrates the Dawn Hub in close proximity to several major storage and gas transportation systems.

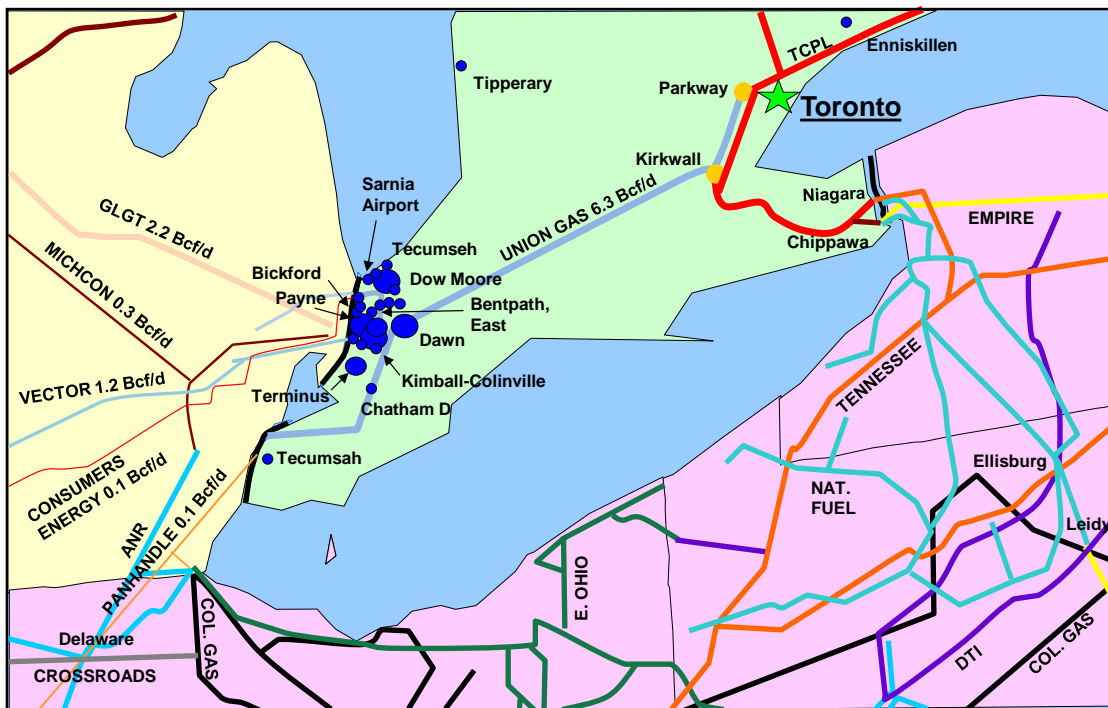


Figure 5. Dawn Hub

6.0 *Declining Alberta to Ontario Natural Gas Flows*

This section describes the decline of western Canadian supply for the Ontario gas market.

6.1 **Access to Growing Unconventional Gas**

The past decade has ushered in dramatic changes in North American natural gas production and supply. Major technological advancements have led to rapidly increasing unconventional gas production. Unconventional gas, which includes shale and tight gas⁴ is low cost compared to conventional gas. Unconventional gas production has grown to half of North American gas supply, and will comprise the lion's share of gas production in coming years. Unconventional gas production growth has occurred in many non-traditional areas where low cost supply is now being developed. Producers have diverted capital investments out of many traditional areas, including western Canada where costs are higher. Supply will continue to grow in low cost areas and decline in high cost areas.

As gas production continues to shift to low cost unconventional gas plays, flows on pipelines will also change. Many traditional supply sources like western Canada and the Gulf of Mexico offshore will decline, decreasing flows on pipelines from these areas. New pipelines will be required to connect gas supply from growing supply areas, such as the Marcellus and Utica plays in the U.S. Northeast, and the Eagle Ford play in Texas, among others.

Consumers in Ontario and Québec have access to multiple supply sources via multiple pipeline connections, and are sourcing more low-cost imported natural gas via the Dawn Hub and the Niagara and Waddington border points (please see Figure 4, these border points bring gas into the Eastern Triangle area). Recent developments include:

- Completion of the Northern Access Pipeline (bi-directional capability) allows Marcellus gas to access Ontario at Niagara
- An amended Presidential permit was received by Iroquois Pipeline in September 2010 for gas exports to Canada at Waddington; an open season for transportation capacity is currently underway
- The Nexus pipeline proposes to deliver up to 1 Bcf/d of Utica gas to Dawn; this project is backed by DTE Energy, Enbridge, and Spectra.

