



An Update on North Dakota's Natural Gas Infrastructure

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Overview

Since the first successful Bakken well was drilled in North Dakota in 2006, the state's petroleum industry has been on a fast paced journey to unlock the vast resources held deep inside this challenging formation. A second formation directly below the Bakken, known as the Three Forks, is also generating a great deal of excitement as area producers have had early success utilizing similar well completion techniques. While the total resource base for these two formations is still being studied, early reports indicated roughly 200-500 billion barrels of oil in place (LeFever and Helms, 2006). With a resource base as large as that found in the Bakken and Three Forks, North Dakota can expect many more years of intense drilling and development, followed by several more decades of continued petroleum production.

This report is an update to the North Dakota Pipeline Authority's 2007 Natural Gas White Paper. In an attempt to reduce duplication, this report will focus on new developments in both production and infrastructure. Please reference the previous report for a comprehensive overview of natural gas infrastructure, marketing, and regulatory fundamentals.

North Dakota Natural Gas Production

The Bakken and Three Forks Formations are most widely known for their immense oil resources. A lesser known fact is that these two formations are also rich in associated natural gas, or natural gas that is produced from an oil well. During the early 2000's, North Dakota's natural gas production was holding steady around 150 million cubic feet per day (MMCFD). As can be clearly seen in Figure 1, North Dakota's natural gas production has risen dramatically with the development of the Bakken and Three Forks and hit an all time record of 280.6 MMCFD in February 2010. The new record is not anticipated to stand long as regional operators continue to expand their drilling programs and completion techniques improve.

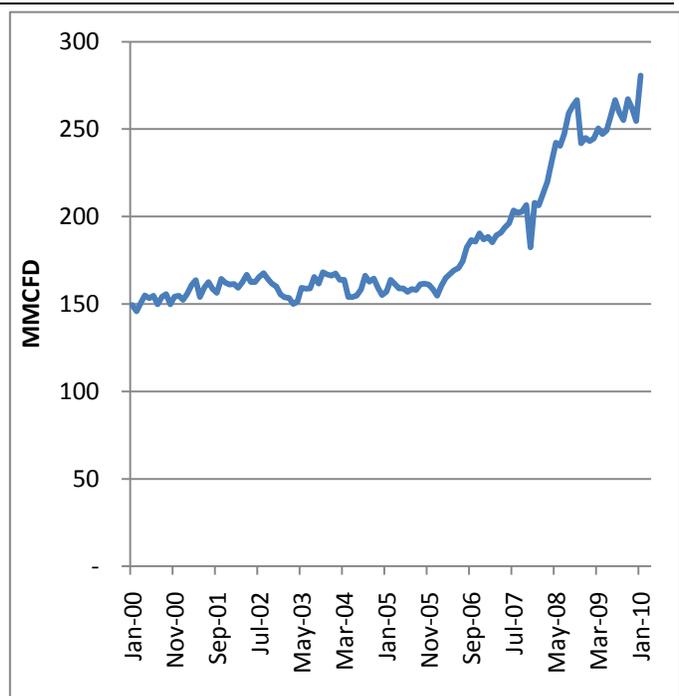


Figure 1. North Dakota Natural Gas Production, Million Cubic Feet per Day

North Dakota Natural Gas Pipelines

Once natural gas is produced from a well, the only economic means of transportation is by pipeline. Natural gas pipelines are divided into gathering, transmission, and distribution pipelines. Gathering pipelines are used to connect individual wells to a processing facility. Larger, high pressure pipelines, called transmission pipelines, are used to move greater volumes of natural gas from a processing plant to an end market. Transmission pipelines may operate entirely inside state boundaries (intrastate) or cross state and international boundaries (interstate). Finally, distribution pipelines are used by local distribution companies (LDC) to deliver natural gas to customers within their service area.

Transmission Pipelines

North Dakota has a broad network of high pressure, high volume natural gas pipelines operating throughout the state (Figure 2). These transmission pipelines are responsible for safely transporting natural gas treated at one of North Dakota's natural gas facilities to markets in and out of state. For the most part, North Dakota's natural gas transmission infrastructure is well sized and positioned to handle future production growth from North Dakota. In order to alleviate small scale constraints within the current infrastructure, it may be necessary to increase compression or loop small segments of the systems.

