### **North Dakota Pipeline Authority**



### Annual Report July 1, 2015 – June 30, 2016

Industrial Commission of North Dakota Governor Jack Dalrymple, Chairman Attorney General Wayne Stenehjem Agriculture Commissioner Doug Goehring

#### North Dakota Pipeline Authority Annual Report July 1, 2015 – June 30, 2016

#### Overview

At the request of the North Dakota Industrial Commission, the Sixtieth Legislature passed House Bill 1128 authorizing the North Dakota Pipeline Authority. It was signed into law on April 11, 2007. The statutory mission of the Pipeline Authority is "to diversify and expand the North Dakota economy by facilitating development of pipeline facilities to support the production, transportation, and utilization of North Dakota energy-related commodities, thereby increasing employment, stimulating economic activity, augmenting sources of tax revenue, fostering economic stability and improving the State's economy". As established by the Legislature, the Pipeline Authority is a builder of last resort, meaning private business would have the first opportunity to invest in and/or build additional needed pipeline infrastructure.

By law, the Pipeline Authority membership is comprised of the members of the North Dakota Industrial Commission. Upon the recommendation of the Oil and Gas Research Council, the Industrial Commission authorized the expenditure of up to \$200,400 during the 2015-2017 biennium for the Pipeline Authority with funding being made available from the Oil and Gas Research Fund. On August 1, 2008 the Industrial Commission named Justin J. Kringstad, an engineering consultant, to serve as Director of the North Dakota Pipeline Authority. The North Dakota Pipeline Authority Director works closely with Lynn Helms, Department of Mineral Resources Director, Ron Ness, North Dakota Petroleum Council President and Karlene Fine, Industrial Commission Executive Director. The Pipeline Authority has no other staff and receives no direct General Fund appropriation. The Pipeline Authority Director reports to the Industrial Commission and the Oil and Gas Research Council on a regular basis.

#### **Statutory Authority**

Statutory authority for the Pipeline Authority is found in Chapter 54-17.7 of the North Dakota Century Code (N.D.C.C.). Section 54-17.7-04 N.D.C.C. delineates the powers of the Pipeline Authority including: 1) making grants or loans or to borrow money; 2) to issue up to \$800 million in revenue bonds; 3) enter into lease-sale contracts; 4) own, purchase, lease, rent and dispose of pipeline facilities or the right to capacity in any pipeline system or systems within or without the State of North Dakota; 5) enter into contracts to construct, maintain and operate pipeline facilities; 6) investigate, plan, prioritize and propose transportation corridors; and 7) participate in regional pipeline organizations.

Before the Pipeline Authority may exercise its power to construct pipeline facilities, it must follow a process defined by statute to ensure public participation and comment. In particular, the Pipeline

Authority must publish a notice describing the need for the pipeline project. Entities interested in constructing the facilities or furnishing services to satisfy the identified needs have 180 days to respond by filing a notice of intent. If the Pipeline Authority receives a notice of intent from an interested entity, it may not exercise its powers to construct unless the Pipeline Authority makes a finding that doing so would be in the public interest. In making such a finding, the Pipeline Authority shall consider the economic impact to the state, economic feasibility, technical performance, reliability, past performance, and the likelihood of successful completion and ongoing operation.

#### **Summary of Activities**

Low oil prices in the 2015-2016 timeframe have caused petroleum related activity in North Dakota to slow considerably. Despite the activity slowdown, the midstream industry continued to position itself to meet current production levels, and continue to plan for further expansion when price levels increase. More efficient drilling rigs and advances in drilling and completion techniques allowed North Dakota oil production to remain at historically high levels. During the past year, the Pipeline Authority has been fully engaged in continuing efforts to convert production and development information into oil and natural gas transportation solutions. Working alongside industry to produce crude oil and natural gas production forecasts to quantify future pipeline needs and time frames continues to be one of the principal tasks of the Pipeline Authority. Pipeline companies are conservative by nature and these forecasting exercises proved to be very beneficial in providing the confidence needed to move forward with expansion project planning.

During the fiscal year the Pipeline Authority contacted, met with, and shared information with numerous interested parties, including the following:

**Enbridge** Pipeline **Hess Corporation** TransCanada Tesoro MDU/WBI Energy True Companies ONEOK Aux Sable Liquid Products **Alliance Pipeline BNSF** Railway Northern Border Pipeline Dakota Prairie Refining **Basin Electric** Gtuit **KLJ** Engineering **Plains All American** Loenbro Sequent Energy **Badlands NGLs Barr Engineering** Paradigm Midstream Whiting Pembina Pipeline Reaction 35 Moody Analytics **Energy Transfer Partners GA Group** Parsons Brinkerhoff **Oasis Petroleum** Flight Scan Tallgrass Energy **HRL Morrison** JP Morgan Petro Nerds

Alpha View Olsson Associates Meridian Energy Group Ferus Inc. Element 1 Corp. Robert W. Baird & Co.