⁴ Shale and tight gas reservoirs most often require the use of hydraulic fracturing to enable the gas to be produced.

Figure 6 shows the location of the low cost Marcellus Shale gas play and rapid production growth.

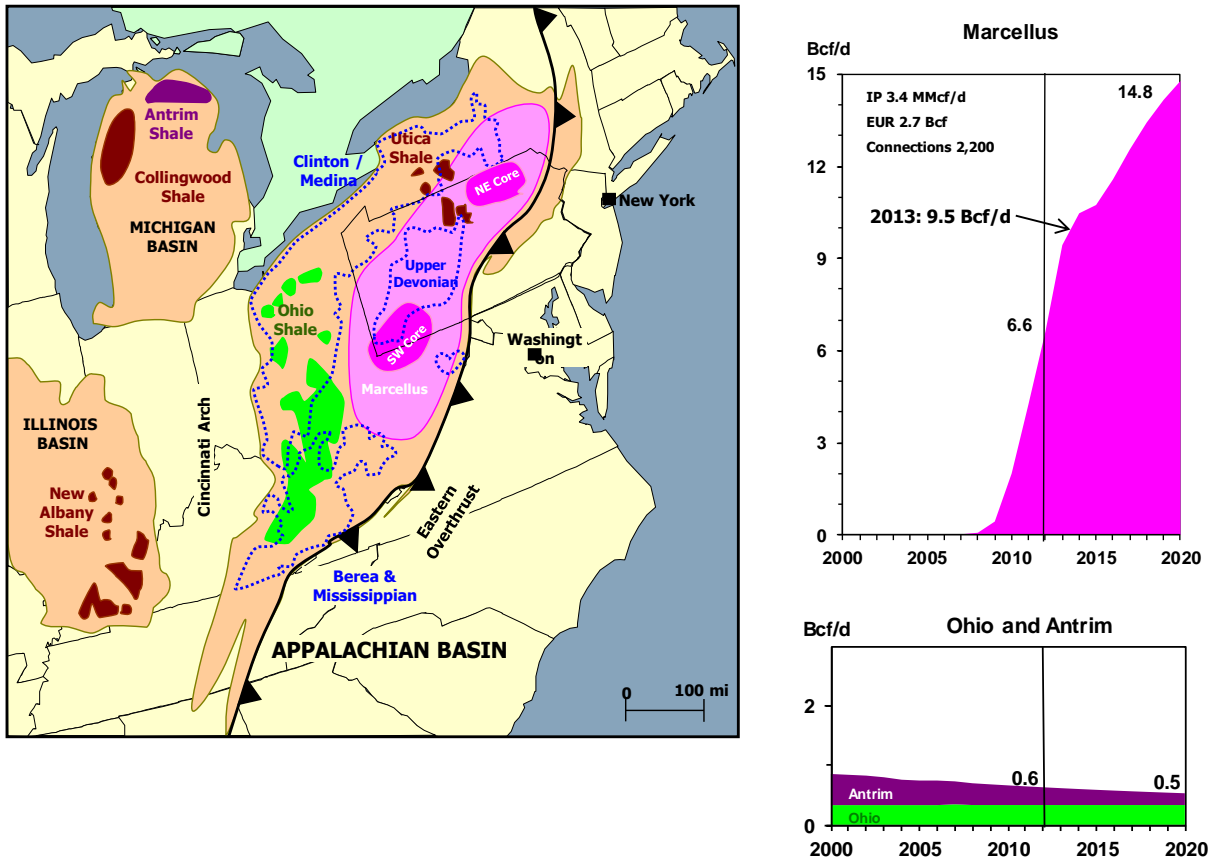


Figure 6. Appalachian Shale Gas

6.2 Ontario Gas Imports

Low cost supply from U.S. supply basins is increasingly accessing Ontario markets. This gas is displacing western Canada supply delivered via the TransCanada Mainline.

Figure 7 shows the amount of gas imported from the U.S. and the amount of gas exported to the U.S. from the TransCanada Eastern Triangle by border point. From 2000–2008 gas exports from the Eastern Triangle into the U.S. Northeast market were relatively stable, averaging 2.4 Bcf/d. Gas imports during this period began to grow with the completion of the Vector pipeline which moves gas from Chicago to the Dawn Hub.

