

National Energy
Board



Office national
de l'énergie

North American **Natural Gas Liquids**

Pricing *and* Convergence

Canada 

An **ENERGY MARKET ASSESSMENT** • May 2001

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Overview

In the fall of 2000, the combination of several factors led to unprecedented high energy prices, including high natural gas liquids (NGL) prices. These pricing events have had an impact on the NGL industry and energy prices remain an issue, as both crude oil and natural gas prices are expected to remain strong in the near term.

This report provides a background on NGL pricing, as well as a discussion regarding the impact of energy price convergence.

NGL Marketing Hubs

There are four major North American NGL trading hubs: Edmonton/Fort Saskatchewan, Alberta; Sarnia, Ontario; Conway, Kansas; and Mont Belvieu, Texas (Figure 1). These locations have substantial underground storage facilities and are connected to pipeline transmission and distribution systems. The Edmonton market interacts directly with the Conway market because of the interconnections between Cochin and Mapco pipelines, with both centres serving the U.S. Midwest region. Similarly, although there is no direct physical link, the Sarnia market interacts with Mont Belvieu as these centres serve the same U.S. market, the Northeast.

The Aux Sable extraction and fractionation plant, which commenced service in December 2000 and is located at the terminus of the Alliance pipeline near Chicago, Illinois, has the potential to effectively create a new NGL trading centre. The Aux Sable facilities also connect with existing U.S. NGL delivery pipelines and are strategically located to access large market centres.

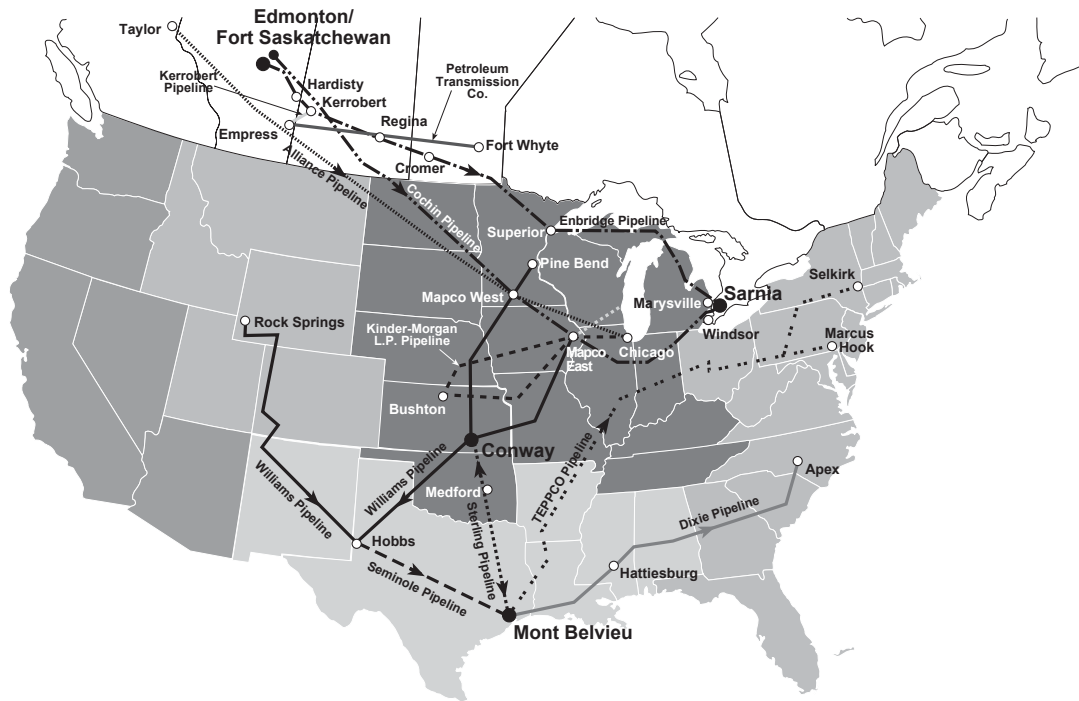
NGL Pricing

All NGL components (ethane (C₂), propane (C₃) and butanes (C₄)) can be used, among other things, as petrochemical feedstock for the production of ethylene, propylene, butylene and other chemical derivatives. Mont Belvieu, with its high concentration of petrochemical, storage, pipeline, fractionation, refinery and waterborne infrastructure, is the largest NGL consuming area in North America. With these facilities and its strategic location on the Gulf Coast, the Mont Belvieu market is the “price setter” or NGL price reference point for North American NGL markets. In addition, since Canadian NGL exports represent only about 10% of U.S. demand, the price for Canadian liquids is set by the U.S. price. The primary factor affecting the Mont Belvieu price is the demand for petrochemical feedstocks.