In addition, the Pipeline Authority worked with a number of state and federal agencies to gather information and provide expertise on pipeline issues. Those agencies and entities included:

North Dakota Public Service Commission	North Dakota Department of Commerce
North Dakota Transmission Authority	Energy and Environmental Research Center
North Dakota Oil and Gas Division	North Dakota Department of Transportation
North Dakota Governor's Office	Federal Railroad Administration
Canadian Consulate	North Dakota Tax Department
North Dakota State University	Wyoming Pipeline Authority
Bank of North Dakota	EmPower North Dakota Commission
US Energy Information Administration	North Dakota State Water Commission
North Dakota Oil & Gas Research Program	Upper Great Plains Transportation Institute
MHA Energy	Province of Alberta
Pipeline and Hazardous Materials Safety Adm	iinistration
North Dakota Office of Management and Bud	lget

The Director of the Pipeline Authority also worked with the following trade associations/groups:

North Dakota Petroleum Council North Dakota Petroleum Marketers Association North Dakota Association of Counties Energy Policy Research Foundation NW Landowners Association Canadian Energy Research Institute North Dakota Society of Professional Engineers National Council of State Agriculture Finance Programs

As noted above, the Pipeline Authority has been facilitating discussions between governmental agencies and companies interested in expanding North Dakota's midstream infrastructure.

In addition, the Director of the Pipeline Authority provided information to citizens and news media on issues related to pipelines.

#### **Crude Oil and Natural Gas Production Forecasting**

The Pipeline Authority continued to develop and maintain crude oil and natural gas production forecasts for North Dakota and the United States portion of the Williston Basin. These forecasts are widely used throughout both public and private organizations. Two assumption scenarios are forecasted for the purpose of communicating the production impacts of different price and activity levels. Figure 1 is a near term oil production forecast for North Dakota. Figure 2 shows a longer term natural gas production forecast using the two different activity scenarios for North Dakota.



Figure 2. North Dakota natural gas production forecast

#### **Natural Gas Liquids**

The Pipeline Authority focused considerable attention in 2015-2016 to the topic of natural gas liquids (NGL). Natural gas produced from the Bakken and Three Forks Formations is very high in natural gas liquids (NGLs) such as ethane, propane, and butane. Forecast models were created by the Pipeline Authority to better understand the production potential and required transportation infrastructure going forward.

The forecast in Figure 3 shows two potential production cases based on different activity level assumptions. In either case, a significant shortfall of gross pipeline capacity occurs in the next 5-10 years. Further complicating the situation is the fact that not all NGL pipelines can handle the same types of NGL products and natural gas plants around the region produce either purity products or unfractionated product, known as Y-grade.

There are several options going forward to address the growing volume of NGLs in North Dakota. One option would be to build, expand, or repurpose existing pipeline systems. A second option would be the development of value added industries that would use NGL products as feedstock. One potential use for NGLs is enhanced oil recovery (EOR) in the Williston Basin as fields continue to mature. The use of NGLs as a working EOR fluid is still in the research phase.



Figure 3. Forecasted North Dakota NGL production and transportation options

#### State Rail Plan

The North Dakota Department of Transportation, along with its partners, is currently working to update the previous 2007 North Dakota State Rail Plan.

Along with the hired consultant agency, Parsons Brinckerhoff, the Department of Transportation partnered with the following agencies to conduct the study:

- North Dakota Public Service Commission
- North Dakota Department of Commerce
- North Dakota Department of Emergency Services
- North Dakota Pipeline Authority
- Upper Great Plains Transportation Institute

The updated North Dakota State Rail Plan is focused on the following key areas:

- Ensuring safe rail transportation
- Providing consistently reliable, diverse Class I, short line and passenger rail service
- Rail service expansion and economic development opportunities
- Funding future rail improvements
- Understanding and defining the role of the state of North Dakota in rail transportation

The final State Rail Plan report is scheduled to be released in October 2016.

#### **Natural Gas Flaring**

While not a regulatory agency, the Pipeline Authority does play a very active role in helping the state reduce the amount of flared natural gas. The Pipeline Authority continually monitors and reports flaring statistics and provides analysis on current and future developments to industry participants, regulators, policy makers, and the public. More information on a comprehensive report published by the Pipeline Authority can be found in the "Industry and Public Communications Activities" portion of this Annual Report.

