


House Energy and Natural Resources

North Dakota Pipeline Authority

January 6, 2016



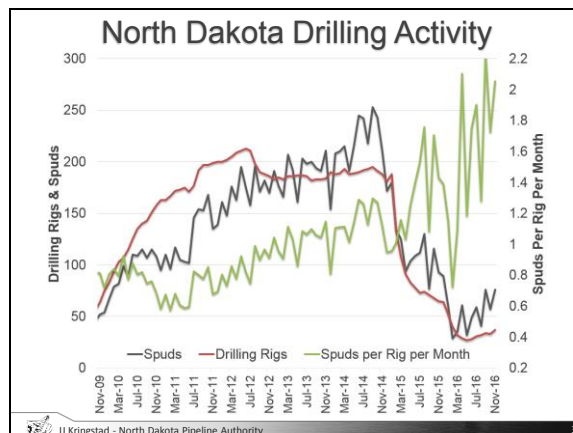
Full page slides available for viewing on the “Presentations” page of: www.northdakotapipelines.com

Presentation Outline

- Understanding current and future oil production
 - Activity
 - Drilling economics
 - Forecasts
- Williston Basin oil transportation dynamics
 - Interstate oil movements
 - Intrastate oil movements
- North Dakota natural gas production
 - Flaring and gas capture
 - Natural Gas Liquids

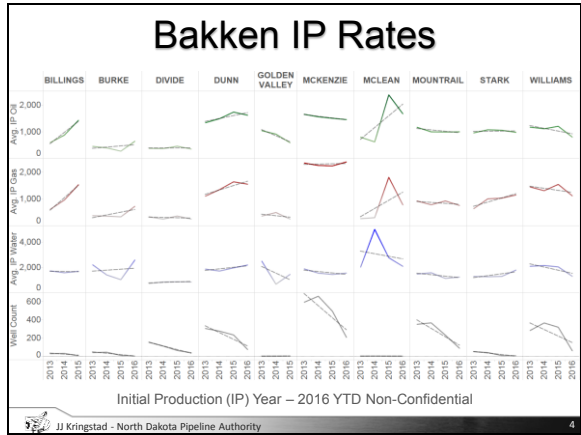
JJ Kringstad - North Dakota Pipeline Authority

Background: The North Dakota Pipeline Authority (NDPA) is a non-regulatory agency that specializes in providing data analytics and production forecasting for the transportation and processing industry in North Dakota.



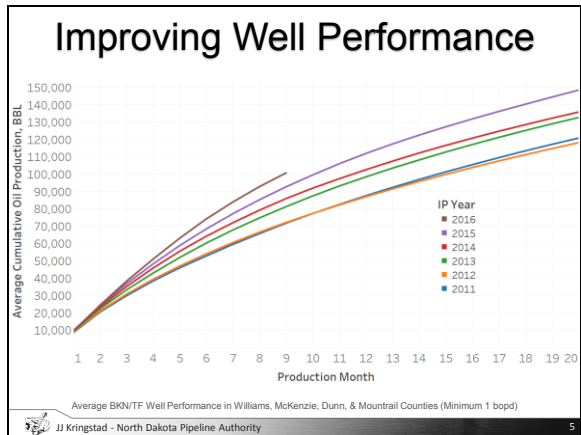
Drilling efficiency continues to improve in ND. The number of “spuds” (new drills) per rig per month is averaging 1.8-2.0. This is up from the old rule of thumb of just 1 spud per rig per month in 2012.

Slide 4



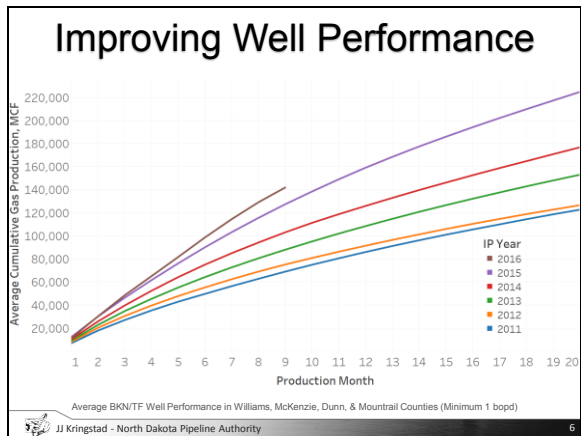
Initial production (IP) rates for the first 24hrs of a well's life have held steady in the major producing regions of ND. (Slides 5-6 tell a different story of well performance increasing despite steady IP rates)

Slide 5



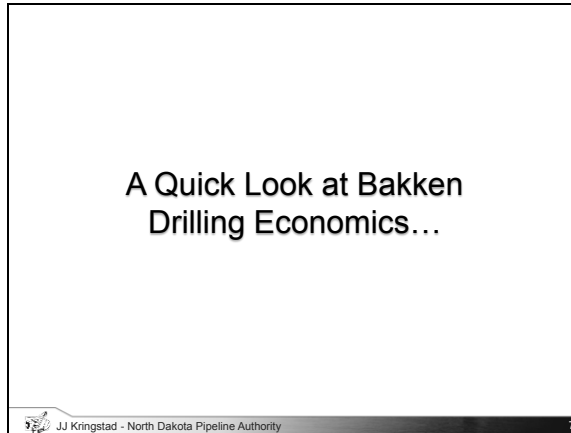
Oil production from Bakken/Three Forks wells has steadily increased each year as completion techniques and technology improve. These improvements challenge midstream infrastructure.

Slide 6



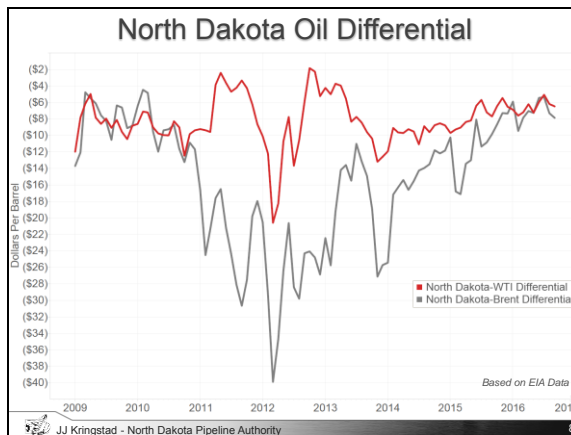
Gas production performance from Bakken/Three Forks wells has increased even quicker than oil performance. Again, these improvements prove challenging for sizing gas capture infrastructure.

Slide 7



An overview of the economics of drilling Bakken/Three Forks wells in North Dakota.