The rapid development of Marcellus Shale Gas in the U.S. Northeast after 2008 altered Eastern Triangle imports and exports. Exports from the Eastern Triangle to U.S. downstream markets, especially via the Dawn and Iroquois border points declined, and imports from U.S. supply basins accelerated. Imports of gas from the U.S. are displacing gas delivered via the TransCanada Mainline system.

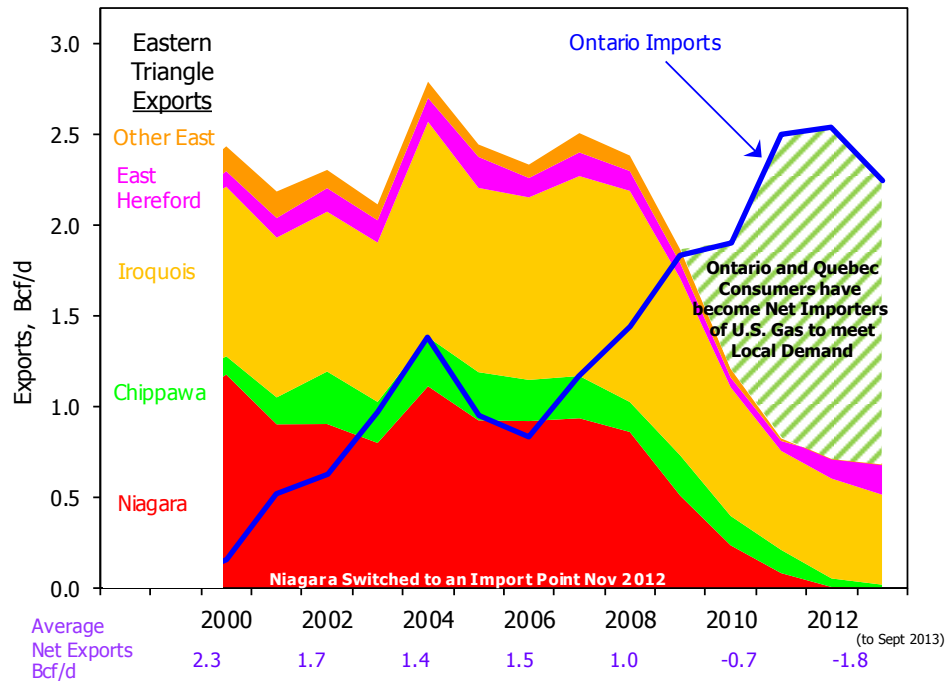


Figure 7. Eastern Triangle Gas Supply-Demand Allocations

7.0 The Ontario Gas Market

Figure 8 illustrates 2012 Ontario Gas Demand by sector.

- Residential and Commercial customers make up over half of Ontario gas demand. These sectors are highly sensitive to weather; demand is not expected to grow significantly as efficiencies offset higher customer counts.
- Industrial gas demand is just under one-quarter of Ontario’s annual requirement. The industrial sector is typically less weather sensitive and gas demand fluctuates with changes in economic activity.
- Gas for the generation of electricity has doubled since 2000 now comprising 23% of the current market.
- Fuel for pipeline operations has declined recently as increased U.S. Northeast gas production has reduced the amount of gas transported through Ontario to the U.S.

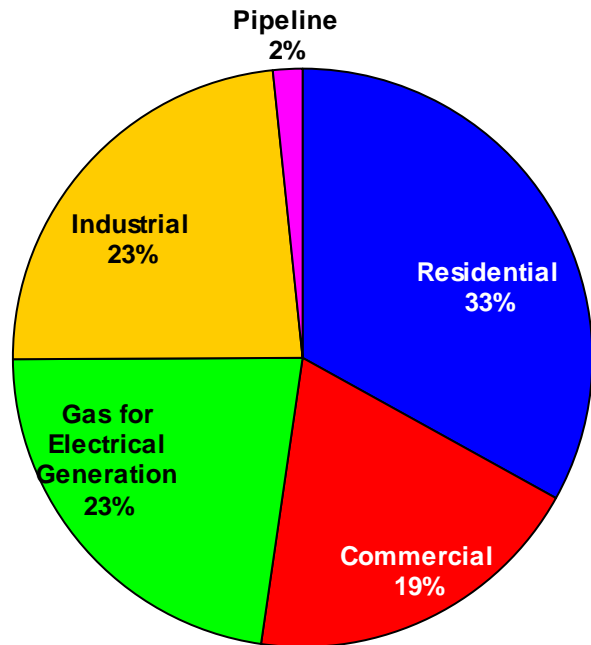


Figure 8. Ontario Demand (2.8 Bcf/d)

7.1 Ontario’s Natural Gas Distributors

As discussed in Section 5.1.1, Ontario has several gas distributors. The two major Ontario gas distributors are Union Gas Limited (Union) and Enbridge Gas Distribution Inc. (Enbridge).

