



Dallas SPEE Chapter Virtual Meeting

Speaker: Deb Ryan, P.E., SPE, SPEE

Speech Title: “Where Did All the Capital Go? A Look at Full Life-Cycle Economics on Key U.S. Shale Plays”

When: Thursday, September 10, 2020

Platform: Zoom videoconference

Presentation Begins: 12:00 pm

Cost: Free to register and participate

Please RSVP by 4:00PM CDT Wednesday, September 9, 2020

Registration is limited to the first 300 participants

Link to RSVP: <https://spee.org/civicrm/event/info?reset=1&id=241>

If the above link does not work, alternatively go to <https://secure.spee.org/> then select ‘Local Chapters’, the ‘Dallas’, the ‘Click Here to Register’.

Process: Once you register your email address online, an invite link will be emailed to you the week of the meeting

Abstract: The story of the US shale revolution is well known. Hydraulic fracturing techniques were executed by Mitchell Energy in vertical Barnett Play gas wells in the early 2000’s, vertical wells matured into horizontal multi-stage frac wells, and one of the largest land leasing campaigns in history exploded as operators chased high gas prices.

As the natural gas market became saturated, the industry started to strip the natural gas liquids (NGLs) out of the gas stream to take advantage of the ever-rising oil pricing. When gas prices tumbled in 2011, and oil prices climbed north of \$100/bbl, the industry looked to the liquid rich / oil plays, such as the Williston Basin, the DJ Basin, and the Permian Basin.

The turning point came in November 2014 when oil prices fell rapidly. As prices bottomed out at \$22/bbl in February 2015, the industry saw a large exodus of operators and capital from the gas rich plays around the US to the liquid rich Permian. The Permian proved to be the haven for oil and gas development with its multiple pay zone targets, high EURs, low break-even costs, friendly regulatory environment, and access to markets. The rush for land, once again ensued, with the hope of an oil price rebound and promise of high returns to capital investors.

The rapid ramp up in activity from 2015-2018 did not come without challenges as it put strain on the availability of services and people, access to pipelines and markets, and access to frac sand/water. This drove up costs and resulted in mixed results for many companies. In addition, operators soon saw that with higher-than-expected gas and water production, expenses to manage these by-products sky-rocketed. Water handling and disposal became a huge portion of operating expenses and with gas export facilities at full capacity, companies started to flare gas in large volumes. Associated gas became a waste product, causing operators needed remove the gas and associated liquids from the revenue stream, and in some cases pay a high cost for flaring permits, rather than shutting in wells.

By 2019, a shift in the investment community was well underway. The days of growth-focused investment were coming to an end, and investors wanted to see returns on their investments. As prices still hovered around the \$55/bbl range, investors were getting anxious to recover their capital invested in the industry, and throughout 2019 operators all talked about the ability to generate free cash flow. This

paper analyses the free cash flow for three key unconventional basins across the US and discusses the associated economic impacts in each basin.

Bio: As Senior Manager, Engineering, Deb is responsible for managing Sproule's Denver office and is part of the team that spearheads Sproule's business development initiatives in the U.S. market. Deb's 15-years of oil and gas industry experience includes reserve and contingent resource evaluations and audits, US and international fair market evaluations, and expert witness testimony. Deb has experience building dynamic simulation models and also provides instruction for various reservoir engineering classes for PetroSkills. Prior to joining Sproule, Deb held various positions with MHA Petroleum Consultants, Arrow Energy and Woodside Energy.

Deb was recently named as the North American Regional Director for Society of Petroleum Engineers (SPE) International Board of Directors. She is also on the SPE International Committee of Business Leadership and Management and was previously the Chair of the Denver Section. She currently serves as the Treasurer for the Women's Energy Network (WEN) Foundation. Deb is also a member of the Society of Petroleum Evaluation Engineers (SPEE) and the Society of Women's Engineers (SWE). In 2019 she was named by Denver Business Journal as one of the 40 Top Women in Energy and received the 2019 SPE Rocky Mountain Service Award. She is a registered Professional Engineer (PE) in Colorado.

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Where Did All The Capital Go?