Slide 8



ND oil pricing has recently been trending \$6-\$8 below the West Texas Intermediate (WTI) benchmark (Cushing, OK).

Slide 9

Key Economic Assumptions

- \$6-\$8 Million Well Costs
- \$45/BBL & \$2.00/MCF Wellhead Pricing
- 1/6 Royalty
- Zero Flaring
- Assumed 10-20% IRR to drill (calculated after production taxes and royalties)
- No Tax Incentives Included
- Production rate is 30-day average
- All Bakken/Three Forks wells drilled in 2008+

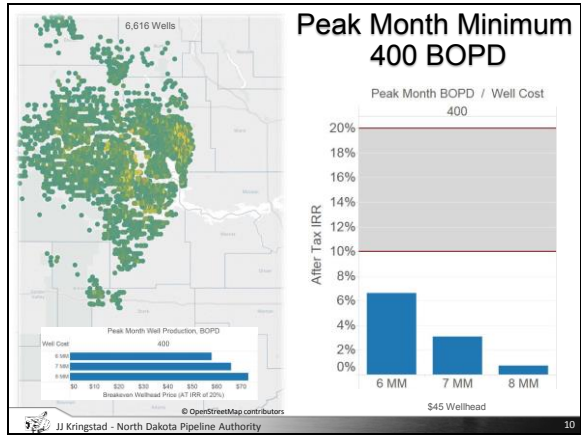
Logo: JJ Kringstad - North Dakota Pipeline Authority

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Assumptions used for the economic views in slides 10-20.

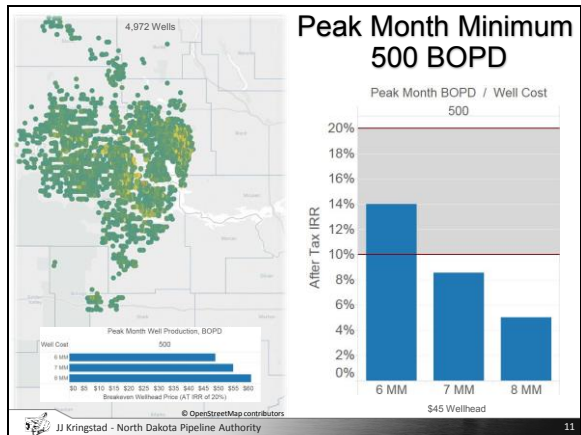
Three drilling and completion price scenarios are run (\$6, \$7, & \$8 million). Average today is around \$6.5-\$7 million.

Slide 10



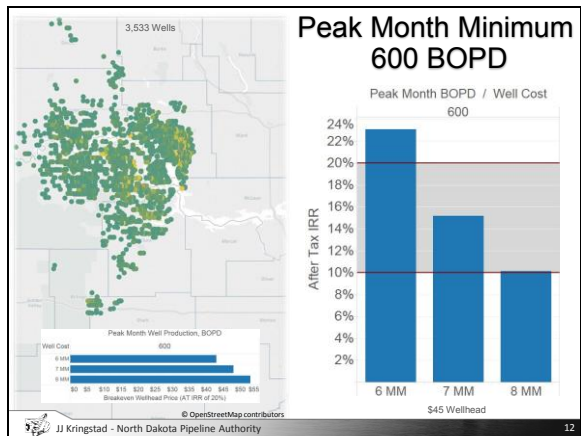
All wells in left map produced at least 400 BOPD during their peak month. Right bar chart shows after tax rate of return for a well that started at 400 BOPD for the first month. Breakeven details under map.

Slide 11



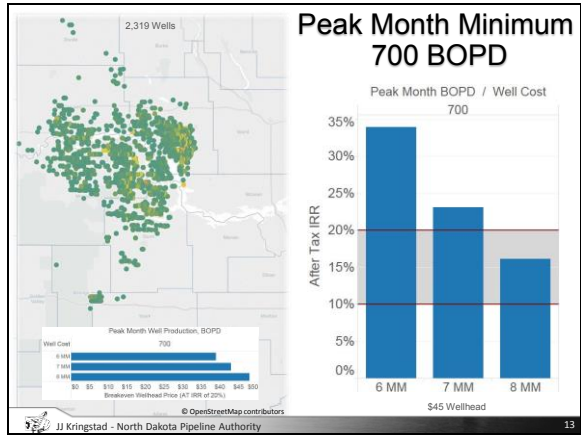
Breakeven analysis and after tax rate of return use three price categories. In the 500 BOPD case, only the \$6 million wells achieve 10+% rate of return.

Slide 12



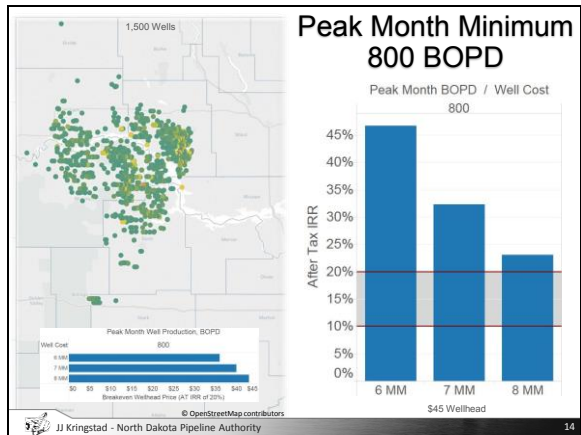
With each scenario, fewer and fewer wells have historically fit into the higher performing well categories. Well economics improve as well performance increases.

Slide 13



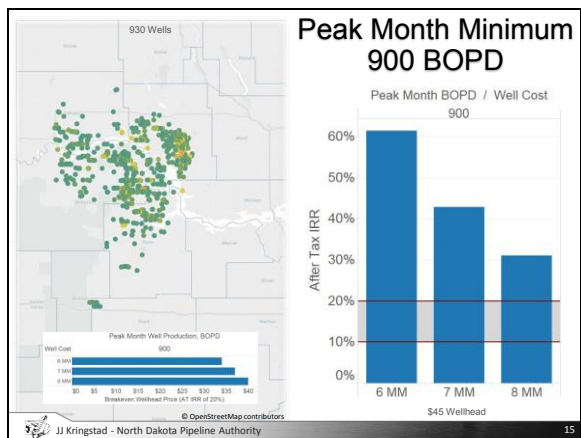
In the 700 BOPD category, all three well cost scenarios are above 10% rate of return. The geographic footprint of where 700 BOPD exist in ND has also shrunk from previous slides.