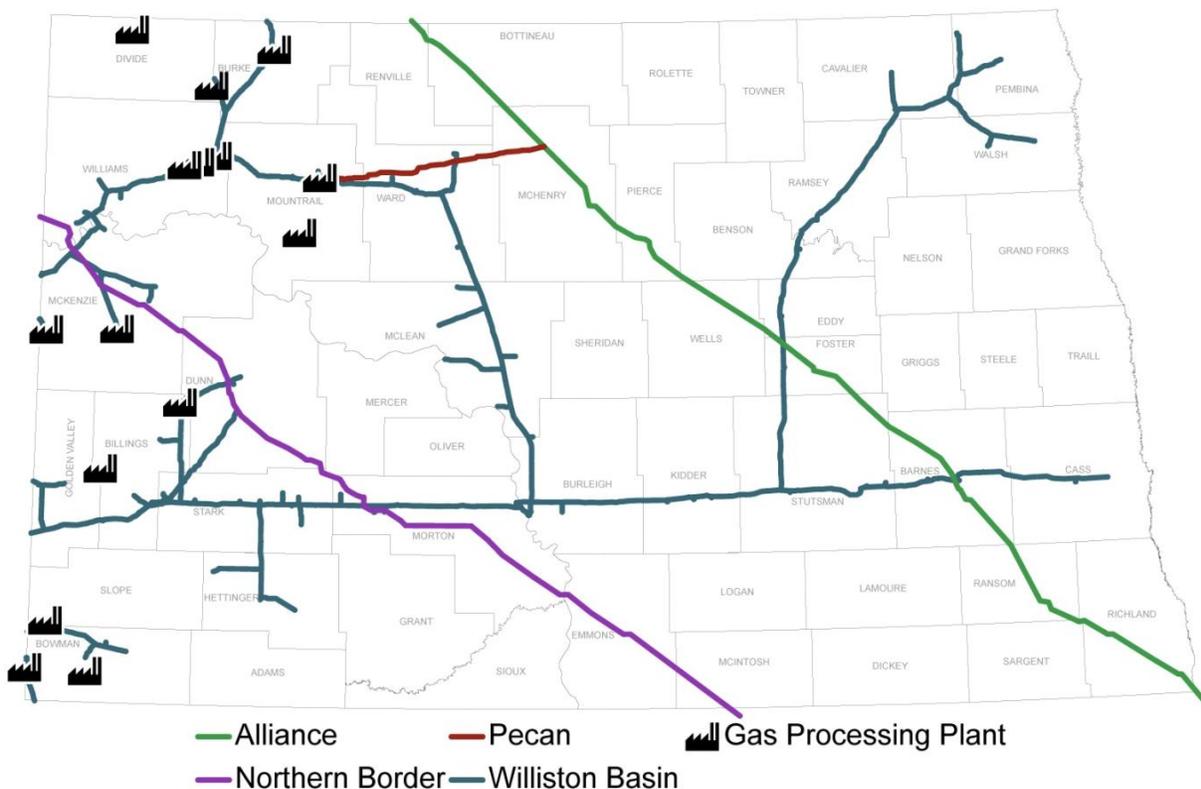


Figure 2. Major Natural Gas Pipelines in North Dakota

Alliance Pipeline: The Alliance Pipeline is a high pressure, large diameter natural gas pipeline that originates in British Columbia, Canada and terminates at the Aux Sable gas processing plant near Chicago, IL. The Alliance Pipeline transports “dense gas” or gas that still contains high BTU natural gas liquids, such as propane and butane. In February 2010, the Alliance Pipeline began transporting rich natural gas from North Dakota via a new interconnect with Pecan’s Prairie Rose Pipeline near Bantry, North Dakota. The 36 inch diameter United States portion of the pipeline has a certified capacity of 1.513 billion cubic feet per day (BCFD) and had 188 MMCFD of capacity available prior to the Prairie Rose Pipeline startup (Alliance, 2009). The Alliance Pipeline has one North Dakota delivery point in Hankinson.

Northern Border: The Northern Border Pipeline, owned by TC Pipelines and ONEOK Partners, is a 1,249 mile pipeline originating at the Port of Morgan in Montana and terminating near North Hayden, Indiana. The pipeline has a system receipt capacity of 2.37 BCFD, a large portion of which is supplied with Canadian natural gas through a receipt point with the Foothills Pipeline at the Port of Morgan. The Williston Basin Interstate Pipeline interconnects with the Northern Border Pipeline in North Dakota in three locations, Charbonneau, Manning, and Glen Ullin. The 42 inch diameter Northern Border Pipeline also receives gas deliveries in North Dakota from Bear Paw Energy at Ft. Buford, Hess at Watford City, and Dakota Gasification Co. at Hebron (Northern Border, 2010).

Williston Basin Interstate Pipeline: The Williston Basin Interstate Pipeline Co. operates 3,367 miles of natural gas transmission pipelines throughout North Dakota, Montana, Wyoming, and South Dakota. This network of pipelines plays a vital role in North Dakota’s natural gas industry. It contains eleven interconnecting points with other regional pipelines and can also deliver natural gas to local distribution companies or natural gas storage fields. Well positioned throughout western North Dakota, the Williston Basin Interstate Pipeline has been able to expand its operating capabilities without needing to place new pipe in the ground. In December of 2008, Williston Basin Interstate Pipeline completed its “Bakken Expansion” which added an additional 32 MMCFD (expandable to 60 MMCFD) of capacity to their North Dakota system by interconnecting to the Northern Border Pipeline at Charbonneau. Also in December 2008, the “Sheyenne Expansion” added an additional 10 MMCFD of capacity to their system by increasing compression and deliveries in eastern North Dakota. Finally, in February 2010, an open season was held to increase firm deliverability from its Baker gas storage field in eastern Montana. Along with the gas storage field upgrades, Williston Basin proposed a pipeline expansion to transport the increased firm storage volumes to the Manning interconnect with the Northern Border Pipeline. The project has a proposed in-service date of April 2012 (Williston Basin Interstate Pipeline Co, 2010). (Results of the open season were not publicly available at the time of this report.)