A look at full life-cycle economics for key U.S. shale plays

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Deb Ryan
Senior Manager, Engineering

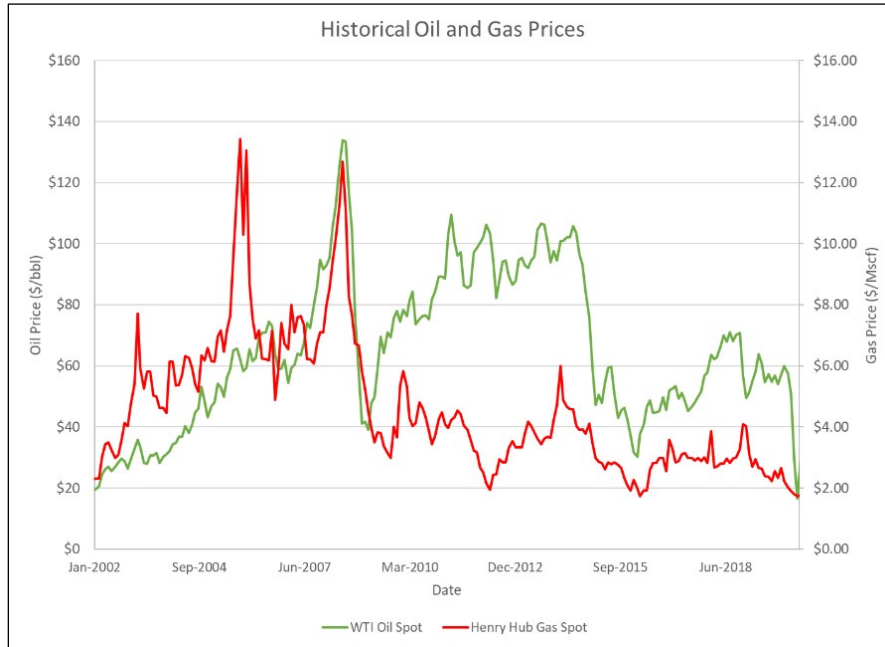
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This presentation contains forward-looking information and statements (collectively, "forward-looking statements") within the meaning of applicable Canadian securities legislation, concerning the outlook of commodity prices and the potential impact these could have on industry netbacks. Forward-looking statements include, but are not limited to, statements with respect to the estimation of commodity prices, permitting time lines, currency exchange rate fluctuations, government regulation of oil and gas exploration and development activities, environmental risks, and judicial ruling. Generally, these forward-looking statements can be identified by the use of forward-looking terminology such as "plans", "expects" or "does not expect", "is expected", "budget", "scheduled", "estimates", "forecasts", "intends", "anticipates" or "does not anticipate", or "believes", or variations of such words and phrases or state that certain actions, events or results "may", "could", "would", "might" or "will be taken", "occur" or "be achieved" or the negative connotations thereof. All such forward-looking statements are based on the opinions and estimates of the relevant management as of the date such statements are made and are subject to important risk factors and uncertainties, many of which are beyond the Corporation's ability to control or predict.