Several significant actions were taken by the ND Industrial Commission in recent years that have had a positive impact on reducing natural gas flaring. The first was the requirement for operating companies to submit a natural gas capture plan to the Oil & Gas Division to outline how produced natural gas would be sold or utilized on location. The second action was an Industrial Commission order on July 1, 2014 that provided flaring reduction targets to the year 2020 and provided a means of enforcement at the Oil & Gas Division through the use of production and permitting restrictions.

In September 2015, the Industrial Commission revised the 2014 natural gas capture targets for Bakken and Three Forks production as follows:

- 74% Capture Q4 2014
- 77% Capture Q1 2015
- 80% Capture Q2 2016
- 85% Capture Q4 2016
- 88% Capture Q4 2018
- 91-93% Capture Q4 2020

The natural gas capture rate for Bakken production was 91% in June 2016, exceeding the required target of 80%. In order for the industry to continue to meet or exceed gas capture targets, additional investments in gas gathering and processing will be required.

#### **Industry and Public Communications Activities**

#### **Pipeline Publication**

During the 2015-2016 fiscal year, three *Pipeline Publication* newsletters were published in order to keep interested parties updated on midstream activities in the region. All three newsletters can be found in Appendix A. In addition to the newsletters, the Pipeline Authority used monthly reports, website content, press conferences, and presentations to share updates on production and transportation dynamics in the Williston Basin (additional details below).

#### **Pipeline Authority Websites**

In an effort to provide industry and public users with the most timely and complete set of information, the Pipeline Authority continues to update the agency websites as new information becomes available. The websites allow the Pipeline Authority to provide users with current Williston Basin oil production data, maps, news, publications, basic pipeline information, pipeline safety information, and links to pipeline mapping systems.

#### **Monthly Updates**

During the 2015-2016 fiscal year, the Pipeline Authority produced monthly transportation and production reports to allow interested parties a quick view of how much crude oil and natural gas was produced each month and how each commodity was shipped and/or processed. Information contained in the reports is presented during monthly media events in conjunction with the ND Oil & Gas Division. Monthly reports are placed on the Pipeline Authority website and an email distribution list has been created to circulate the update to interested parties.

#### North Dakota Drilling Economics

In order to assist the midstream industry in understanding current and future petroleum activity levels, the Pipeline Authority routinely publishes information exploring the economics of drilling in North Dakota's Bakken/Three Forks Formations. The research takes a detailed look at where drilling in North Dakota has been most successful in the past and then predicts where drilling may be concentrated during periods of fluctuating oil prices.

Figure 4 below was generated during the drilling economics research to represent the expected after tax rate of return at three different drilling and completion costs. While assuming \$45/bbl at the wellhead, it was discovered that wells drilled in North Dakota would not consistently receive a 10%-20% rate of return until they were producing at least an average of 700 barrels of oil per day during the well's peak production month. Maps were also generated to show where the locations of the wells in Figure 4 are located.



Figure 4. North Dakota drilling economics summary (Assumes \$45/bbl at the wellhead)

#### **Video Presentations**

During the 2015-2016 fiscal year, the Pipeline Authority researched several areas of interest for the state's midstream industry. Video presentations were created to share the information with interested parties in a timely and concise format. Replays of the video presentations are available on the Pipeline Authority website.

#### **Pipeline Presentations**

Over the past year, the Pipeline Authority has had the opportunity to make presentations at a variety of industry and public events. Some of those events included:

Legislative Interim Committees NDPC CookFest Events Rotary International NDPC Teachers Education Seminar North Dakota Safety Council EmPower Commission Baird Capital Bismarck-Mandan Chamber ND Society of Professional Engineers Bank of North Dakota ND Oil and Gas Law Update Williston Basin Petroleum Conference

Slides from major presentations can be found on www.northdakotapipelines.com

#### Williston Basin Pipeline Infrastructure

For reference, a series of North Dakota pipeline maps can be found in Appendix B

#### Crude Oil Pipelines, Refining, and Rail Transportation

**Enbridge Pipelines North Dakota:** Having completed several expansion projects over the past number of years, Enbridge now has the capacity to move 355,000 BOPD on its pipeline system to Clearbrook, MN. Enbridge completed their work to expand north bound capacity of 145,000 BOPD in early 2013 for the larger scale "Bakken Expansion Project". Oil using the northbound route navigates the Enbridge Saskatchewan system to an interconnect with the Enbridge Mainline at Cromer, MB. Once on the Mainline system, the Williston Basin oil quickly reenters the United States and meets east bound Enbridge oil at Clearbrook, MN.