Pecan Pipeline: While the North Dakota Public Service Commission determined Pecan’s Prairie Rose Pipeline to be a gathering pipeline, the Pipeline Authority believes the uniqueness and location of the pipeline make it worth noting in this section. The 75 mile, 12 inch pipeline went into service February 2010 and has the capability to transport over 100 MMCFD of unprocessed natural gas per day from Mountrail County to an interconnect with the Alliance Pipeline near Bantry, ND (Pecan Pipeline, 2010).

Bison Pipeline: TransCanada plans to begin construction of the 302 mile, 30 inch Bison Pipeline during the summer of 2010. The pipeline will be built to connect natural gas production in the Powder River Basin of Wyoming to the Northern Border Pipeline in Morton County North Dakota. The pipeline will have an initial capacity of 477 MMCFD and could be expanded to 1 BCFD. If the construction process proceeds as scheduled, the pipeline will be set to begin operation in November 2010 (TransCanada, 2010).

Gathering Pipelines

North Dakota contains a vast network of natural gas gathering pipelines throughout the western portion of the state. Gathering pipelines vary from small diameter, low pressure systems, to large diameter pipelines capable of transporting 100 MMCFD or more, such as the new Prairie Rose Pipeline.

Natural gas gathering currently represents the largest challenge for North Dakota's natural gas industry. With drilling located in regions that were not previously served by a natural gas plant, high drilling rig counts, and more efficient completion techniques, the challenge of natural gas gathering systems keeping up with expanding development is one that will continue for several more years.

Natural gas gathering pipelines are exempt from the North Dakota Public Service Commission siting and regulatory process. This exemption makes it very difficult to obtain material and maps showing the exact placement of the state's gathering systems, unless the information is shared or made public by an individual pipeline operator. One alternative method to determine where natural gas gathering pipelines are operating is to map individual wells labeled by which particular natural gas processing plant they are connected (Figure 3). Figure 3, last updated in January 2010, nicely depicts exactly what regions are serviced by natural gas gathering infrastructure and which regions are currently undeveloped. Note the colors represent well locations only and that natural gas gathering pipelines may be operating in areas not highlighted on the map.

During the early stages of Bakken exploration in North Dakota, much of the drilling was focused in and around Mountrail County. Mountrail County lacked the necessary natural gas gathering infrastructure and large volumes of natural gas were flared as a result. After commissioning two new natural gas plants in 2008 and expanding the associated gas gathering systems (Figure 4), Mountrail County was able to reduce its flaring 62% from December 2008 to December 2009.