7.1.1 Union

Union is headquartered in Chatham, Ontario servicing customers widely distributed geographically throughout Ontario (southwestern, northern, and eastern Ontario).

- Union’s distribution business serves about 1.4 million residential, commercial, and industrial customers.
- Union’s northern Ontario⁵ customers rely on the TransCanada Mainline for their gas supply, with very little penetration of U.S. gas into this delivery.
- Union’s storage and transmission business offers a variety of storage and transportation services to customers at the Dawn Hub.

⁵ The Sault Ste. Marie area is an exception, as it is served by the U.S. Great Lakes Transmission system.

7.1.2 Enbridge

Enbridge is headquartered in Toronto, Ontario servicing customers primarily concentrated in central and eastern Ontario (including Toronto, the Niagara Peninsula, and Ottawa).

- Enbridge’s gas distribution business serves over 2 million residential, commercial and industrial customers.
- Enbridge’s storage facilities are located in south-western Ontario, and are connected to the Dawn Hub.

Figure 9 shows Enbridge and Union distribution areas relative to the TransCanada Mainline system. Also shown are other gas distributors that connect to the TransCanada Mainline system and they include smaller Ontario distributors and Gaz Métro which delivers gas into Québec.

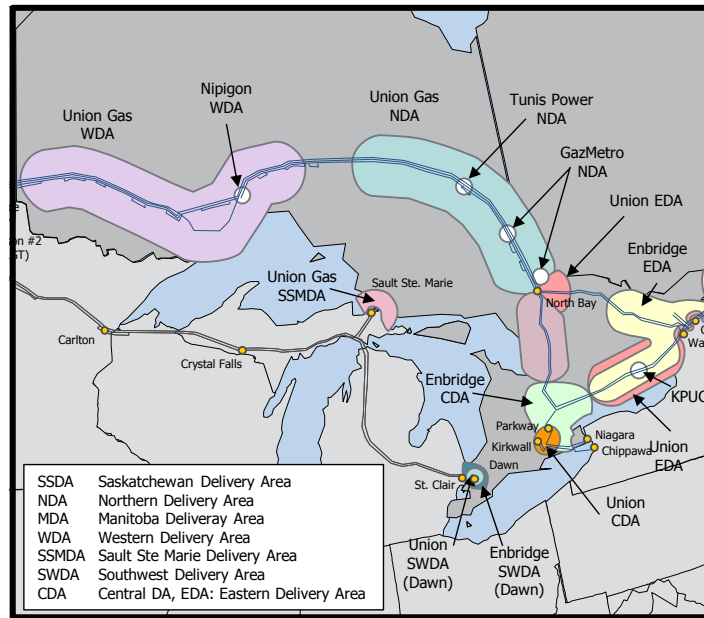


Figure 9. Ontario Gas Distributors

8.0 Gas Market Integration

This section describes how gas markets operate and how pipelines respond to changing supply and demand.

8.1 How North American Gas Prices Are Set

The North American natural gas market is characterized by large numbers of competing sellers, buyers, intermediaries, and huge trading volumes. The market is highly liquid, price transparent, and facilitated by electronic trading platforms, a vigorous futures market, and the availability of financial instruments to enable price hedging and related activities.

The natural gas futures contract is traded on the New York Mercantile Exchange (NYMEX) and clears at Henry Hub, Louisiana where many gas pipelines and storage facilities interconnect. The price at Henry Hub is generally used to represent overall movements in North American natural gas prices. Prices at other major trading Hubs (shown in Figure 10) relate to Henry Hub and generally respond to local supply and demand conditions, and availability of transportation and storage capacity.

Some market Hubs, such as AECO/Nova Inventory Transfer (NIT) in Western Canada, are not physically connected to Henry Hub via pipeline infrastructure; however, prices at all major Hubs are expressed relative to Henry Hub. Market region Hubs such as Dawn and Chicago are connected to multiple supply basins.

Transportation disruptions, storage field limits, weather, and power plant failures can impact regional gas prices.