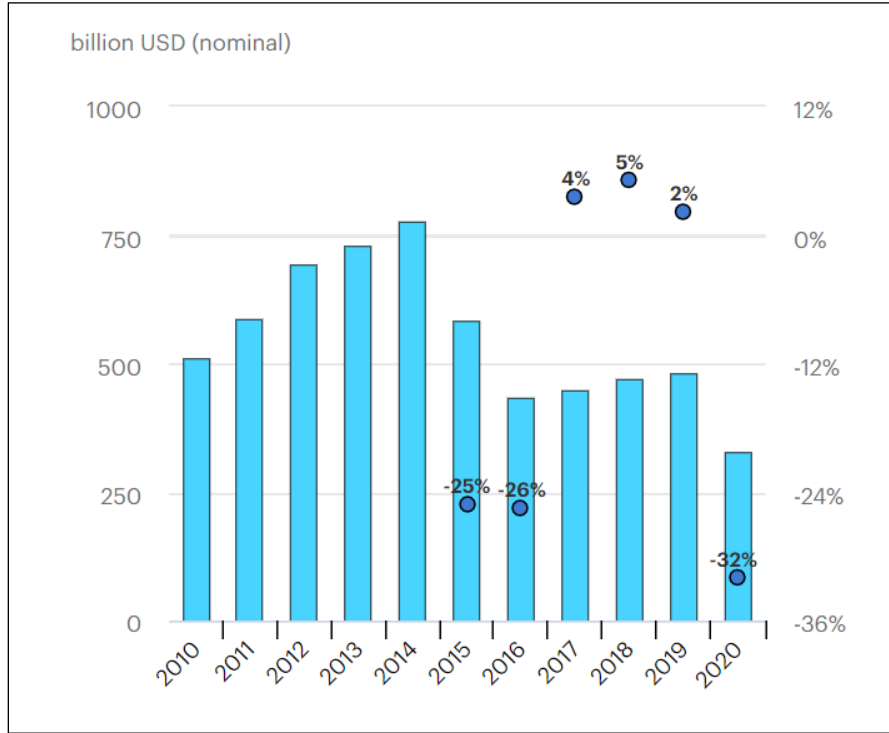
- Oil and gas capital development has always been a story of boom and bust, with supply and demand dictating commodity price and driving development decisions
- Throughout the 2000's the shale gas development was driven by continually increasing gas prices
- Oil and liquids started to become the preferred product, and operators followed suit by moving to develop positions in more “liquid-rich” plays such as parts of Texas, North Dakota, and Colorado
- In response, companies started stripping out the natural gas liquids (NGL's) as the value of associated liquids tracked closer to the rising oil prices