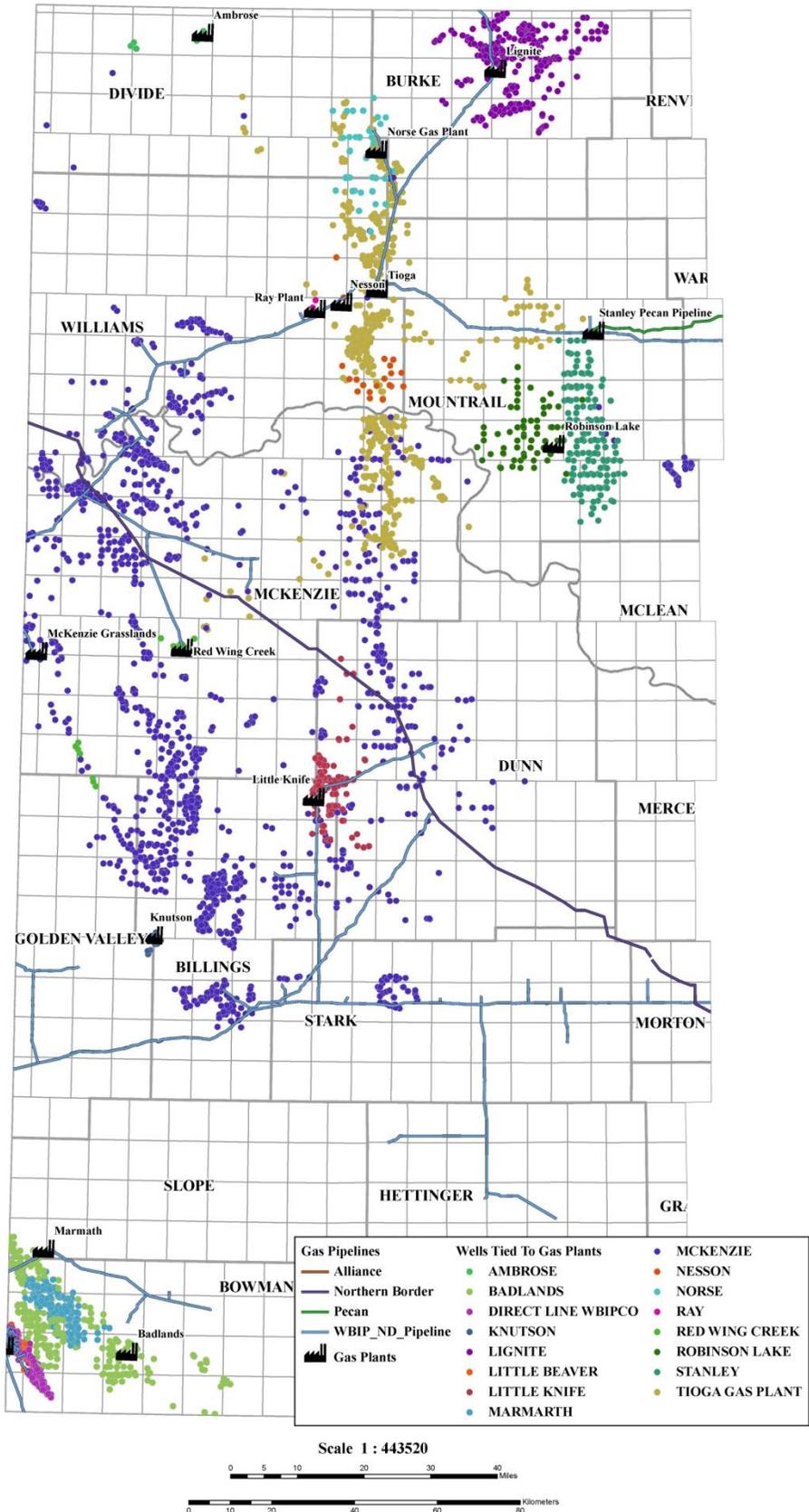


Figure 3. North Dakota Natural Gas Plant Connections (Created ND DMR, Updated Jan 2010)

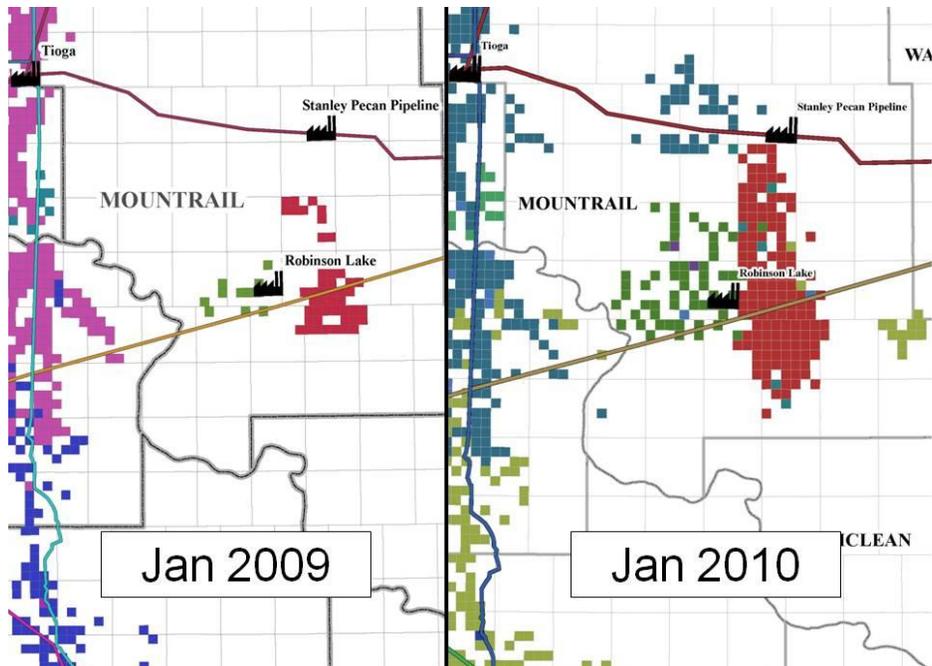


Figure 4. Gathering System Expansion Growth in Mountrail County North Dakota

North Dakota Natural Gas Plants

North Dakota has eleven traditional natural gas processing plants currently operating within the state (Figure 5). In February 2010, EOG's gas plant near Palermo, ND was converted to a condensate recovery facility for Pecan's Prairie Rose Pipeline. Also shown in Figure 5 is Summit Resource's natural gas separation unit in Billings County, which returns all the separated natural gas back to the field for fuel. Lastly, Whiting's Ray gas plant in Williams County was idled in January 2009 for economic reasons and no timeline has been set for reactivation.

As seen by the total gas processing capabilities in Figure 5, North Dakota has seen tremendous growth in its ability to either process natural gas locally or remotely, as is the case of Pecan's Prairie Rose Pipeline. Figure 6 charts the growth in natural gas plant intake volumes over the past ten years. At first glance, it would appear that North Dakota has an oversized natural gas processing industry, but it is believed that as the Bakken and Three Forks development continues to expand, additional processing or large scale gas gathering pipelines will be necessary to support the expanding development. A chart of North Dakota's natural gas plant dry gas production can be found in Appendix A.