Slide 14



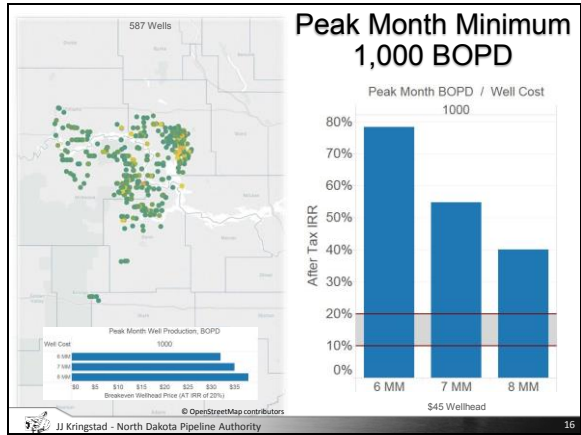
Further increasing the historic well performance to 800+ BOPD. The “Core” or “Sweet Spot” of the play is beginning to be well defined in the left hand maps.

Slide 15



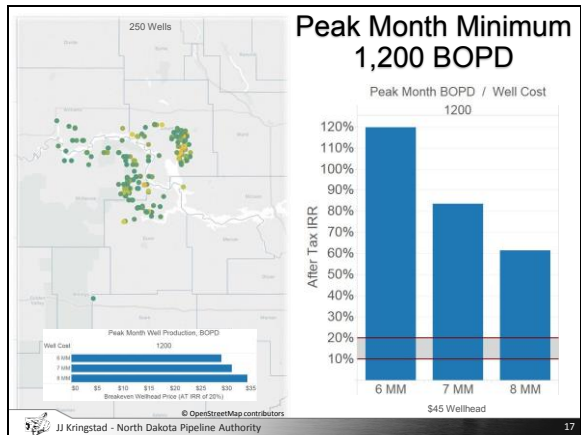
Further defining the highest performing areas of ND.

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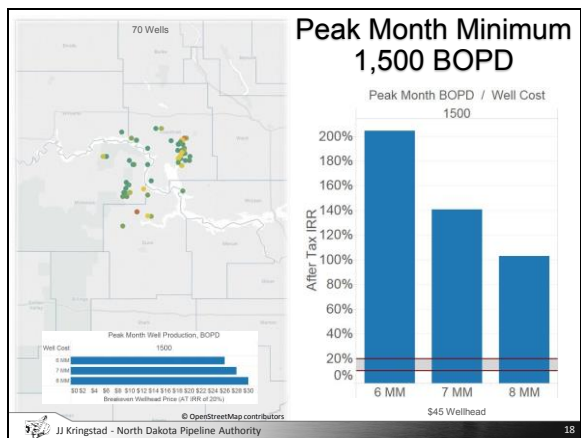
Only 587 wells (top of map) have performed at 1,000+ BOPD for an entire month.

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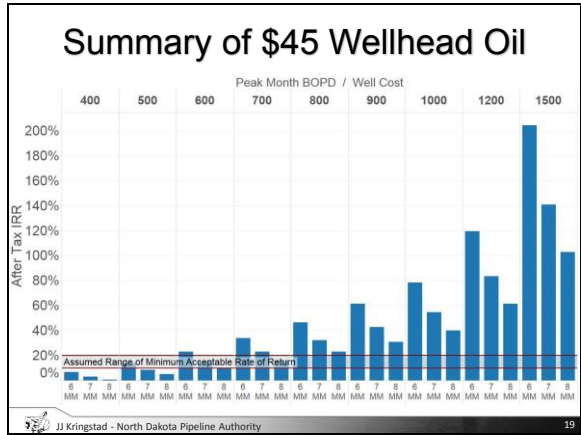
Using the breakeven chart below the map, a well producing 1,200 BOPD during its peak month would need wellhead oil pricing in the upper \$20's to lower \$30's to achieve a 20% after tax rate of return.

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The highest historic performing areas of ND are clear in the 1,500 BOPD category. Breakeven pricing in this region is mid to upper \$20's/bbl at the wellhead.

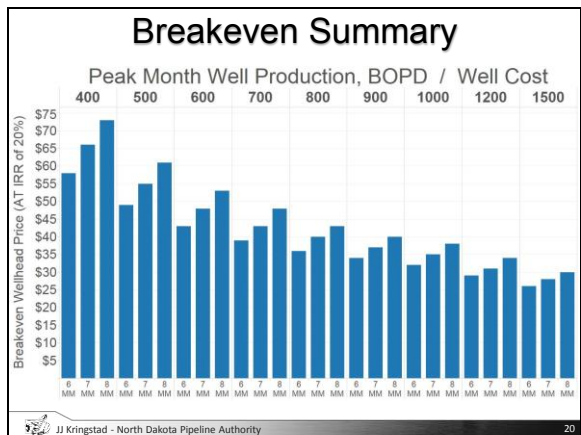
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Summary of each well performance and price categories.

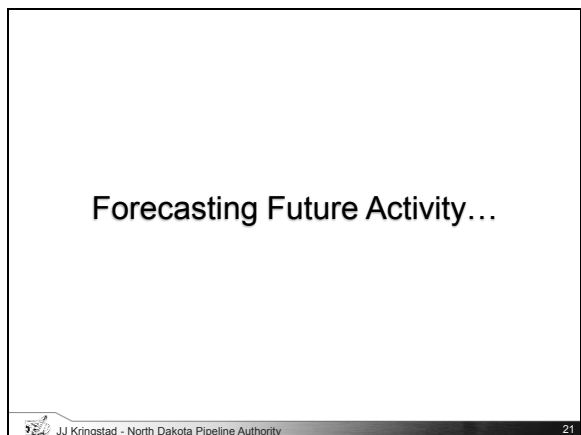
It is clear that both well performance and cost control are important to staying economics in lower price environments.

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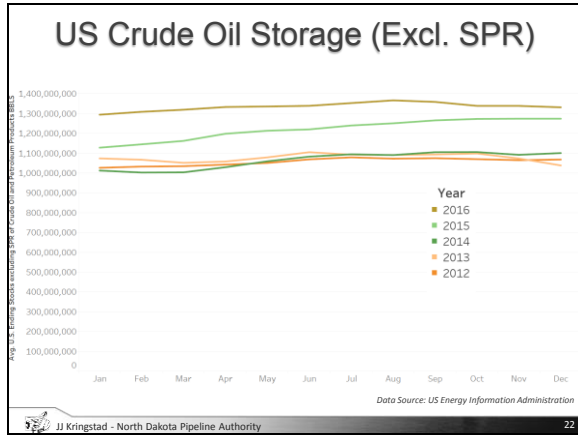
Breakeven summary from the previous slides. There is no single answer to ND's breakeven pricing. It all depends on well performance and cost to drill/complete.