Enbridge continued work during the 2015-2016 fiscal year to further expand their Williston Basin system with the "Sandpiper" project. Plans to construct the 225,000 BOPD system were deferred during the third quarter of 2016 due to unexpected market conditions in the near term planning horizon.

**Bridger, Belle Fourche, and Butte Pipelines:** Bridger and Belle Fourche Pipelines operate as intra-basin pipeline systems moving oil to several pipeline interconnects or rail facilities in the Williston Basin. One such pipeline interconnect is with the Butte Pipeline near Baker, MT. The Butte Pipeline currently has the capacity to move 260,000 BOPD to Guernsey, WY. In Guernsey, WY, the oil is transported to Wood River, IL on the Spectra Platte Pipeline or loaded into rail cars for further transport.

**BakkenLink:** After announcing plans in 2010 to offer a pipeline system connecting the Williston Basin to the Keystone XL Pipeline in Eastern Montana, BakkenLink has altered their current project scope. Now in service, the BakkenLink system collects crude oil from various locations along its route south of Lake Sakakawea and delivers the oil to a unit train rail facility located near Fryburg, ND. In late 2015, Tesoro Corporation purchased the BakkenLink pipeline and rail facility from Great Northern Midstream.

**Energy Transfer Partners:** In early 2014, Energy Transfer Partners (ETP) held an open season to solicit interest in a new 30" pipeline from North Dakota to Patoka, IL. In June 2014, ETP announced that they had secured sufficient shipper support to move forward with the project. The "Dakota Access" pipeline will collect oil north and south of Lake Sakakawea and have the ability to initially transport 470,000

BOPD. If additional interest exists, the pipeline could be expanded to carry up to 570,000 BOPD. The project began construction in May 2016 and scheduled to be complete in 2017.

**Plains All American Pipeline:** In November 2010, Plains All American Pipeline (Plains) announced plans to construct a new 103 mile, 12 inch, pipeline from Trenton, ND to an interconnect with the existing Wascana Pipeline at the United States-Canada border in northeast Montana. The "Bakken North" pipeline went into service in May 2014, with an initial capacity of 40,000 BOPD, expandable to 75,000 BOPD.

**TransCanada BakkenLink:** On September 13, 2010, TransCanada launched a successful open season for Bakken producers interested in accessing TransCanada's proposed Keystone XL pipeline project in eastern Montana. The proposed 100,000 BOPD interconnect would be located near Baker, MT and would require new pumps and tanks to accommodate the Bakken oil. Third party shippers would be necessary to move crude from North Dakota to the Baker, MT facilities.

In November 2015, President Obama announced that the Keystone XL Pipeline was not in the national interest of the United States and that a required Presidential Permit would not be granted.

**TransCanada Upland Pipeline:** In February 2015, TransCanada announced plans to construct a 20" pipeline connecting North Dakota to the proposed Energy East project. The pipeline is expected to be in service in 2020 with an initial capacity of 220,000 BOPD, expandable to 300,000 BOPD. The TransCanada Energy East project will use a combination of repurposed natural gas pipeline and new construction to move 1,100,000 BOPD to eastern Canada. North Dakota crude oil not processed in eastern Canada could become waterborne for further shipment to coastal refining centers.

**Tesoro Mandan Refinery:** Expanded by 10,000 BOPD in 2012, Tesoro operates a 68,000 BOPD refinery in Mandan, ND. The refinery receives its light sweet feedstock though a network of pipelines in the Williston Basin operated by Tesoro High Plains Co. The Tesoro High Plains Pipeline gathering network continues to evolve and expand, with the most recent announcement being the "Connolly Gathering System" which will collect oil from various points in Dunn County for delivery at the existing Connolly pipeline station in central Dunn County. The project began in mid-2014 and is currently in service.

Products generated at the refinery are distributed directly from a truck rack at the facility or through the NuStar North Pipeline to Eastern North Dakota and Minnesota.

**Dakota Prairie Refinery:** In May 2015, a joint venture of MDU Resources Group and Calumet Specialty Products Partners, the Dakota Prairie Refinery, began processing 20,000 BOPD at its facility just west of Dickinson, ND. The "diesel topping" refinery produces around 7,000 BPD of diesel fuel for consumption, while the remaining product is transported for further processing or use.

In late June 2016, Tesoro Corporation purchased the Dakota Prairie Refinery.