Although the Sarnia market is a “price taker”, it does so generally at a small premium over Mont Belvieu (historically the premium has been approximately 1/2 to 1 US¢/US gal). The premium represents the theoretical value of transportation (there is no physical link) from the Texas Eastern Pipeline (TEPPCO) terminal in the U.S. Northeast to Sarnia. The Sarnia area has petrochemical, fractionation and refinery facilities.

FIGURE 1

North American NGL Trading Hubs and Pipelines



The Conway market is typically a price taker; however, during months of cold weather (when inventories are low and heating demand is high) the price at Conway can exceed the Mont Belvieu price. The Edmonton market is typically a price taker and is aligned with the Conway price. The Conway and Edmonton hubs are similar in that they have access to petrochemical facilities that utilize ethane only. The Conway and Edmonton netback prices are set relative to Mont Belvieu and Sarnia, respectively, minus a transportation differential. The Conway/Mont Belvieu differential reflects the pipeline tariff to Mont Belvieu. The Edmonton/Sarnia differential reflects the Cochin tariff to Sarnia.

NGL sales contracts generally cover a term of one year, with the price indexed to one of the trading hub's posted-reference price to accommodate monthly price adjustments. The NGL component prices have traditionally tracked oil prices, as the components compete mostly with oil-based products - naphtha and gas oils in particular.

Ethane is the exception. In light of the fact that ethane has an alternative use as a heating fuel, its price tracks the price of natural gas.

Propane and butanes have generally traded at about 75% and 85% respectively, relative to the price of oil (on a volumetric basis). This price relationship, excluding the influence of short-term, local market conditions, generally prevailed until late 2000 when energy markets converged.

Winter 2000/2001: The Beginning of Convergence

In the winter of 2000/2001, the relationship between liquids and crude oil prices essentially collapsed. High energy prices led to a situation where, for a period of time, extraction of liquids from natural gas became uneconomic, as producers received more value for NGLs left in the gas stream. Subsequently, when NGL supply/demand balances tightened in various regions of North America, NGL prices commenced reflecting the unprecedented high natural gas prices.

To understand the events that led to the recent convergence of North American energy prices and the subsequent collapse of the relationship between NGL and crude oil prices, it is necessary to review the broader context within which the Canadian NGL industry is situated. A brief discussion of recent events in both the world oil and North American natural gas markets follows.

World Oil Prices: 1999 and 2000

The recovery of the Asian economies in 1999 and the continuing strong U.S. economy were largely responsible for an increase in the demand for world crude oil in the last half of 1999. This demand growth, in conjunction with OPEC production cutbacks, resulted in demand outpacing supply (production plus crude oil inventories). In fact, by the commencement of the 2000/2001 heating season, world oil inventories had fallen to their lowest levels in a decade.

Economic growth in North America has been strong over most of the past decade. This, in turn, has provided ongoing support for growth in North American energy demand. In addition, low oil prices in 1998 and 1999 and the associated reduction in exploration and development capital spending by oil and gas companies, led to reserve replacement not keeping pace with North American oil production. U.S. oil inventories entering the 2000/2001 winter were at five-year lows.

All of the above events supported high world oil prices, peaking in the US\$35 plus per barrel range in November 2000, and these high prices spilled over into other tight energy markets.

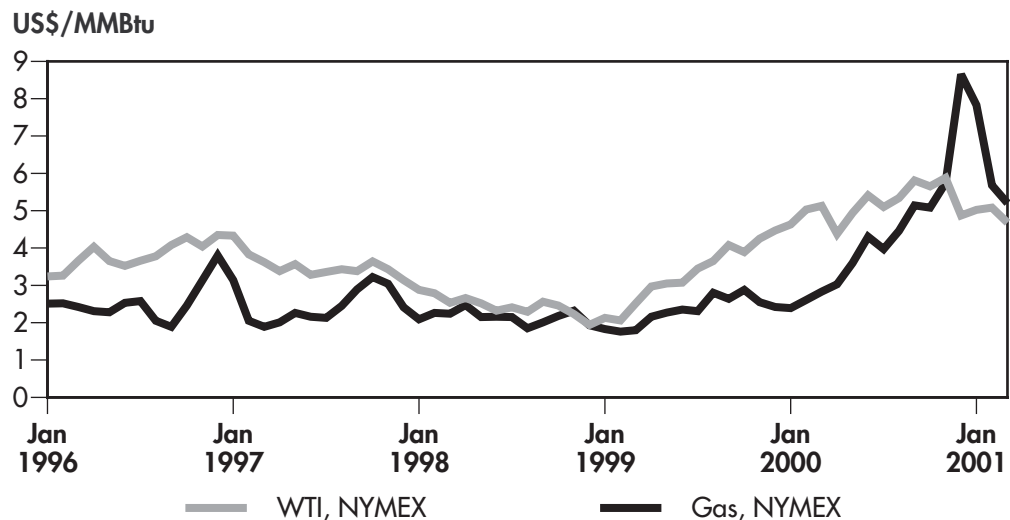
North American Gas Market: 1999 and 2000