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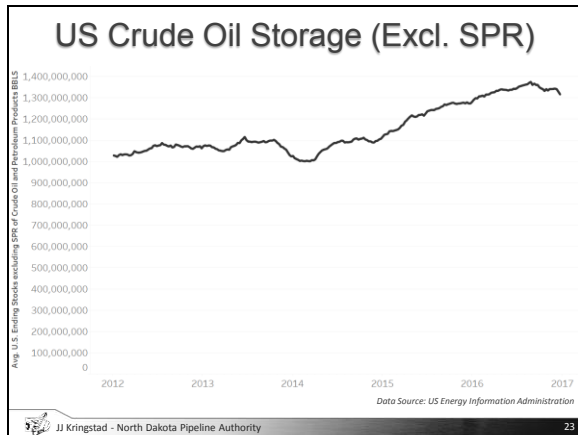
The next set of slides outlines the NDPA forecasting assumptions for activity and production.

Slide 22



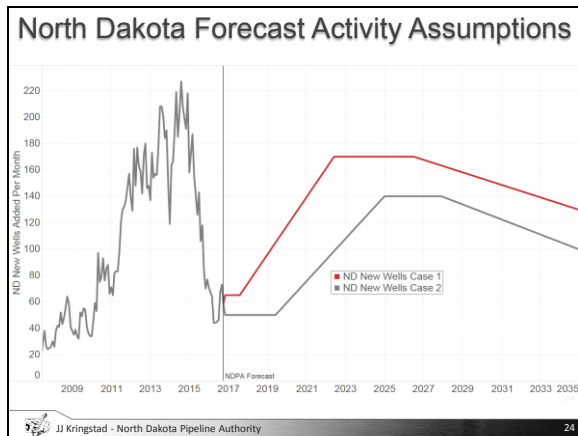
Yearly oil storage volumes in the US (not including the Strategic Petroleum Reserve). Current volumes are still 200-300 million barrels above historic norms.

Slide 23



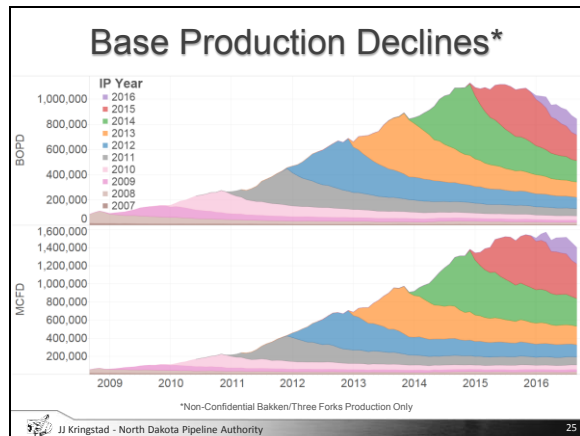
Same dataset as slide 22, just a different view. Storage volumes have been reduced recently. High storage volumes place downward pressure on price.

Slide 24



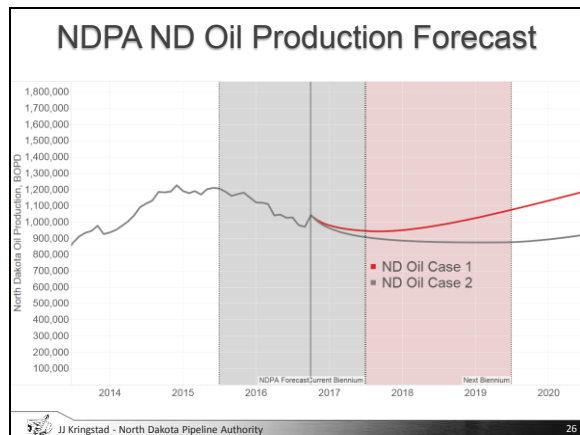
Historic and forecasted (Case 1&2) well completion activity in ND. The length of activity slowdown and recovery pace differs in the two cases. Neither case reaches the high activity levels seen in the past.

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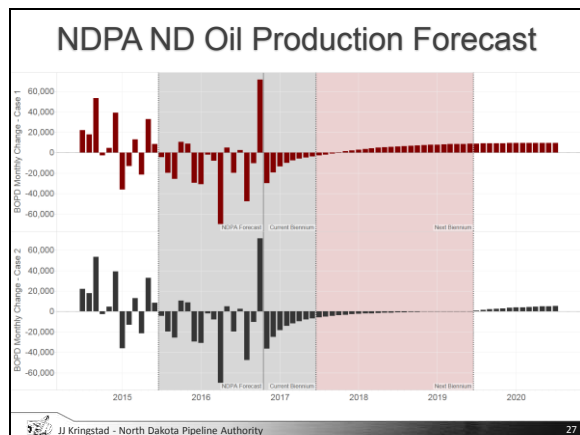
Underlying the production forecasts is the historic production decline for both oil and gas. Oil & gas decline at different rates and impact the forecast models independently.

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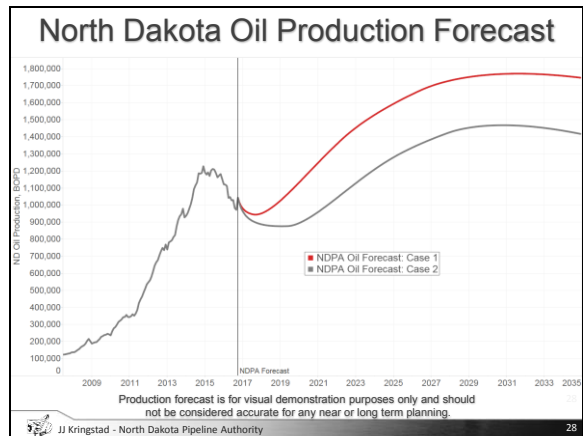
Near term look at the ND oil production forecast. Both cases expect near term declines before production starts to increase again.