#### A map of North Dakota crude oil gathering systems can be found in Appendix C

**Rail Loading Facilities:** The transportation of crude oil by rail car has played a key role in moving growing volumes of crude oil from the Williston Basin to markets around the United States and Canada. Figure 5 shows the estimated Williston Basin market share percentages for rail, pipeline, and local refining. Figure 6 shows the estimated volume of oil moved by rail out of North Dakota. Maps, capacities, and additional information on the various facilities can be found on the Pipeline Authority websites.





A map of North Dakota oil rail loading facilities can be found in Appendix D

#### Natural Gas Pipelines

**Alliance Pipeline:** The Alliance Pipeline is a high pressure, large diameter natural gas pipeline that originates in British Colombia, 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 the Prairie Rose Pipeline near Bantry, ND (See Aux Sable below). The 36 inch diameter United States portion of the pipeline has a certified capacity of 1.513 billion cubic feet per day (BCFD). The Alliance Pipeline has one North Dakota delivery point in Hankinson.

In response to growing natural gas production, Alliance Pipeline announced plans on June 22, 2011, to construct a new, 80 mile, natural gas pipeline from the Hess Gas Plant in Tioga, ND to an interconnection point near Sherwood, ND. Commissioned in late 2013, the "Tioga Lateral Pipeline" has the ability to deliver liquids rich, high BTU, natural gas to Chicago, IL for further processing and transportation. The Tioga Lateral has the capacity to transport up to 126 MMCFD.

**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 42 inch diameter Northern Border Pipeline receives gas deliveries at a total of 15 receipt points in the Williston Basin with twelve of those points for North Dakota gas supply. One additional North Dakota interconnect is expected to go into service in the second half of 2016 increasing total interconnect capacity to 1,690 MMCFD.

**WBI Energy Transmission:** Formerly known as Williston Basin Interstate Pipeline Co., WBI Energy Transmission operates more than 3,700 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 twelve interconnecting points with other regional pipelines and can also deliver natural gas to local distribution companies or natural gas storage fields. WBI continues to make system upgrades in western North Dakota in order to meet growing customer demand. In June 2016, WBI announced an open season to connect the eastern North Dakota portion of the system with the Viking Pipeline in western Minnesota. This expansion does not directly support North Dakota gas production volumes, but rather would serve to provide additional gas volumes to consuming markets in eastern North Dakota.

**Aux Sable:** In June 2011, Aux Sable announced the acquisition of the Prairie Rose Pipeline and condensate recovery facility near Stanley, ND. Originally constructed by Pecan Pipeline, the 75 mile, 12 inch system went into service February 2010 and has the capability to transport over 100 MMCFD of unprocessed natural gas from Mountrail County to an interconnect with the Alliance Pipeline near Bantry, ND.

**Bison Pipeline:** TransCanada placed the 302 mile, 30 inch Bison Pipeline into service in early 2011. The pipeline was 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 has an initial capacity of 407 MMCFD and could be expanded to 1 BCFD.

#### **Natural Gas Liquids Pipelines**

**ONEOK Bakken NGL Pipeline:** On July 26, 2010, ONEOK Partners announced plans to construct a new 12 inch natural gas liquids pipeline capable of moving 60,000 BPD from existing and planned facilities in the Williston Basin to an interconnect with the Overland Pass Pipeline near Cheyenne, WY. The "Bakken NGL Pipeline" was built to address the high volumes of natural gas liquids that are extracted from the rich Bakken gas during processing. The pipeline operates as a Y-grade system, with product fractionation taking place in Bushton, KS. ONEOK announced completion of the pipeline in April 2013 and an expanded capacity of 135,000 BPD in September 2014.

**Vantage Pipeline:** On July 15, 2010, Mistral Energy announced a new 430 mile liquid ethane pipeline from Tioga, ND to Empress, AB. With an initial capacity of 40,000 BPD, the new "Vantage Pipeline" was built to address the high concentration of ethane found in North Dakota's natural gas. Placed into service Q2 2014 in conjunction with the Hess Tioga Gas Plant Expansion, the pipeline was constructed of 10 inch pipe. Other than this particular project, the majority of North Dakota's ethane is being left in the natural gas stream after it leaves the gas processing plant.

In September 2014, Pembina Pipeline Corporation purchased the Vantage Pipeline from Mistral Midstream.

On February 10, 2015, Pembina Pipeline announced that the Vantage ethane pipeline would expand to connect to ONEOK's Stateline plants with 50 miles of 8" pipeline. The \$85 million system expansion also included taking the existing mainline capacity from 40,000 bpd to 65,000 bpd.