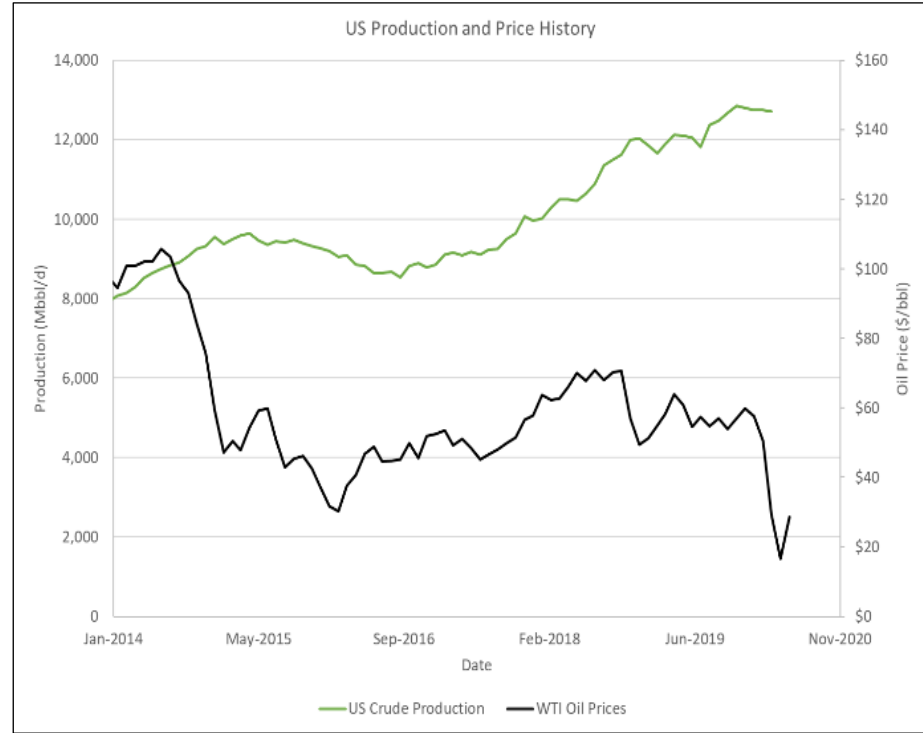
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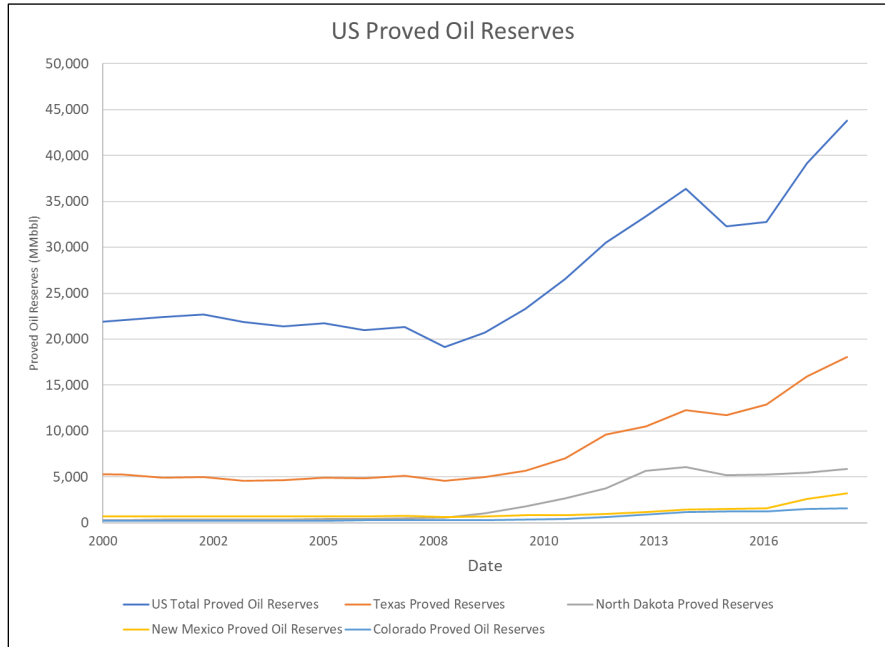
- While oil production was on the rise in the US due to unconventional oil development, international oil production held steady
- Emerging BRIC countries (Brazil, Russia, India, and China) maintained supply until the end of 2014
- The market was over-supplied, and prices plummeted
- Throughout 2015 and 2016, global oil market continued to be oversupplied by over 1 million barrels per day (bpd)
- Until OPEC cut production by 1.2 million bpd in November 2016, causing oil prices, to once again rise