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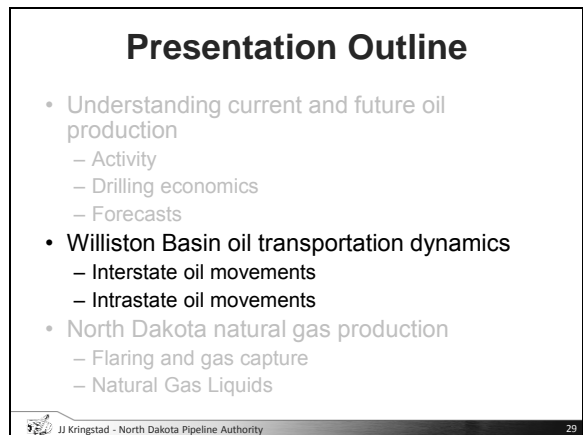
Month to month production changes (historic and forecasted). The recent big picture trend has been monthly decreases, despite wide monthly fluctuations.

Slide 28



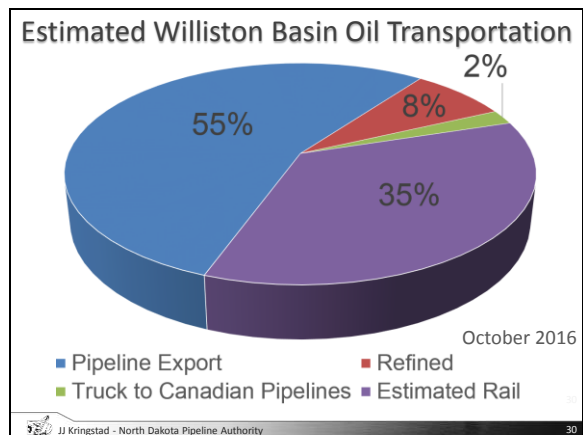
Long term production forecast for oil production in ND. Long term outlook indicates much higher oil production based on well performance and activity assumptions.

Slide 29



Taking a look at how oil is transported out of the region (interstate) as well as how oil moves locally from the wellhead to a pipeline or rail facility (intrastate).

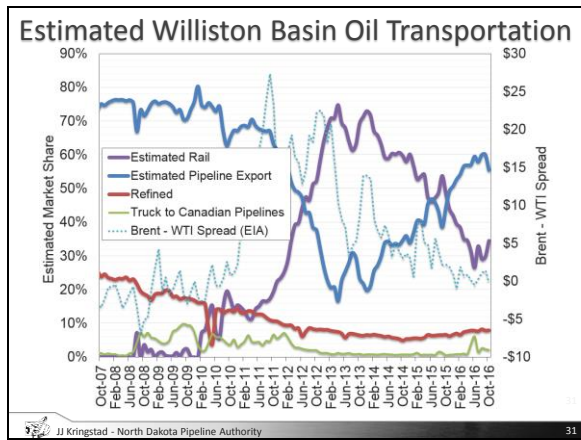
Slide 30



Estimated breakdown of how oil was transported out of the US Williston Basin (Eastern MT, ND, & SD).

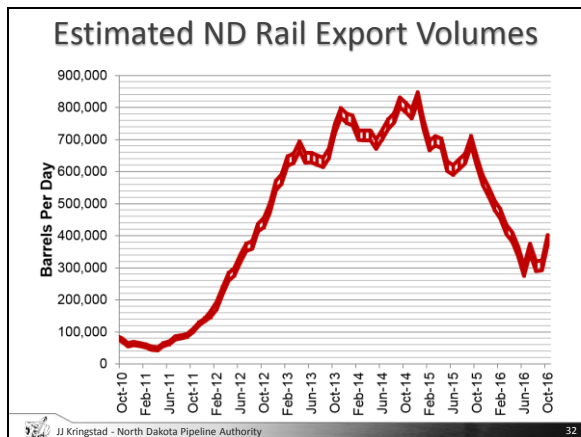
Oct 2016 Estimates (most recent available)

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Historic view of oil transportation market share. Blue dotted line is the spread between Brent (global) and WTI (Cushing, OK) prices. When spread is high, the incentive exists to move oil by rail to coasts.

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Estimates of crude by rail volumes leaving ND. Declining rail volumes since 2014 are due to new pipelines, narrow WTI-Brent price spreads, and overall production declines.

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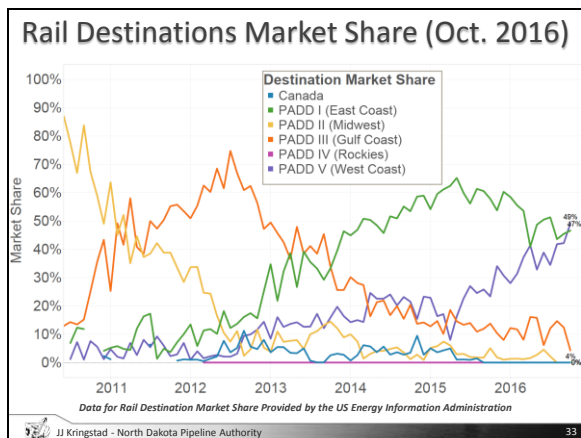
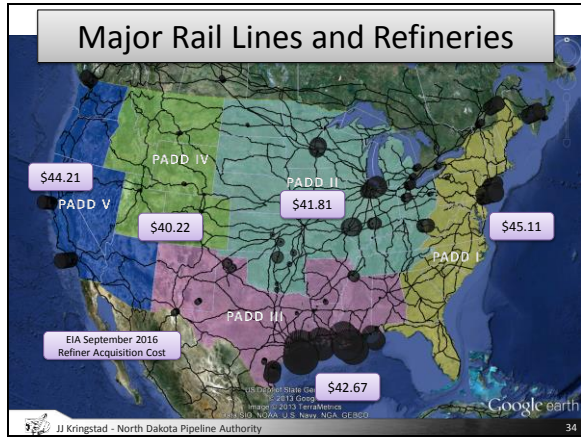


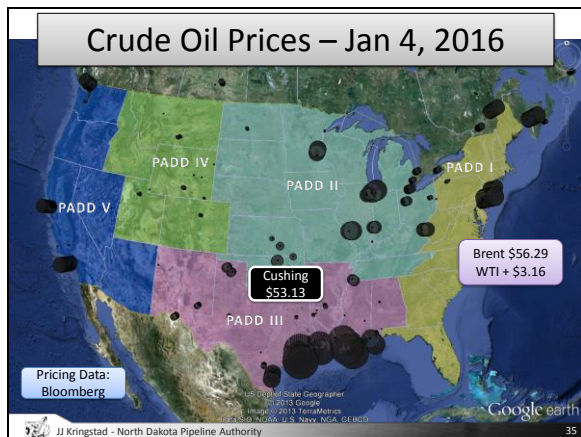
Chart showing the evolution of where crude by rail volumes are heading after leaving ND. As of Oct 2016, most crude by rail is going to the west and east coasts.