Since the late 1980s and prior to the fall of 2000, natural gas traded (on a heat content basis) at a value lower than oil (Figure 2). Over the last two years, gas demand growth outpaced supply growth. This, in turn, led to an explosion in natural gas prices in the fall of 2000 into the US\$7 to US\$9/MMBtu range, for the following reasons.

- i) Economic growth in North America has been strong and provided ongoing support for an increase in energy demand.
- ii) The rise in electricity demand has been faster than the growth in overall energy demand, partly due to increased use of computing equipment and electrical appliances

FIGURE 2

Natural Gas and Crude Oil Prices



(air conditioning, exterior lighting, home entertainment systems, refrigeration, etc.). This rise in electricity demand (in conjunction with concern about the environment) has intensified natural gas demand, as gas-fired electricity generation rose significantly.

- iii) In the summer of 2000, rather than replenishing gas storage volumes, gas sales were focussed on meeting gas-fired power generation demand. This resulted in a low natural gas inventory situation going into the winter 2000/2001.
- iv) A lack of power generating capacity (particularly in California and to a much lesser extent in Alberta) added additional pressure, increasing the price of both gas and electricity¹.

The escalation in natural gas prices seemed to appear with stunning swiftness. From 1999 through 2000, North American gas prices almost quadrupled from about US\$2.50/MMBtu to US\$9/MMBtu. All of these events (increased energy demand, low energy stocks, lagging reserves replacement, constrained power generation capacity and constrained gas transportation capacity near market centres in both Canada and the U.S.) led to the unprecedented high energy prices by the end of 2000.

The Recent NGL Market: December 2000 to January 2001

In this period, North American gas plant operators began adjusting operations to minimum liquids recovery levels. That is, they responded to high natural gas prices by curtailing NGL extraction (ethane and propane in particular), recovering butanes and condensate as required to meet gas pipeline dewpoint specifications. As a result, producers received the higher gas price for the liquids left in the gas stream, as opposed to the lower ethane and propane market prices at that time. In addition, producers were not required to pay the increased gas processing and fractionation fees, which also resulted from high natural gas and electricity costs. For example, prior to the fall of 2000, producers in Alberta paid about Cdn\$45/MW.h of electricity compared to Cdn\$200 to Cdn\$250/MW.h during the winter 2000/2001. Extraction and fractionation costs, which ranged from about 6US¢/USgal to 10US¢/USgal (Cdn\$24 to \$40/m³), depending upon the extraction process, prior to fall 2000, increased by approximately 3US¢/USgal (Cdn\$12/m³). The economics justifying the separation of liquids to spec products had essentially disappeared².

As NGLs have an alternative use as fuel (home heating and industrial/refinery processes), it is now understood that liquids prices can be influenced not only by oil prices but also by natural gas prices, depending upon which commodity is trading at a higher value on a heat content basis. In general, as long as plant economics remain poor liquids production will remain below full recovery levels. This, in turn, will cause NGL supply/demand balances to tighten and prices to increase³.

Demand for NGLs changed significantly during the 2000/2001 winter period. For example, the shortage of liquids resulting from extraction cutbacks prompted some petrochemical companies to look for other feedstocks for their ethylene crackers, wherever possible. Refiners, particularly in California, switched to burning NGL as fuel for refinery processes, rather than pay the higher price for natural gas. Eventually the NGL supply/demand balances tightened dramatically in several

1 The link between natural gas and electricity prices relates to how electricity is priced. In Power Pools, electricity is generally priced on-the-margin (i.e., based on the price of the last unit of electricity sold). As gas-fired units are often the last units used to meet peaking demand, the cost of gas-fired generation often sets the market clearing price of electricity for markets which rely on Power Pools for their electricity supply.