Natural Gas Processing, Million Cubic Feet Per Day (MMCFD)

Owner Company	Facility	County	2006 Plant Capacity	2008 Plant Capacity	2010 Plant Capacity
North Dakota					
Bear Paw / ONEOK	Lignite	Burke	6	6	6
Bear Paw / ONEOK	Marmath	Slope	7.5	7.5	7.5
Petro Hunt	Little Knife	Billings	32	32	32
True Oil	Red Wing Creek	McKenzie	4	4	4
Sterling Energy	Ambrose	Divide	0.5	0.5	0.5
EOG Resources	Stanley	Mountrail	NA	20	0*
Whiting Oil & Gas	Robinson Lake	Mountrail	NA	30	35
Whiting Oil & Gas	Ray	Williams	NA	10	10
XTO	Nesson	Williams	NA	10	10
Bear Paw / ONEOK	Grasslands	McKenzie	63	100	100
Hess	Tioga	Williams	110	120	120
Hiland Partners	Badlands	Bowman	4	40	40
Hiland Partners	Norse/McGregor	Divide	NA	NA	10
Summit Resources	Knutson	Billings	NA**	NA**	NA**
Aux Sable - Chicago, IL					
Pecan Pipeline/Aux Sable	Stanley	Mountrail	NA	NA	100
Total			227	380	475

*Stanley plant converted to a condensate removal facility on the Pecan Prairie Rose Pipeline
 **Knutson facility operates a gas separation unit. All separated gas is returned to well site for fuel.

Figure 5. North Dakota Natural Gas Processing Facilities

New or Expanding Natural Gas Plants

On April 13, 2010, Hess filed a letter of intent with the North Dakota Public Service Commission to expand the Tioga Gas Plant, currently the largest and oldest natural gas processing plant in the state. The plant expansion will more than double the current throughput with a new nameplate capacity of 250 MMCFD. Hess plans to begin construction in March 2011 and have the facility operational by December 2012. Hess anticipates the expansion to cost approximately \$325 million (Hess, 2010)

On April 21, 2010, ONEOK Partners announced a new 100 MMCFD natural gas processing plant in eastern McKenzie County. The new "Garden Creek" plant will double ONEOK's processing capacity in North Dakota and is expected to be complete in late 2011. ONEOK estimates the new processing plant will require an investment of \$150 - \$210 million (ONEOK, 2010). An additional \$200 - \$205 million is scheduled to be invested in new gathering infrastructure during 2010 and 2011 to supply ONEOK's gas processing facilities.