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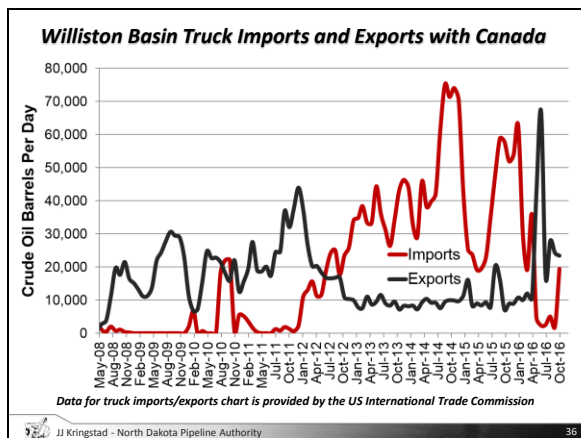
Refinery acquisition pricing information for the various regions of the US. Highest average prices were being paid at the east and west coast refinery complexes. Rail is currently the only method of reaching coasts.

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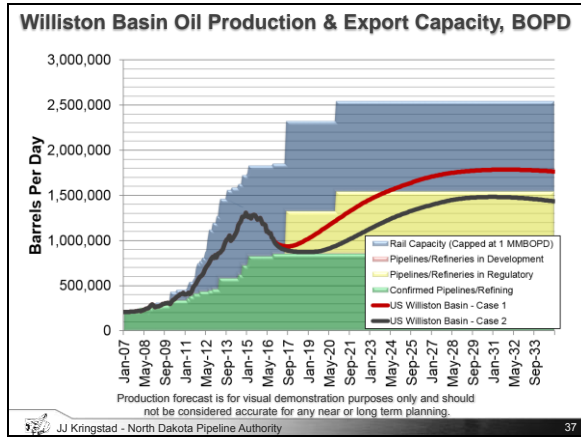
Snapshot of the two major oil price benchmarks on January 4, 2016.

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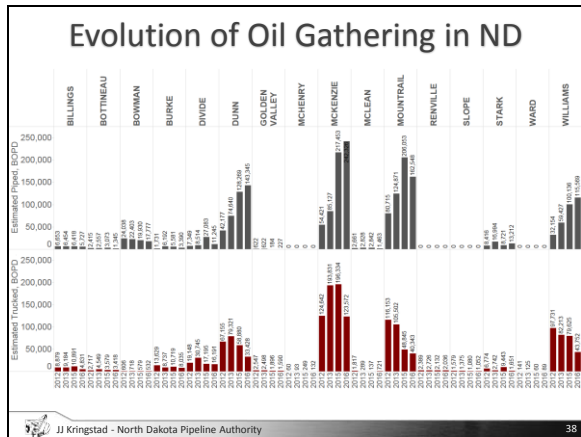
The US and Canadian portions of the Williston Basin see truck movements of oil between to the two regions. Fluctuations are typically due to market conditions or transportation option disruptions.

Slide 37



Overview of forecasted US Williston Basin oil production and takeaway options. (Green: Pipelines/refineries in service, Yellow: Systems seeking regulatory approval, Gray: Rail Option)

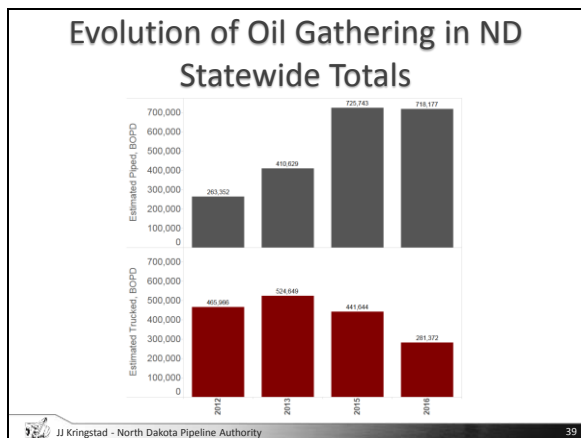
Slide 38



Intrastate Oil Movements

County breakdown of estimated oil gathering method (truck vs pipe). Data indicates the industry is actively moving to more pipeline gathering vs truck.

Slide 39



Statewide summary of oil gathering type. Numbers for 2015 & 2016 are slightly misleading due to overall production declines.

Slide 40

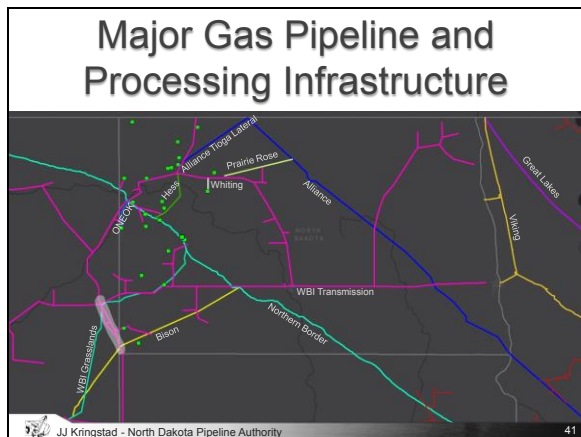
Presentation Outline

- Understanding current and future oil production
 - Activity
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 - Forecasts
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 - Interstate oil movements
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- North Dakota natural gas production
 - Flaring and gas capture
 - Natural Gas Liquids

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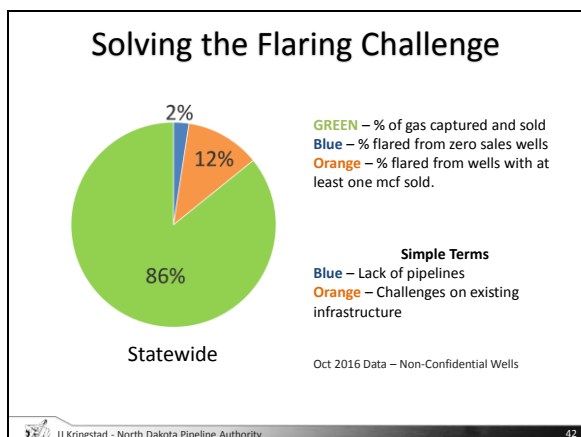
Next series of slides cover the topic of natural gas, natural gas liquids, and gas capture.