#### **Carbon Dioxide Pipelines**

North Dakota continues to have only one carbon dioxide pipeline in service. The Dakota Gasification Company's, 12-14 inch, 205 mile pipeline went into service in 2000 and transports roughly 150 MMCFD of carbon dioxide to oilfields near Weyburn, SK.

The Pipeline Authority continues to work with interested parties on the development of new carbon dioxide pipelines for capture and sequestration, as well as enhanced oil recovery operations. The Pipeline Authority is an active member of the Plains CO<sub>2</sub> Reduction Partnership through the Energy and Environmental Research Center in Grand Forks, ND.

#### Natural Gas Processing

For reference, a North Dakota Gas Processing and Transportation map can be found in Appendix E

#### New or Expanding Natural Gas Plants

Due to the vast footprint of the Bakken resource, natural gas gathering and processing operators in North Dakota have faced difficult challenges in the past to keep pace with faster, more efficient drilling and completion techniques. Despite the daunting task, industry is rising up to reap the great economic reward contained in the rich Bakken gas.

North Dakota currently has twenty-six natural gas processing/conditioning plants operating, with the capability to process roughly 1.86 BCFD. Two additional new plants are expected in 2016 and will add 160 MMCFD of processing capacity (Figure 7). Two gas plants have been suspended until market conditions justify their construction. A detailed breakdown of the existing and proposed facilities can be found on the Pipeline Authority website.



#### **Planned Activities**

Over the past year, the Pipeline Authority has continued to experience great success by working with industry to quantify future crude oil and natural gas production in order to provide the assurance needed to move forward with various expansion projects. The forecasted petroleum production levels have been modified to reflect the current low price environment and will require continuous updating and review over the next year as technology advances and market prices fluctuate. The Pipeline Authority will continue to utilize new and existing development information to gain a deeper understanding of the crude oil, natural gas, and carbon dioxide pipeline needs in Williston Basin.

Industry and public information distribution will continue with the use of newsletters, presentations, monthly updates, and agency websites. The Pipeline Authority will continue to conduct information presentations to public audiences, legislative groups, and industry representatives at various events throughout the coming year.

#### APPENDIX A

North Dakota Pipeline Authority's Pipeline Publication Newsletter



## PIPELINE publication

Volume 7 \* Is: October 20

#### INDUSTRIAL COMMISSION OF NORTH DAKOTA PIPELINE AUTHORITY

Governor Jack Dalrymple

Attorney General Wayne Stenehjem

Agriculture Commissioner Doug Goehring

Director Justin J. Kringstad

May 2015

1,202,714

The first step in developing a new pipeline or processing project is to understand the current and future demand for such a system. In an effort to better understand where future oil and gas production levels may be headed in the current low price environment, the Pipeline Authority has recently published two new video presentations to inform interested parties about topics of drilling, production, and economics. Both videos are available for replay on the "Presentations" page at www.northdakotapipelines.com

#### **UNDERSTANDING 2015 OIL PRODUCTION**

Released on August 20, 2015, this 40 minute video presentation takes an in-depth view at the first half of 2015 and proposes why oil and natural gas production levels did not decrease, even during a time of significant drilling rig reductions. One key takeaway is an appreciation for the time between when a drill bit begins turning (spud) and when the oil and gas are brought to the surface for sale. Data revealed that on average, it took between 170-180 days to bring a well into production. There are many factors that could decrease or increase that time span, but it does help explain why production in early 2015 seemed immune to the decreasing drilling rig fleet.

#### Key points from the presentation:

- In the first half of 2015, production was largely impacted by ND winter/spring conditions and drilling decisions made in 2014 (due to lag between well spud and initial production).
- The second half of 2015 is when the production impact of the rig reduction will be noticed most.
- Producers will offset rig reduction with higher producing wells, but it is unclear if it will be enough to prevent a statewide oil production drop.
- Drilled but uncompleted wells are ideally positioned in the Bakken and act as a wild card that allows some flexibility to "cherry pick" the most attractive producing locations for completion.



Chart showing how spud to initial production times have changed through time.

## NORTH DAKOTA — Production Numbers "www.pipeline.nd.gov Average Daily Oil Average Daily Gas

#### Average Rig Count **Production, BOPD** Production, MMCFD May 2015 Jun. 2015 Jul. 2015 Jun. 2015 Jul. 2015 May 2015 Jun. 2015 Jul. 2015 1,211,330 1.201.920 1.630.3 1.652.0 1.657.4 83 78 73

As of September 29, 2015, there are 69 active rigs in North Dakota.