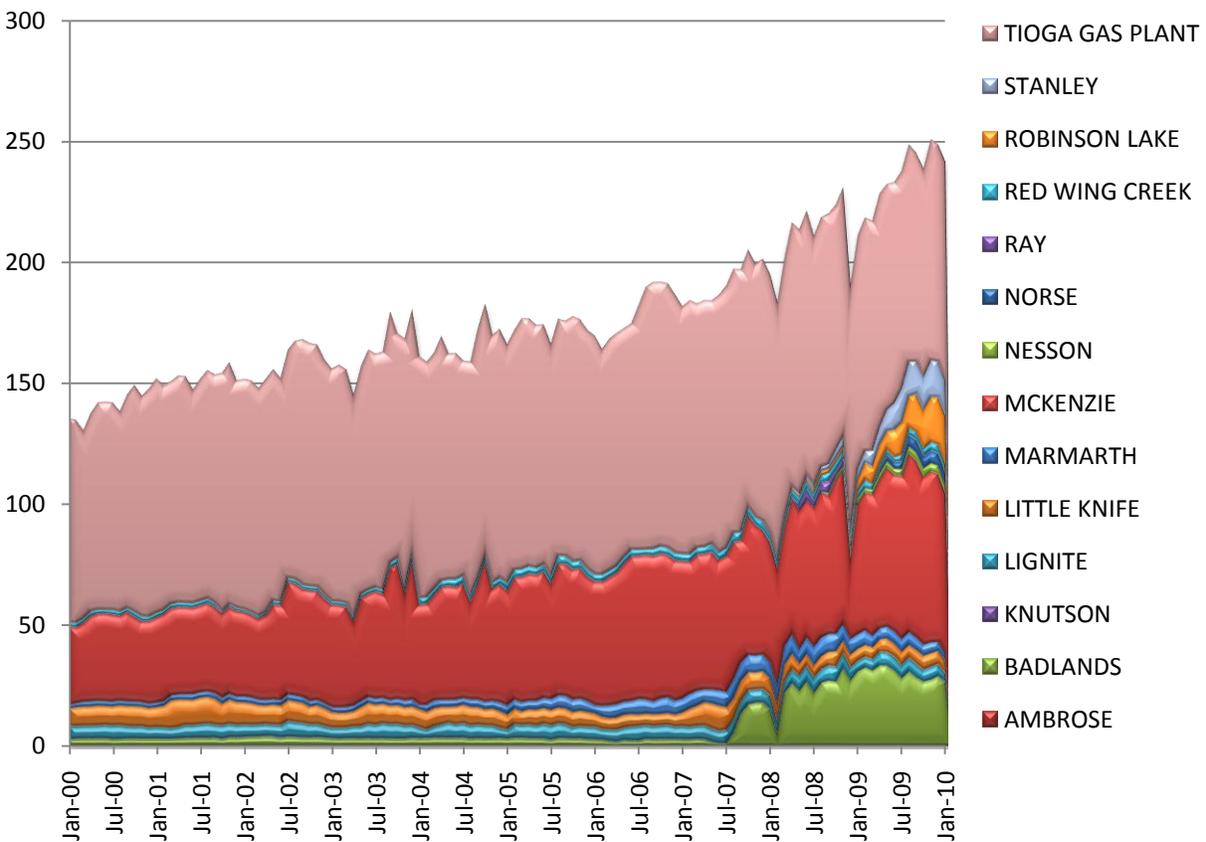


Figure 6. Historical Natural Gas Plant Intake by Facility, MMCFD

North Dakota Natural Gas Liquids

The natural gas produced from the Bakken and Three Forks formations is considered to be “rich” or “wet” natural gas, meaning it is high in natural gas liquids (NGLs). As seen in Figure 7, North Dakota produced just over 20,000 barrels per day of NGLs in January 2010 on a curve that has been steadily growing since Bakken exploration accelerated in 2006. The natural gas liquids, such as propane, butane, and natural gasoline, are held in the produced natural gas stream and must be separated at a natural gas processing plant using a procedure known as fractionation. Detailed propane, butane, and natural gasoline charts can be found in Appendix B.

Differing from natural gas, NGLs can be transported in liquid form by truck, rail, or pipeline to market. The two largest markets for NGL’s in North Dakota are butane consumption at Tesoro’s Mandan Refinery and liquefied petroleum gas (LPG) for use as a heating fuel. Tesoro’s demand for butane fluctuates greatly depending on whether the refinery is producing summer or winter blends of gasoline. During the peak demand at Tesoro’s refinery, between 2,000 and 3,000 barrels of butane per day are

combined with gasoline to create a winter blend. The North Dakota Tax Department reported that just over 3 million barrels of LPGs were sold to consumers in North Dakota during the 2009 fiscal year. All NGL's that are not consumed locally are transported to market by rail or truck.

North Dakota has one NGL pipeline operating in the state, the Kinder Morgan Cochin Pipeline. The twelve inch Cochin Pipeline currently carries propane produced in Alberta through North Dakota, with one propane delivery point in Carrington, North Dakota. At this time, the Cochin Pipeline does not transport any NGLs out of North Dakota. Kinder Morgan has been working with area crude oil producers and shippers to utilize available space on the Cochin Pipeline for transporting crude oil to markets in the Midwest.