2 With gas valued at over US\$7/MMBtu, oil at about US\$28/bbl and electricity priced above US\$200/MW.h, producers with discretionary volumes determined that it was not economic to separate and sell liquids as spec product.

3 However, if operations remain at minimum recovery levels for an extended period of time, liquids cannot be left to accumulate in the gas stream indefinitely. Eventually, gas plants will be required to extract the NGLs to meet pipeline specifications, thus increasing supply and causing downward pressure on liquids prices.

market regions (e.g., Sarnia, California, Hattiesburg, Mississippi) and liquids prices commenced tracking the price of natural gas.

The following three graphs (Figures 3, 4 and 5) compare the prices of C₂, C₃ and C₄, respectively, to the price of natural gas on a heat content basis. Figures 4 and 5 also include crude oil prices. Although C₃, C₄ and oil prices are not normally discussed in terms of \$/MMBtu, for the purpose of this report heat content units have been chosen to illustrate the cross-over point in December 2000, when C₃ and C₄ prices commenced tracking natural gas prices^{1,2}.

FIGURE 3

Ethane and Natural Gas Prices (on a heat content basis)

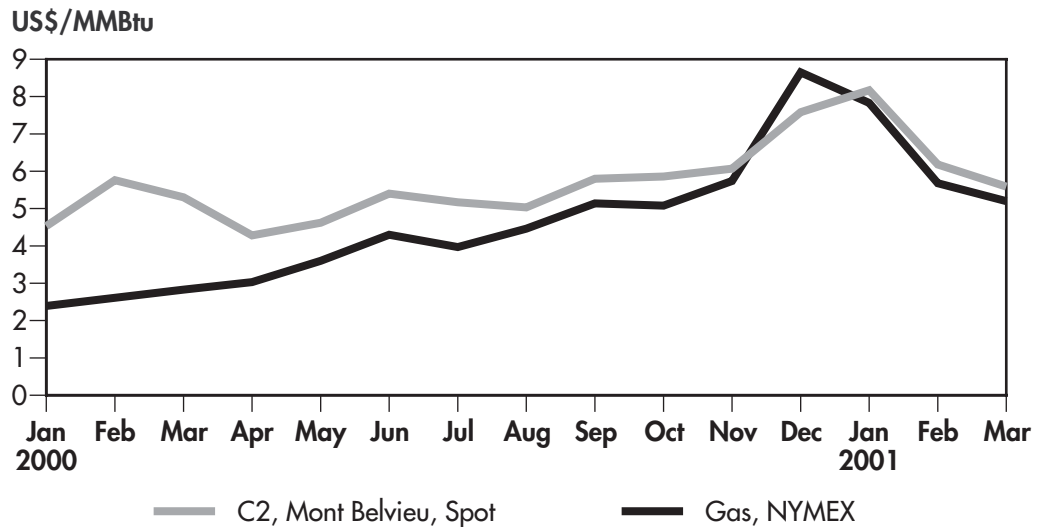
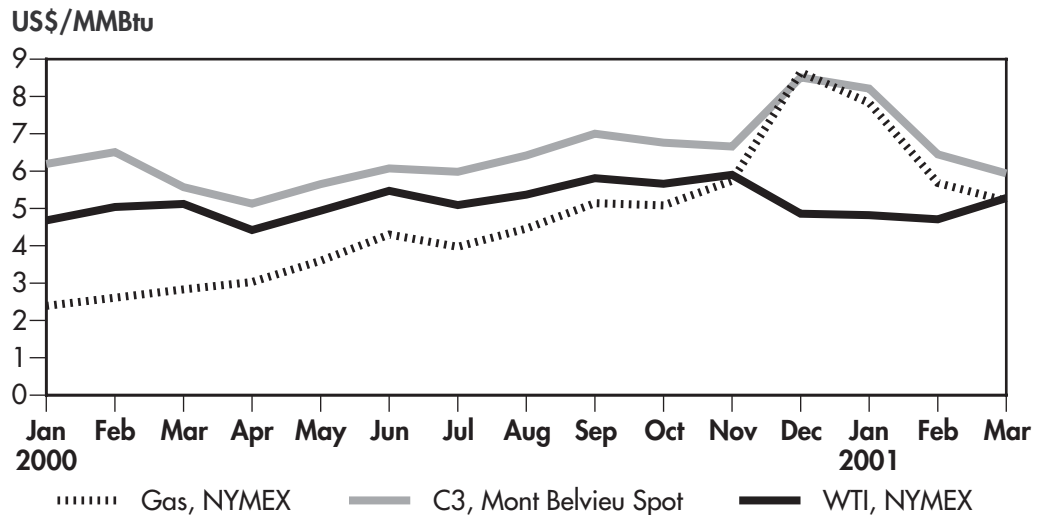