Source: IEA (2020)



Source: EIA



Proved Reserves:

- Proved Developed Producing (PDP)
- Proved Undeveloped (PUD)

PDP reserves:

- Producing wells with no remaining drilling and completion capital assigned to them. The associated cash flows do not include the payback on the capital investment because reserves are forward-looking

PUD reserves:

- All drilling and completion costs are included
- Land acquisition costs excluded
- Increased production and reserves have historically been the focus in investor community
- These numbers do not show the ability of an oil and gas company to generate free cash flow and give investors a return on their investment.

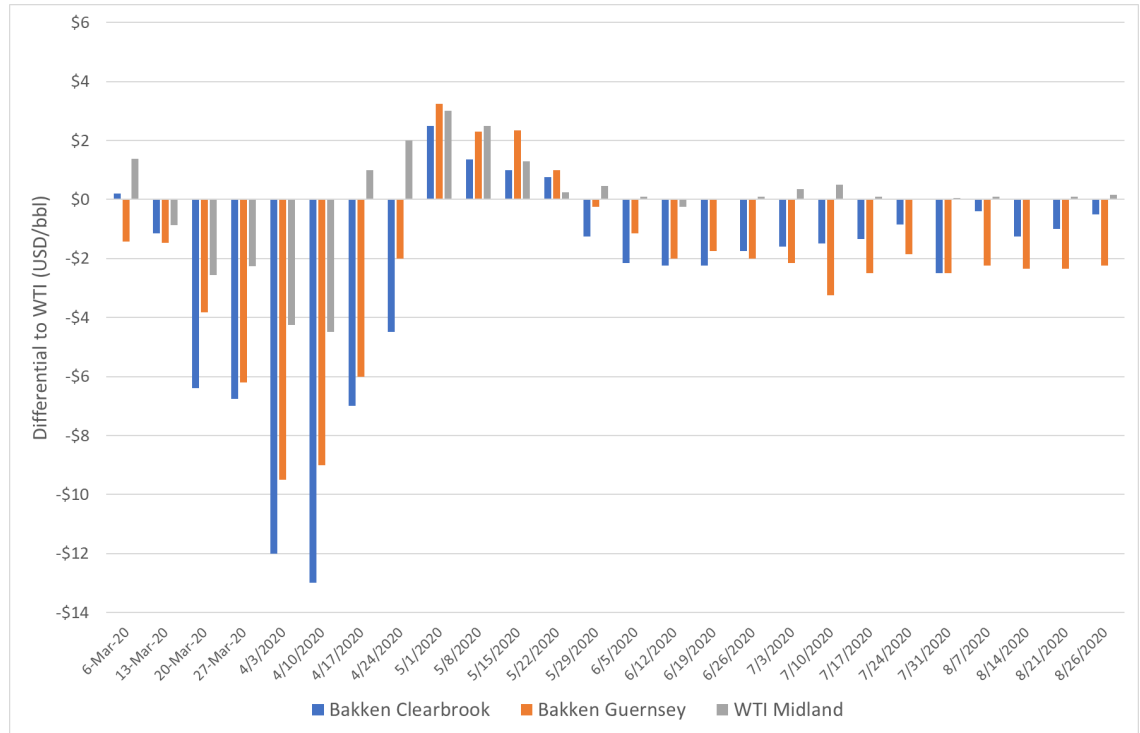
Demand Recovery:

- Global demand expected to be between 90.5 and 95 MMbbl/d by end of 2020, and 2021 range expected to be 94 to 99 MMbbl/d
- Significant uncertainty in market

Supply:

- Supply will continue to be adjusted using curtailed production, storage inventories, DUCs and then new drilling
- US storage levels are declining, but still above the 5 year average

US Regional Price Differentials to WTI

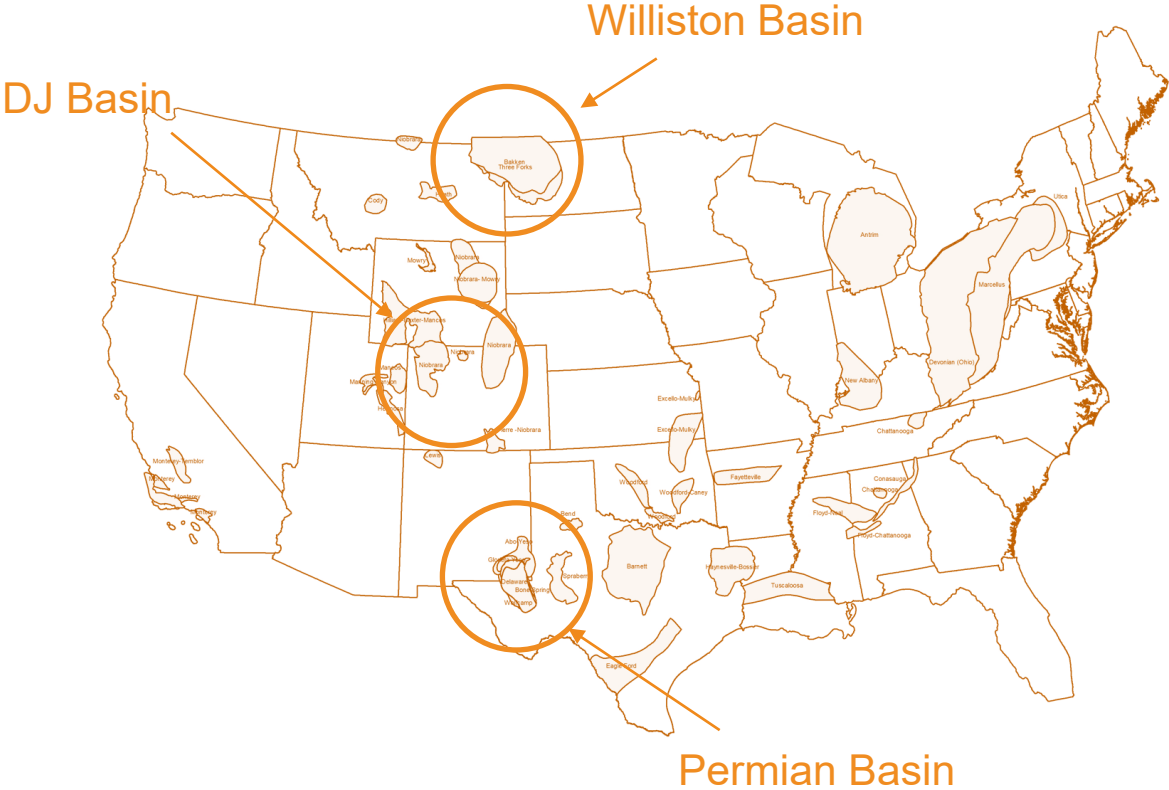


Source: Bloomberg, Sproule

Economic Workflow

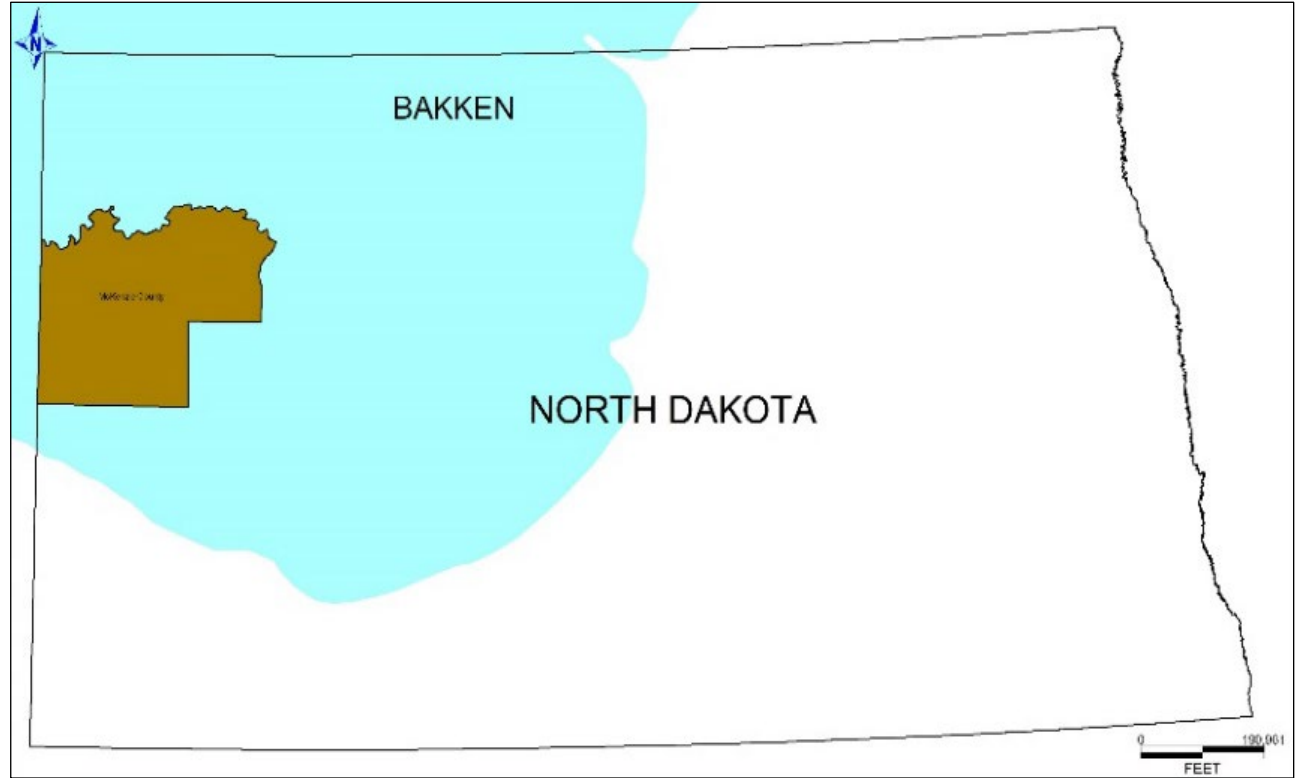
- Average type curves were developed for 2-mile laterals based on available production history
- Land acquisition, drilling & completion capital, and operating expenses were obtained from public sources of information
- WI/NRI assumed at 100/80%
- These type curves and cost assumptions were evaluated at three fixed net oil prices, \$20/bbl, \$40/bbl and \$60/bbl