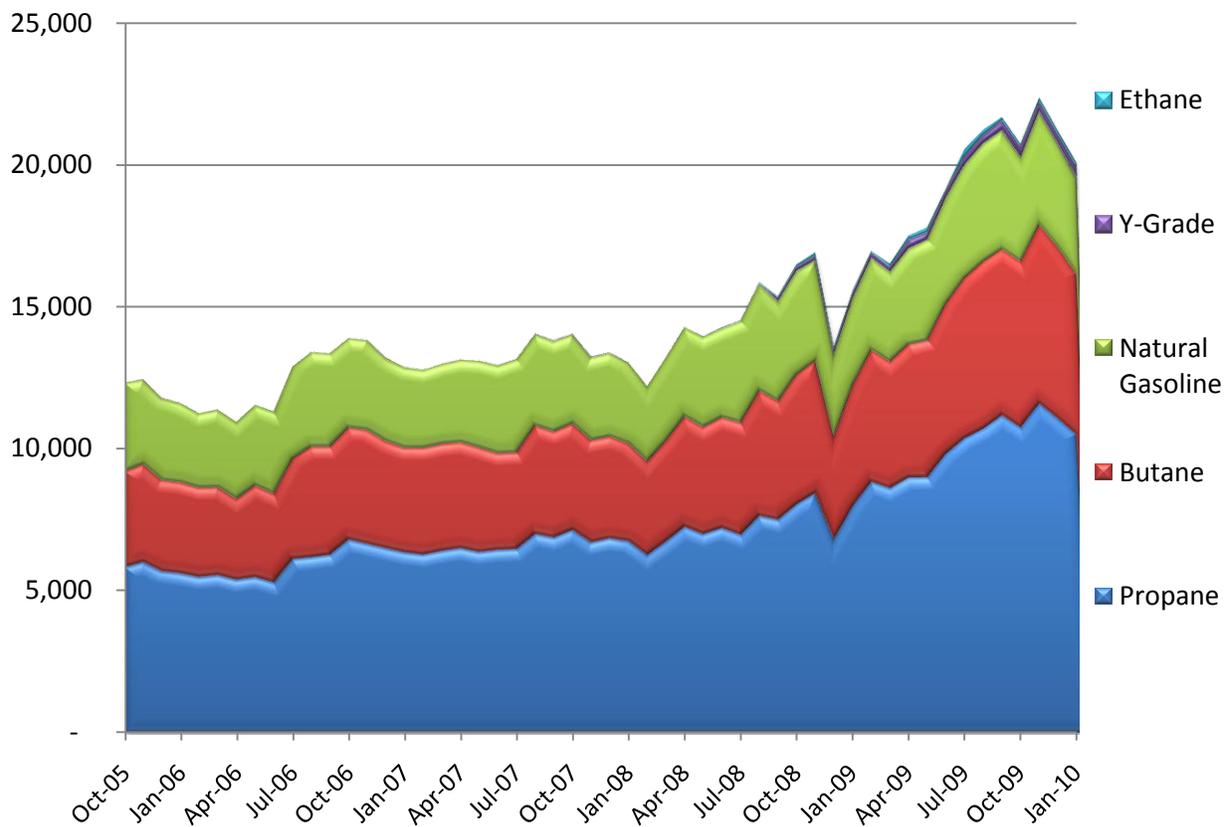


Figure 7. North Dakota Natural Gas Liquids by Type, Barrels per Day

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Acknowledgment

All natural gas production and processing data used in this report was obtained from the North Dakota Oil & Gas Division's database.

APPENDIX A: North Dakota Dry Natural Gas Production

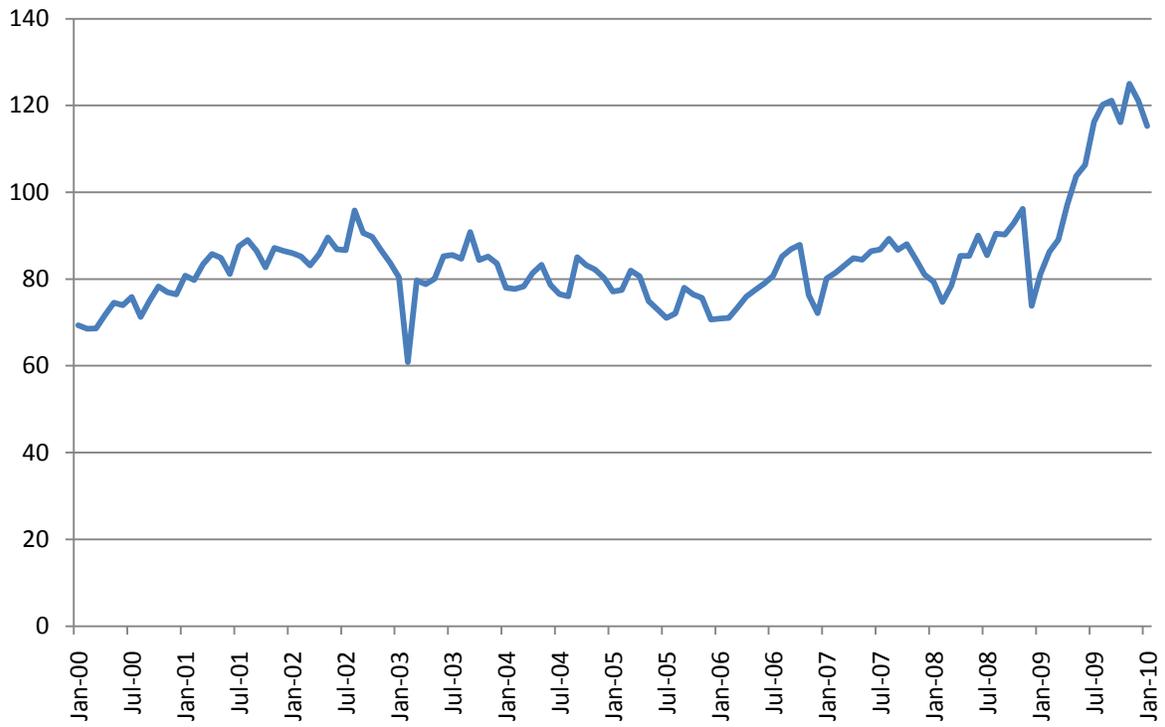


Figure 8. North Dakota Dry Natural Gas Production, MMCFD (Natural Gas Plant "Tailpipe" output)