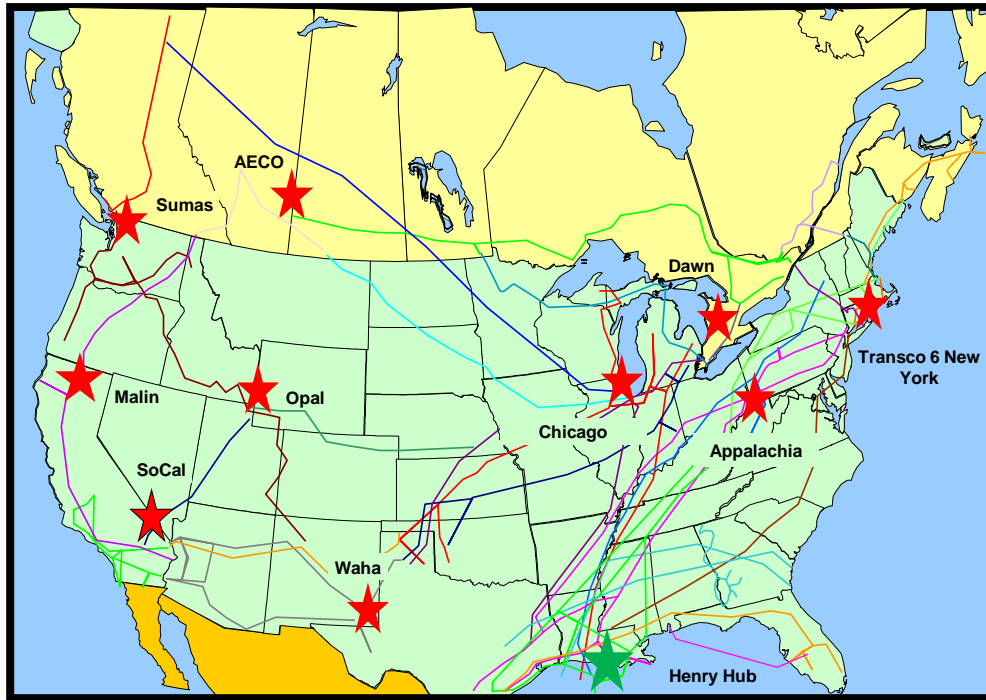


Figure 10. North American Trading Hubs

8.2 Changing Pipeline Infrastructure and Flows

The North American gas supply system is a sophisticated network of gas transportation and storage facilities that move gas from one region to another to meet demand. The natural gas delivery infrastructure has developed and adapted rapidly in response to changing gas supply and demand conditions.

The process of infrastructure development is ongoing and relies on market signals and pricing differentials between supply regions and demand centers. If there is insufficient pipeline capacity between an area with excess supply and an area that needs gas supply, price differentials⁶ widen and more pipeline capacity is built.

Throughout the 1990s, pipeline capacity from western Canada was expanded to eastern Canada, the U.S. Pacific Coast, Midwest, and Northeast. Gas storage infrastructure was also enhanced. These enhanced pipeline connections provided a valuable continental link giving consumers in most regions of North America the ability to mitigate seasonal energy supply disruptions.

Gas investment and production has now shifted to new geographical areas and unconventional supply sources. Low cost North American unconventional gas supply is now altering North American gas flows and causing a re-configuration of pipeline infrastructure. Western Canadian Sedimentary Basin (WCSB) supply is more expensive compared to gas imported to the Dawn Hub from other regions.

⁶ A natural gas pricing differential is the difference in gas prices between two natural gas trading hubs.

Ziff Energy expects that transportation costs on many long-haul pipelines⁷ will be too high for continued export of gas to traditional markets in the U.S. and Canada. Low cost supply from the Marcellus and Utica shale gas plays in the U.S. Northeast will continue pushing into eastern Canada at the expense of western Canadian gas delivered via the TransCanada Pipeline.

The growth of Marcellus and Utica Shale Gas renders it unlikely that TransCanada Mainline volumes will recover. Gas flows from western Canada into the TransCanada mainline are not expected to recover. TransCanada has proposed the Energy East project to repurpose the under-utilized pipeline capacity.

Figure 11 shows western Canada supply flows into the TransCanada Mainline at Empress declining to 2.0 Bcf/d in 2013, down 63% (3.5 Bcf/d) from 2005. The reduction of gas flows from Alberta to eastern markets on the TransCanada Mainline has lowered revenues and put upward pressure on pipeline tolls making western Canadian gas supplies more expensive than U.S. supply in eastern Canada (and traditional export markets).