Cost Parameters	Williston Basin (Bakken)	Dj Basin (Niobrara)	Permian Basin NM (Wolfcamp)
2019 Land Acquisition Cost (\$/acre)	\$ 15,000	\$ 10,000	\$ 40,000
Expected Land Acquisition Cost (\$/acre)	\$ 7,000	\$ 3,000	\$ 15,000
Drilling & Completion Capital (Million \$)	\$ 8.5	\$ 4.7	\$ 10.0
Operating Expense (\$/month)	\$ 10,000	\$ 4,000	\$ 10,000
Water Expense (\$/bbl)	\$ 2.50	\$ 2.50	\$ 2.50
Taxes	Oil 10%, Gas \$0.0712/Mscf	Oil 5%, Gas 5%, Ad Valorem 1%	Sev & Ad Valorem 8%
Abandonment Capital	\$ 150,000	\$ 150,000	\$ 150,000

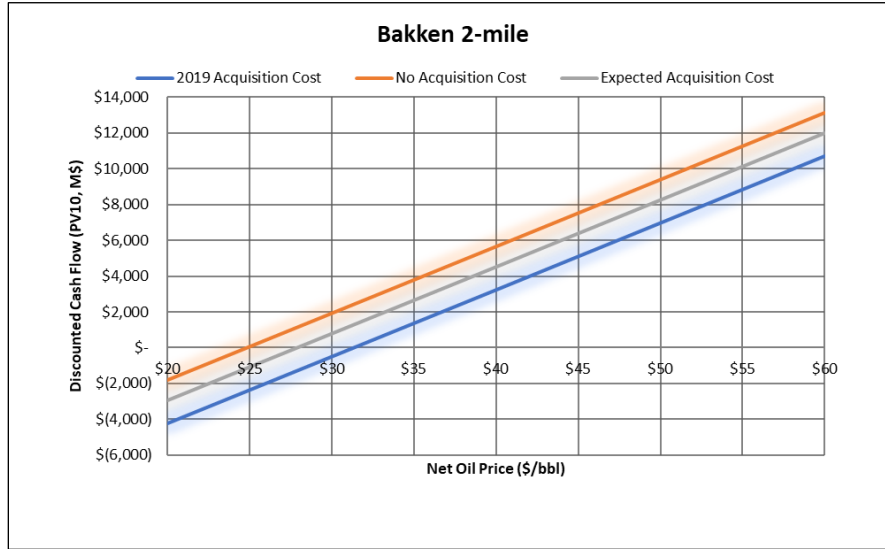


Highlights

- One of the first “unconventional” plays
- Located in North Dakota and Montana, the major unconventional targets are the Bakken and Three Forks formations.
- Horizontal drilling specifically targeting the Middle Bakken started in 2003 and dramatically increased in 2006.
- Crude is 40-43° API. Water handling is an issue, given high water volumes.
- Oil differentials: Have seen over \$10/bbl prior to production shut-ins which alleviated surplus.