Slide 41



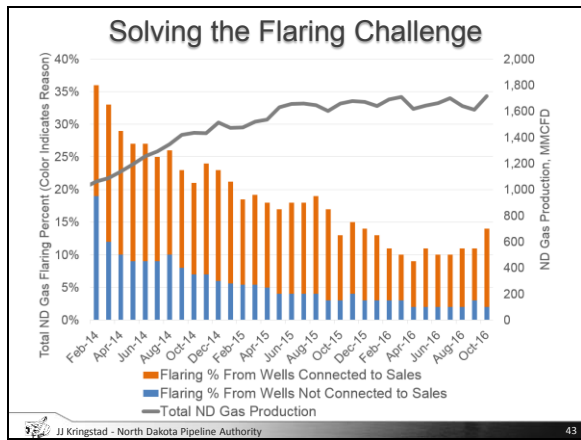
Map of major natural gas pipeline systems, processing plants (green squares), and storage (white outline near Baker, MT).

Slide 42



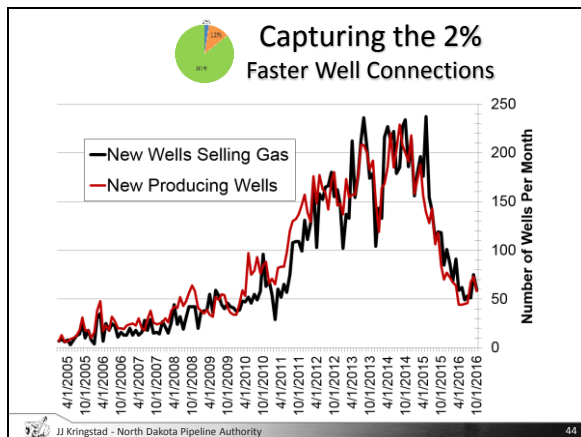
The NDPA breaks down gas capture into three categories. Green is gas captured and sent to market. Orange and blue is gas flaring due to different infrastructure issues (no pipe or lack of pipe space).

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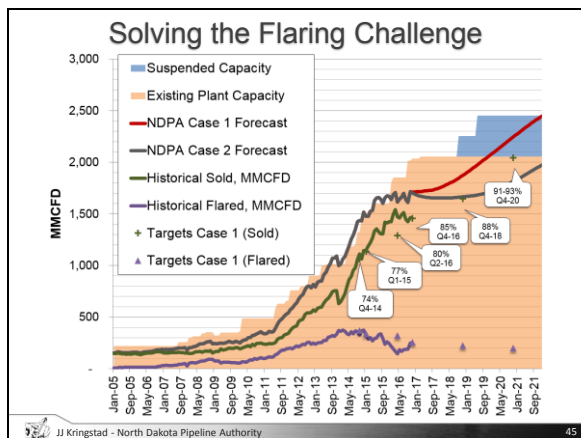
Historic look at gas flaring and reason for the flaring. The blue portion is flaring from wells that did not have a pipeline (shrinking over time). The orange portion is flaring due to space constraints on pipelines.

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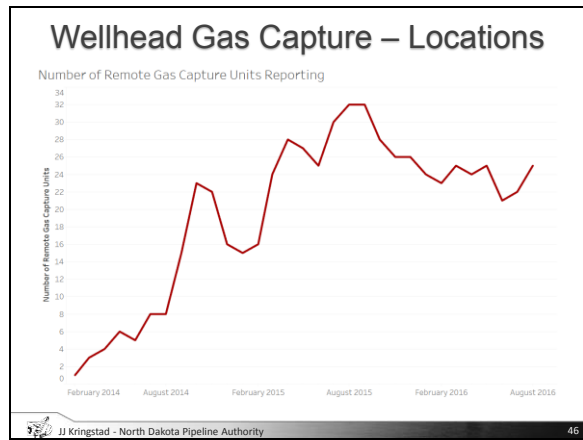
Wells being connected to gas gathering pipelines (black) has been able to keep up with the pace of drilling (red). (This was not always the case as can be seen in the chart when red line is above the black)

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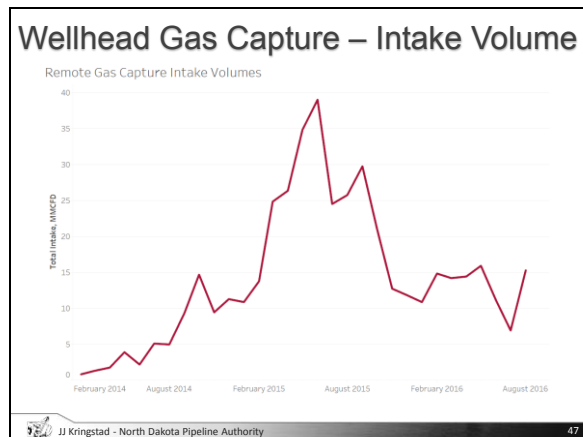
Gas processing capacity (orange/blue) is expected to keep pace with forecasted gas production (black/red) and gas capture targets (green/white) in the near term.

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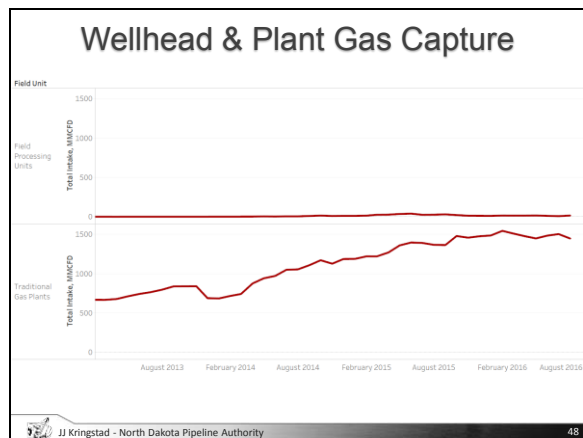
Non-traditional wellhead gas capture units have been used by the industry to increase gas capture rates. The chart is a historic look at the number of locations using the wellhead units.

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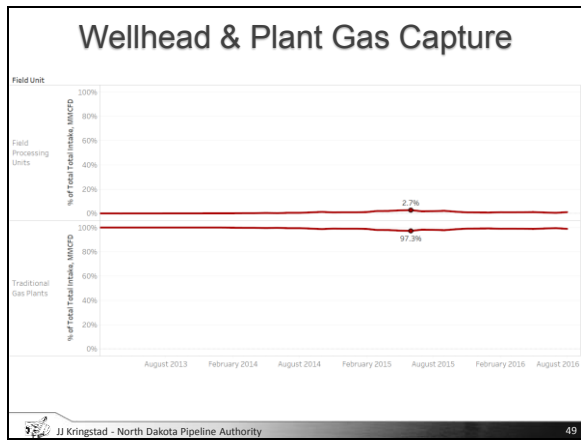
Historic look at the total volume of gas run through the wellhead gas capture units in ND. Decreasing volumes are due to new or expanded gas gathering and processing.