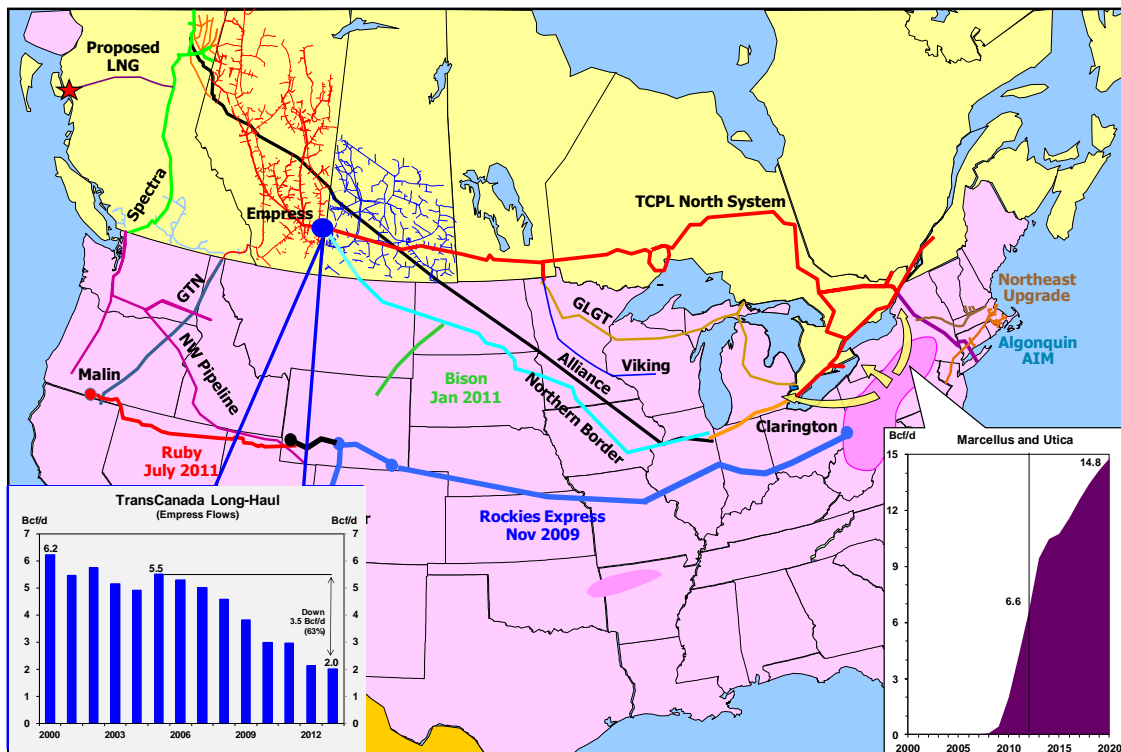


Figure 11. Competition and Declining Western Canada Gas Flows

⁷ Repurposing of other natural gas pipelines is underway: a) Pony Express Pipeline is expected to be switched to oil service in late 2014 and b) Trunkline currently has an application before the Federal Energy Regulatory Commission in the U.S. to convert one of two pipelines into oil service.

9.0 Potential Impacts of TransCanada's Proposed Energy East Pipeline Project

The proposed Energy East Pipeline project would include the conversion of approximately 3,000 km of existing natural gas transmission pipeline to the carriage of crude oil. By repurposing an under-utilized gas pipeline to carry oil, some existing gas capacity will no longer be available to consumers of natural gas in Ontario, Québec, and U.S. markets.

To assess the impact on Ontario consumers, it will be necessary to consider existing and expected Ontario gas demand and the availability of remaining TransCanada Mainline capacity to deliver gas supply. After conversion, if the remaining natural gas pipeline capacity is insufficient to meet projected demand, there is a potential that natural gas supply could be disrupted on a peak day. Supply disruptions could cause natural gas prices to increase in some regions of Ontario. If remaining pipeline capacity is adequate to meet demand in all regions of Ontario, there is unlikely to be any impact to Ontario gas consumers.

There could be positive impacts for Ontario consumers. After conversion, the cost of repurposed gas facilities will no longer be borne by gas consumers through regulated pipeline tolling mechanisms, likely reducing gas transportation costs.

Ziff Energy will be conducting a detailed assessment of the impacts of the Energy East Pipeline Project on Ontario natural gas markets. Ziff Energy will review and assess TransCanada's Project Description filed with the National Energy Board on March 4, 2014 to determine project specifics and resultant potential impacts on Ontario natural gas markets. Ziff Energy will also consider the impacts of other factors and developments, such as pipeline open season results, settlement discussions and NEB approvals.