#### **REVISITING DRILLING ECONOMICS**

Released on September 10, 2015, this 13 minute video updates previous Pipeline Authority research on the economics of drilling wells in the Bakken/ Three Forks. The work used existing well production data as an indicator to where drilling could remain economically attractive at low oil prices. Maps were created to separate the oilfield into several "baskets" based on well performance. Several different scenarios were examined to show how sensitive the economics are to changing drilling and completion costs.



Assuming \$40/bbl at the wellhead, the chart above provides a summary of after tax rate of return for various drilling/completion costs and a well's peak daily oil production. Each company has its own threshold, but 20% was chosen as baseline to show where a company may consider it attractive to drill.

#### North Dakota Pipeline Authority State Capitol, 14<sup>th</sup> Floor 600 E. Boulevard Ave. Dept. 405 Bismarck, ND 58505-0840

Drilling efficiency has continued to improve in North Dakota. Data now indicates that an average rig can spud 1.7 wells per month, up from 0.7 wells per month in 2011. Drilling efficiency is just one of the critical factors to consider when predicting North Dakota's future petroleum production and required pipeline infrastructure.







#### North Dakota Pipeline Authority

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#### INDUSTRIAL COMMISSION OF NORTH DAKOTA PIPELINE AUTHORITY

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#### ND CRUDE OIL GATHERING

At the end of 2015, the Pipeline Authority published an updated analysis of crude oil gathering in Western North Dakota. The data indicated that crude oil gathering by pipeline had surpassed truck gathering for movement away from well locations. The amount of oil gathering by pipeline increased the most in McKenzie

County, but significant increases were also seen in other producing counties. Interestingly, even though McKenzie County had the highest increase in oil pipeline gathering, the region did not see an overall decrease in trucking due to the significant rise in production that area had experienced.

Detailed video commentary and slides on the topic of oil gathering can be found on the "Presentations" page of www.northdakotapipelines.com

#### **Bakken Drilling Economics**

Drilling economics were revisited at the end of 2015 using a lower wellhead price of \$30 per barrel. Since that work was published, prices have dropped, further impacting the economics of drilling and completing a Bakken/Three Forks well. Full video commentary and slides are available online and an estimated breakeven price chart is included in this newsletter.

Please note that the estimated breakeven prices are based on the cost to complete the well, the peak month average daily rate of oil from that well, and assumes an after-tax rate of return of 20%. Lowering costs, improving well performance, and lowering the expected after-tax rate of return would decrease the breakeven price per barrel beyond what is seen in the chart.



#### NORTH DAKOTA — Production Numbers

#### www.pipeline.nd.gov

Ave Pro	erage Daily duction, BC	Oil OPD	Ave Prod	rage Daily luction, MN	Gas ICFD	Average Rig Count						
Oct. 2015	Nov. 2015	Dec. 2015	Oct. 2015	Nov. 2015	Dec. 2015	Oct. 2015	Nov. 2015	Dec. 2015				
1,172,832	1,181,787	1,152,280	1,658	1,676	1,671	68	65	64				
An of Ephruary 22, 2016, there are 20 poting in North Dakata												

Header image courtesy of the North Dakota Department of Commerce.

#### TRANSPORTATION AND PROCESSING UPDATES

- **::** In December 2015, the ONEOK Lonesome Creek natural gas processing plant went into service. The 200 million cubic feet per day (MMCFD) plant is located in central McKenzie County.
- In January 2016, the North Dakota Public Service Commission approved the routing of the Dakota Access Pipeline in North Dakota. Iowa is the only state that has yet to make a route determination for the project.
- In February 2016, Enbridge made a decision to modify the anticipated startup time of the Sandpiper Pipeline from 2017 to early 2019. The decision does not have an impact on the system capacity of 225,000 barrels per day (BPD) out of North Dakota.

Estimated Williston Basin Oil Transportation



#### North Dakota Pipeline Authority State Capitol, 14<sup>th</sup> Floor 600 E. Boulevard Ave. Dept. 405 Bismarck, ND 58505-0840





**OILFIELD FACTOID** 

New crude oil and natural gas pipeline maps have been placed on the Pipeline Authority website. The maps are available for download in large format for high resolution printing.







#### North Dakota Pipeline Authority

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## PIPELINE publication

#### INDUSTRIAL COMMISSION OF NORTH DAKOTA PIPELINE AUTHORITY

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#### **UNDERSTANDING NATURAL GAS LIQUIDS**

Much attention has been focused on gathering natural gas produced in association with crude oil in western North Dakota. Receiving less attention is the unique quality of the natural gas stream being gathered to gas plants around North Dakota. Natural gas produced from the Bakken and Three Forks Formations is very high in natural gas



#### FORECASTED ND NGL PRODUCTION AND TAKEAWAY OPTIONS

liquids (NGLs) such as ethane, propane, and butane (see table on back page). While majority of the NGL's are removed at processing plants in the state to separate the liquids from the "dry" methane stream, a large percent of the ethane remains with the methane stream.