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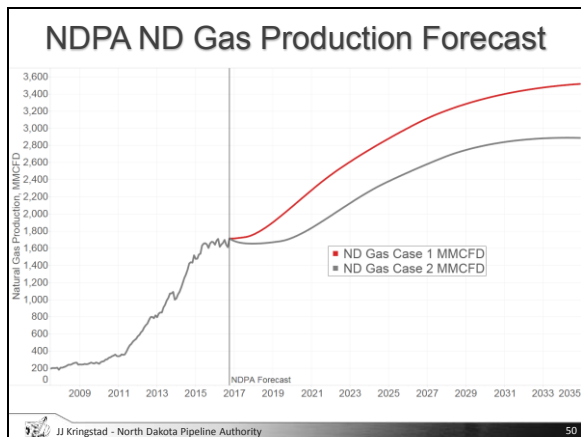
Comparison of volumes captured by wellhead units (top) and traditional gas processing plants (bottom).

Slide 49



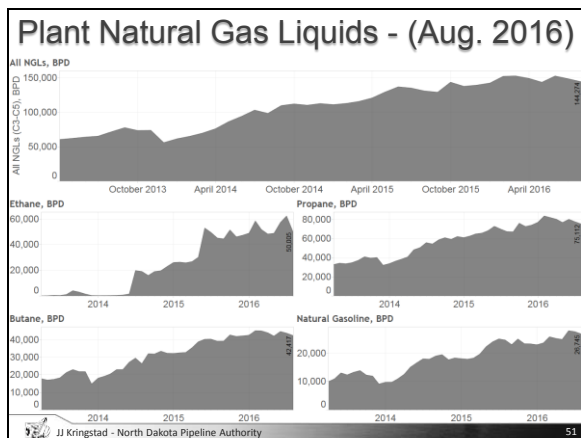
Comparison of captured gas market share for wellhead units (top) and traditional gas processing plants (bottom). The highest market share of captured gas for wellhead units was 2.7% in 2015.

Slide 50



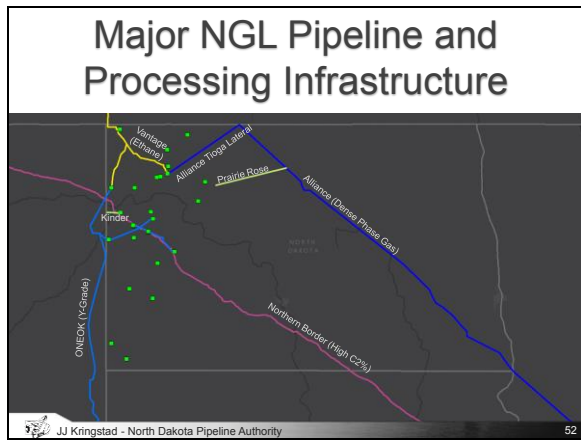
NDPA production forecast for ND natural gas production. The same activity assumptions are used (slide 24). As Bakken wells age, gas to oil ratios increase and give gas a stronger growth outlook.

Slide 51



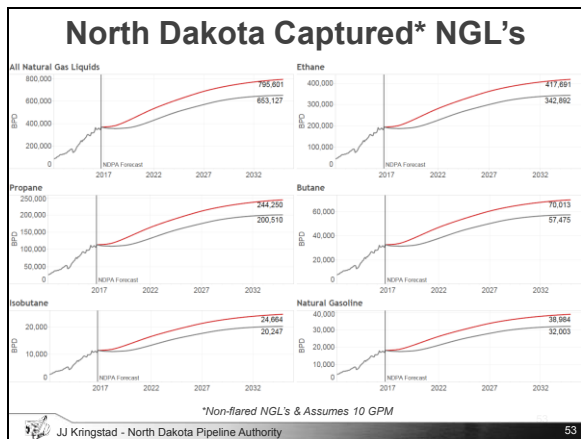
Natural gas liquids (NGL) output from the various gas processing facilities in North Dakota. As gas production and capture increase, so will the volume of NGLs needing transport.

Slide 52



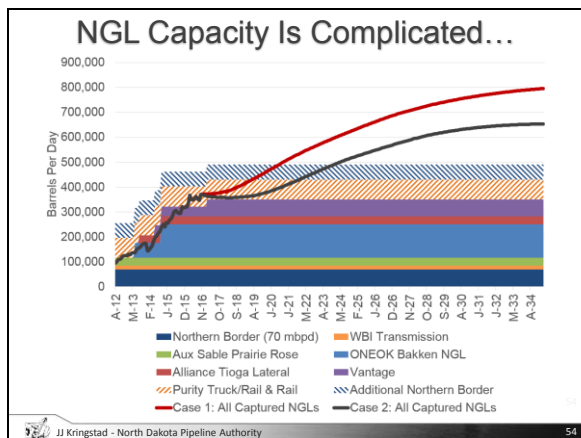
Major pipeline systems transporting ND NGLs. The systems include dedicated NGL service (ONEOK & Vantage), dense phase gas (Alliance), and high ethane % residual gas (Northern Border).

Slide 53



NDPA production forecast for ND NGL production. The same activity assumptions are used (slide 24). These forecasts assume DMR gas capture requirements are met.

Slide 54



In the long term, the current NGL transportation infrastructure is not adequately sized to meet growth expectations. The NDPA is actively working with industry to better understand the situation.

NGL Capacity Is Complicated...



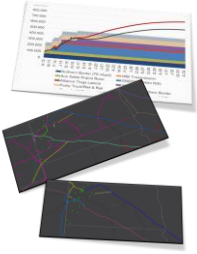
Key Challenges

- Plant complexity varies
 - Y-grade vs purity product
 - Ethane capture equipment
- Scattered plant locations
- Market pricing
- Pipelines vary by type of product they can ship
- Uncertainty of Canadian and Wyoming volumes and quality
- Seasonal product demand

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NGL transportation dynamics are much more complicated than natural gas or crude oil. Some of the key challenges are outlined in slide 55.

NGL Capacity Is Complicated...



Potential Solutions

- New, expanded, or repurposed pipeline systems
- Local consumption by new petrochemical industries
- Creative market solutions to manage plant NGL/BTUs
- Enhanced oil recovery
- Rail movements of excess products

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Despite the complications and challenges, many potential solutions are being explored to help address the expected transportation shortage. Potential solutions are outlined in slide 56.