10.0 Common Natural Gas Acronyms

AECO Hub	Storage facilities in Western Canada where the benchmark Alberta gas price originated, also known as AECO C (see NIT, below)
Bcf	Billion cubic feet
Bcf/d	Billion cubic feet per day
BCM	Billion cubic metres
CDA	Central Delivery Area
CMS	Consumers Energy
CSA	Canadian Standards Association
DOE/FE	(U.S.) Department of Energy, Office of Fossil Energy
EDA	Eastern Delivery Area
EIA	(U.S.) Energy Information Administration
Empress	Receipt Point for the beginning of the TransCanada Mainline near the AB/Saskatchewan Border
Enbridge	Enbridge Gas Distribution Inc.
FERC	Federal Energy Regulatory Commission
GLGT	Great Lakes Gas Transmission
IGUA	Industrial Gas Users Association
LNG	Liquefied natural gas
MDA	Manitoba Delivery Area
MMBtu	Million British thermal units
MMcf/d	Million cubic feet per day
NDA	Northern Delivery Area
NEB	National Energy Board
NEB OPR	NEB Onshore Pipeline Regulations
NIT	Nova Inventory Transfer, the notional point for gas trades on the Nova Pipeline system, also known as the AECO Hub, or AECO/Nova Inventory Transfer (NIT)
NYMEX	New York Mercantile Exchange
OEB	Ontario Energy Board
SSDA	Saskatchewan Delivery Area
SSMDA	Sault Ste Marie Delivery Area
SWDA	Southwest Delivery Area
TBO	Transportation by Others
Tcf	Trillion cubic feet
TransCanada	TransCanada PipeLines Limited
U.S.	United States of America
U.S. Northeast	Pennsylvania, New York, New Jersey, Connecticut, Rhode Island, Massachusetts, Maine, Vermont, New Hampshire
Union	Union Gas Limited
WCSB	Western Canadian Sedimentary Basin
WDA	Western Delivery Area

11.0 Appendix A: Overview of Ziff Energy

Ziff Energy – A Division of HSB Solomon Associates LLC (Solomon), is a leading international energy consulting firm providing sophisticated industry and operational business analysis, and specialized consulting, to the worldwide energy industry. The firm focuses its efforts principally in two areas:

- E & P – Dozens of North American upstream producers have been involved in field level operating cost and finding and development cost studies that cover most North America onshore and offshore production basins, and a growing number in foreign countries.
- Gas Services – Recognized for its in-depth analysis of North American regional gas markets, gas and liquids supply, transportation, storage, and long-term gas price forecasts.

11.1 Gas Consulting Services

We undertake Gas Consulting assignments that address specific client needs in the areas of operations, strategies, and regulatory matters. Some specifics include:

- Comprehensive advice on emerging gas industry issues and developments within North America and elsewhere internationally. Our technical knowledge and detailed fundamental analysis on emerging supplies and demand sectors are particularly strong.
- Unbiased opinions on complex natural gas industry issues, supported by an understanding of your business challenges; our candid view of industry trends and developments.
- Expert testimony on gas pricing, supply, transportation, storage, and pipeline tolls.
- Early reporting on changing business conditions; strong competitive intelligence.
 - Clearly written, focused research that can help you identify business opportunities and threats; efficient delivery of knowledge.

11.2 Ziff Energy's Gas Team

- *Paul H. Ziff – Executive Vice President*, founded Ziff Energy in 1982 and HSB Solomon Associates LLC (Solomon) acquired the firm in July 2013. He conceptualized the theme of “World Asset Types.” Mr. Ziff has 3 decades of assessment experience for the oil and natural gas industry. A specialist on natural gas industry strategies and upstream corporate performance, Mr. Ziff conceived and directed a wide range of benchmarking studies and consulting projects in upstream corporate performance. Prior, he directed energy research for a major investment firm, gas pricing analysis for a key Alberta government agency, and energy lending analysis for a major bank. Mr. Ziff is an honors graduate of Harvard University, and attended the Université de Paris (Sorbonne) and the Institut d’Études Politiques.
- *W. P. (Bill) Gwozd, P.Eng. – Senior Vice President, Gas Services*, has over 3 decades of natural gas experience regarding gas supply contractual purchases and gas storage strategies, directing gas control functions for transportation contractual arrangements, and preparing written regulatory applications. Other experience includes transportation planning of natural gas liquids pipelines and storage facilities. Mr. Gwozd oversees forecast assessments, semi-annual client debriefings, and our

expert witness testimony service offerings. Focus is on long-term natural gas price outlooks for LNG, LDC, Pipeline, power, and acquisitions. Mr. Gwozd is a frequent guest contributor to various TV stations, radio, newspapers, and magazines.