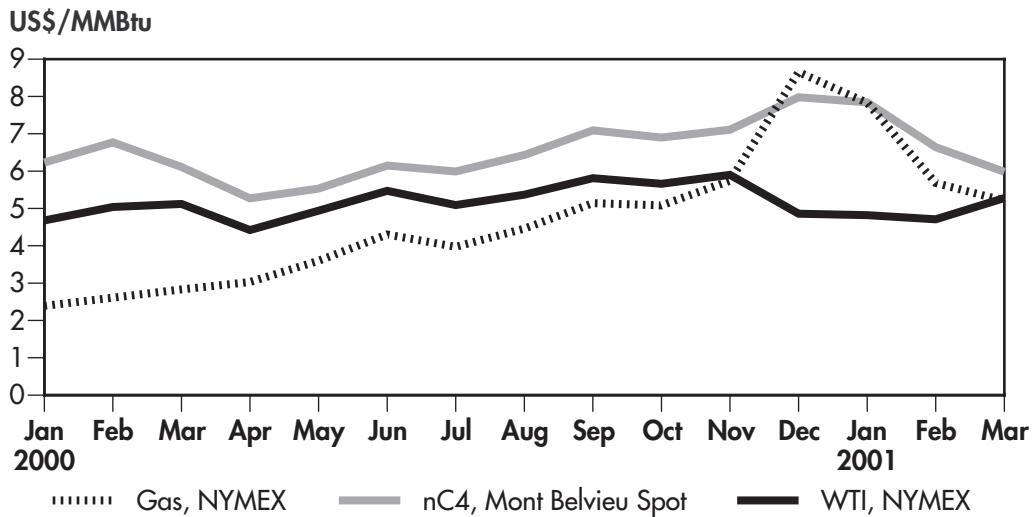
FIGURE 4

Propane, Natural Gas and Crude Oil Prices (on a heat content basis)



1 Heat Content: Ethane (3.08 MMBtu/bbl); Propane (3.84 MMBtu/bbl); Butane (4.33 MMBtu/bbl); Naphtha (5.25 MMBtu/bbl); Crude Oil (assumed to average 5.83 MMBtu/bbl)

2 Of note, when viewed in terms of energy content as opposed to on a volumetric basis, the price relationship of C₃ and C₄ trading at 75% and 85%, respectively, relative to the price of oil is not apparent.

FIGURE 5**Butanes, Natural Gas and Crude Oil Prices (on a heat content basis)****First Quarter 2001 Energy Price Developments**

About December 2000, OPEC oil production increases throughout 2000 led to production catching up with demand. After reaching over US\$35/bbl for WTI in mid-November 2000, crude oil prices decreased, as growth in the U.S. economy started to slow and oil product stocks commenced increasing to more normal levels. During 1Q2001, oil prices remained in the US\$26 to US\$28/bbl range.

Also during this period, the unprecedented high gas prices, in conjunction with decreased oil prices, led to accelerated gas-to-oil fuel substitution. This factor along with the curtailment of energy-intensive industrial activity eventually led to natural gas “demand destruction”. By March 2001, natural gas prices fell to about US\$5 to US\$6/MMBtu due to this demand loss and slowly increasing gas production. By the end of April 2001, gas was trading at a value approximately par with oil and NGL production is returning to the marketplace.

With the decline in natural gas prices, NGL prices once again appear to be tracking oil prices, but at a premium to their former liquids/oil relationship. However, as long as natural gas prices remain “at parity” with oil prices there is potential for reduced NGL supplies.

Observations

The unprecedented high natural gas prices in the November 2000 to January 2001 period had an impact not only on NGL prices, but on how liquids were valued. As a result of this experience, NGL prices are expected to continue to be influenced by both oil and gas prices. With natural gas prices forecast to be volatile for the next few years, extraction economics become questionable. In other words, producers with discretionary volumes will make periodic decisions (based on oil and natural gas prices, as well as the price of NGLs in the marketplace - taking into account processing costs) on whether to extract liquids or to leave them in the gas stream.



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