NGLs gathered and processed in the region will ultimately need to be moved to consuming markets. A forecast of gathered NGLs in North Dakota was created to quantify the growing transportation needs from the region. The forecast in the chart shows two potential production cases based on different activity level assumptions. In either case, a significant shortfall of gross pipeline capacity occurs in the next 5-10 years. Further complicating the situation is the fact that not all NGL pipelines can handle the same types of NGL products and natural gas plants around the region produce either purity products or unfractionated product, known as Y-grade.

There are several options going forward to address the growing volume of NGLs in North Dakota. One option would be to build, expand, or repurpose existing pipeline systems. A second option could be the development of value added industries that would use NGL products as feedstock. One potential use of NGLs is for enhanced oil recovery (EOR) in the Williston Basin as fields continue to mature. The use of NGLs as a working EOR fluid is still in the research phase.

#### **NORTH DAKOTA** — Production Numbers www.pipeline.nd.gov **Average Daily Oil Average Daily Gas** Average Rig Count Production, BOPD **Production, MMCFD** Jan. 2016 Feb. 2016 Mar. 2016 Jan. 2016 Feb. 2016 Mar. 2016 Jan. 2016 Feb. 2016 Mar. 2016 1,119,092 40 1,122,462 1,109,246 1.641 1.689 1,710 52 32 As of May 20, 2016, there are 25 active rigs in North Dakota

Header image courtesy of the North Dakota Department of Commerce.

#### NATURAL GAS STORAGE

One primary use of natural gas is heating residential and commercial buildings. Without the use of underground natural gas storage, the supply chain would be challenged to handle strong seasonal demand shifts. During the warm summer months, natural gas is stored in underground reservoirs and withdrawn during colder periods with higher demand. The reservoirs used for natural gas storage are typically depleted gas producing fields that are converted to serve a storage role. The nearest storage field is located near Baker, MT and is operated by WBI Transmission. Regional pipelines provide transportation service to and from the Baker storage field.

#### Generalized Bakken Gas Quality

Component	Gallons per MCF	% of Liquids
Nitrogen	NA	NA
Carbon Dioxide	NA	NA
Hydrogen Sulfide	NA	NA
Methane	NA	NA
Ethane	5.32	52.5%
Propane	3.11	30.7%
Isobutane	0.32	3.1%
Normal Butane	0.89	8.8%
Isopentane	0.14	1.4%
Normal Pentane	0.20	2.0%
Hexane+	0.16	1.5%
Totals	10.14	100%
Gas Stream BTU Value	1,399	

Mole % Source: Energy & Environmental Research Center (EERC)

#### North Dakota Pipeline Authority State Capitol, 14<sup>th</sup> Floor 600 E. Boulevard Ave. Dept. 405 Bismarck, ND 58505-0840



The largest natural gas storage field in the United States is located in the Williston Basin. WBI Transmission's Baker gas storage field has a working gas capacity of over 164 billion cubic feet. The storage field is located primarily in SE Montana in the Cedar Creek Anticline.







now what's **Delow. Call before you dig**.

#### North Dakota Pipeline Authority

State Capitol 14<sup>th</sup> Floor | 600 E. Boulevard Ave. Dept. 405 | Bismarck, ND 58505-0840 Phone: (701) 220-6227 | Fax: (701) 328-2820 | Email: jjkringstad@ndpipelines.com | www.pipeline.nd.gov22

#### APPENDIX B

North Dakota Pipeline Maps

## North Dakota Crude Oil Pipelines



## North Dakota Natural Gas Pipelines



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## North Dakota CO<sub>2</sub> Pipeline



## — Dakota Gas

#### APPENDIX C

North Dakota Crude Oil Gathering Map

## Active Oil Wells By Transport Type

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Map Data Date : 7/1/2016 Map Update Date : 10/11/2016

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#### APPENDIX D

North Dakota Crude Oil Rail Loading Map

# North Dakota Crude Oil Rail Loading Facilities In Service





North Dakota Pipeline Authority – February 2015

#### APPENDIX E

North Dakota Gas Processing and Transportation Map

## **DRAFT - North Dakota Gas - DRAFT** Processing and Transportation February 2016







#### Date: 2/19/2016

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