APPENDIX B: North Dakota Natural Gas Liquids Production

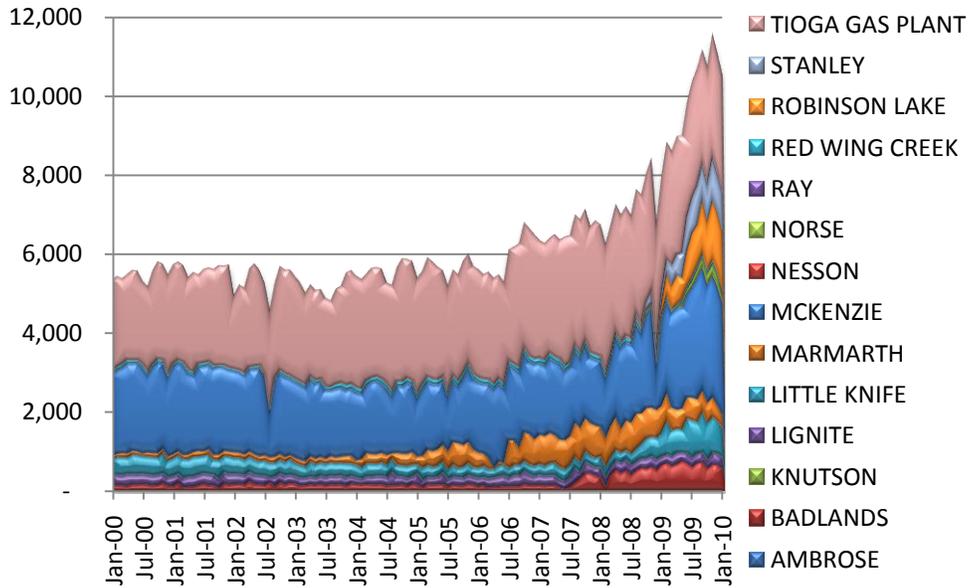


Figure 9. North Dakota Propane Production, Barrels Per Day

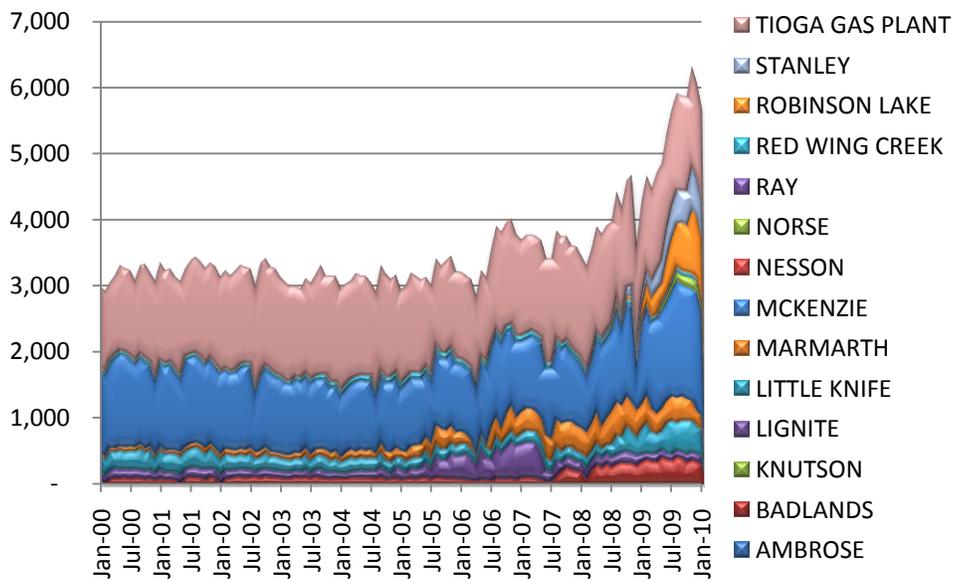


Figure 10. North Dakota Butane Production, Barrels Per Day

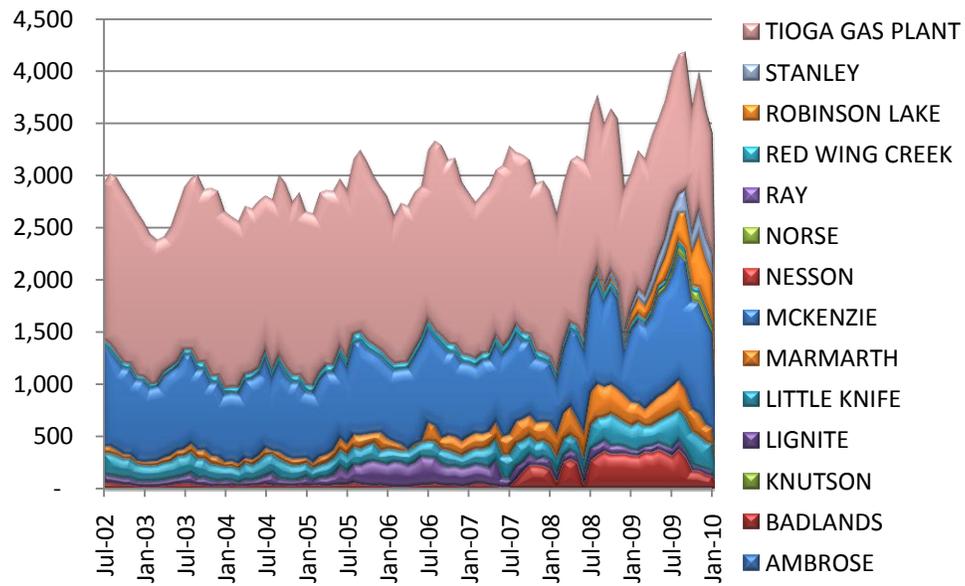


Figure 11. North Dakota Natural Gasoline Production, Barrels Per Day