- *Edward Kallio, B.A. – Director, Gas Consulting*, has over 3 decades of gas industry experience in trading, marketing, portfolio management, supply, forecasting, and policy analysis in the private and public sectors. Mr. Kallio’s experience includes analysis of pipeline rate applications, economic analysis of major domestic and cross-border gas transactions and contracts, and negotiation of storage, transportation, and supply arrangements. He has advised clients with respect to natural gas and electricity supply transactions and hedging programs. Mr. Kallio has traded natural gas in several North American gas supply basins and managed production and supply portfolios in eastern and western Canada and the U.S. At Ziff Energy, Mr. Kallio directs analyses of gas and liquids issues and fundamentals and leads client presentations and briefings. He is frequently quoted in industry and national media.
- *Cameron Gingrich, B.Sc., B.A. – Director, Gas Services*, has a decade of natural gas experience. Responsible for analytical support and in-depth customized data analysis, trending, and modeling. Focuses effort toward the North American Gas Strategies Retainer Service, multi-client studies, and custom consulting projects include: analysis of pipeline tolls, gas supply/storage load duration modeling, gas demand outlooks, and gas price modeling. Mr. Gingrich was the lead analyst on the Northern Gas and Evolution of Dawn Multi-client studies, and authored papers on: Summer Gas Storage Analysis, Canadian Gas Exports to 2025, Natural Gas Price Forecast to 2045, and LNG Outlook to 2035. In addition to the Canadian Securities Course, Mr. Gingrich has two degrees: a Bachelor of Science from the University of Alberta and a Bachelor of Arts in Economics from the University of Calgary where his studies focused on strategic energy and financial markets.
- *Simon Mauger, P.Geol. – Director, Gas Supply and Economics*, has 3 decades of experience in the upstream oil and gas industry as an exploration and development geologist in the Western Canadian Sedimentary Basin and other locations. Mr. Mauger planned, evaluated, and economically modeled gas resources for a leading international exploration and production company; prepared and optimized long term gas supply plans for growing gas markets; and developed the regional exploration component of the North American integrated natural gas strategy. Mr. Mauger develops a gas supply outlook for each North American gas producing region, authors technical research reports on supply, demand, and transport, issues, and assesses gas costs of North American gas basins.
- *Dr. Lev Virine, P.Eng., Ph.D. – Manager, Gas Consulting*, has over 2 decades of technical experience, economic evaluation of oil and gas reserves, decision and risk analysis, portfolio management, and oil and gas reserves management. He assisted leading national and international exploration and production companies in establishing reserves evaluation and decision analysis processes. Dr. Virine is the author of more than 40 scientific papers and articles, 7 patents, and 2 books. His current focus is gas production outlooks, gas supply decline analysis, and full cycle cost assessment. He has spoken at conferences and symposiums around the world. Dr. Virine received his doctoral degree in engineering and computer science from Moscow State University of Railway Engineering.
- *Zuzana Jurickova – Intermediate Gas Analyst*, for the past 8 years, has assisted with gas related North America projects in the areas of gas supply, gas demand, and long-term forecasts. Specific assignments include Western Canada Reserve Replacement (F&D) Cost Study, North American pipeline expansions for a major steel producer, North American Cost Inflation, and Montney, North Duvernay, and South Duvernay gas, NGL, Ethane outlooks. Additional focus pertains to the North American Gas Basin Cost studies. Prior to joining Ziff Energy, Ms. Jurickova worked in corporate credit and finance. Ms. Jurickova holds a Degree in Economics from University of Economics in Bratislava, Slovakia.

- *Julia Sagidova – Gas Analyst*, is responsible for gas supply (including LNG import/export analysis), gas demand, gas transport, gas storage, and gas price data management for the Gas Services team. Client project activity pertains to analysis of natural gas fundamentals and supporting analytics for North American regional multi-client gas studies, the North American Gas Strategy retainer service, and in-depth client consulting projects. Prior experience in petroleum economics and analysis of gas supply issues, along with pricing, forecasting, and analyzing gas market trends. Julia holds a Master's degree in Economics from University of Calgary.