Source: Company Presentations, Sproule

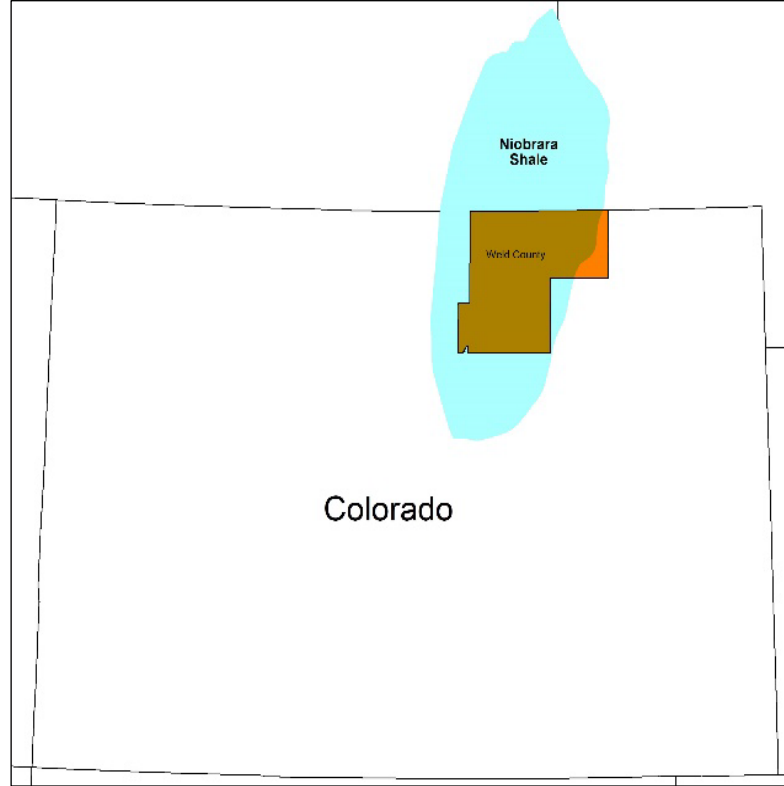


Breakevens (net oil price):

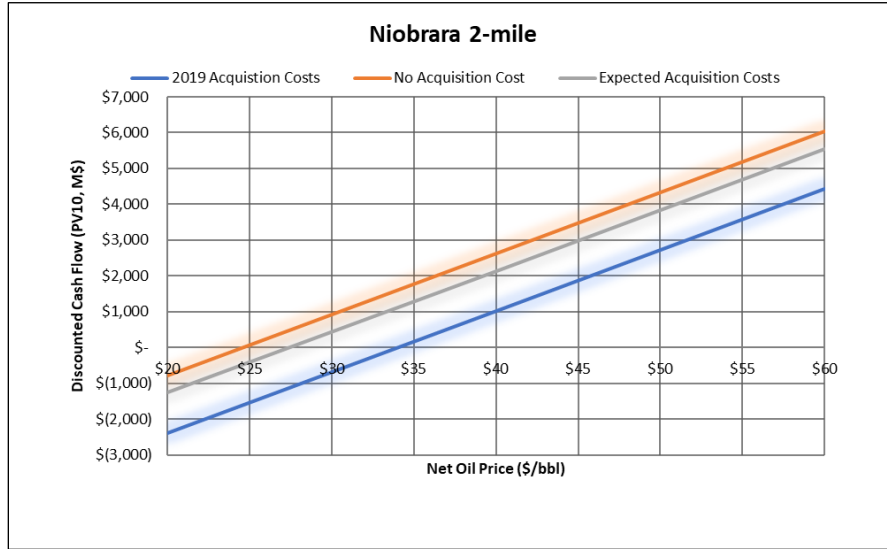
- 2020 - Without Acq. Costs = \$25/bbl
 - 2020 - Acquisition Costs = \$27.50/bbl
 - 2019 – Acquisition Costs = \$31/bbl
-
- Oil differentials in the Williston basin range between \$6/bbl & \$14/bbl below WTI benchmark prices
 - Bakken did not see the mass shut-in of production in early 2020, but operators laid down rigs and cut capital spending
 - Using 2019 acquisition costs, the breakeven price is pushed north of \$30/bbl
 - Slowed M&A activity in the basin
 - Moved capital investment out of the basin
 - Land acquisition costs need to come down significantly before capital begins to flow back into the basin. This will likely become even more of a sticking point given the 2020 outlook

Highlights

- Located in Colorado, Wyoming and Nebraska, the major unconventional targets are the Niobrara and Codell formations.
- Weld country contains majority of operations in basin due to existing infrastructure and legacy leases.
- Horizontal drilling specifically targeting the Niobrara and Codell in the Wattenburg field started in 2009.
- Crude is 45-58° API in Wattenburg.
- Oil Differentials: Have seen over \$10/bbl prior to production shut-ins which alleviated surplus.



Source: Company Presentations, Sproule

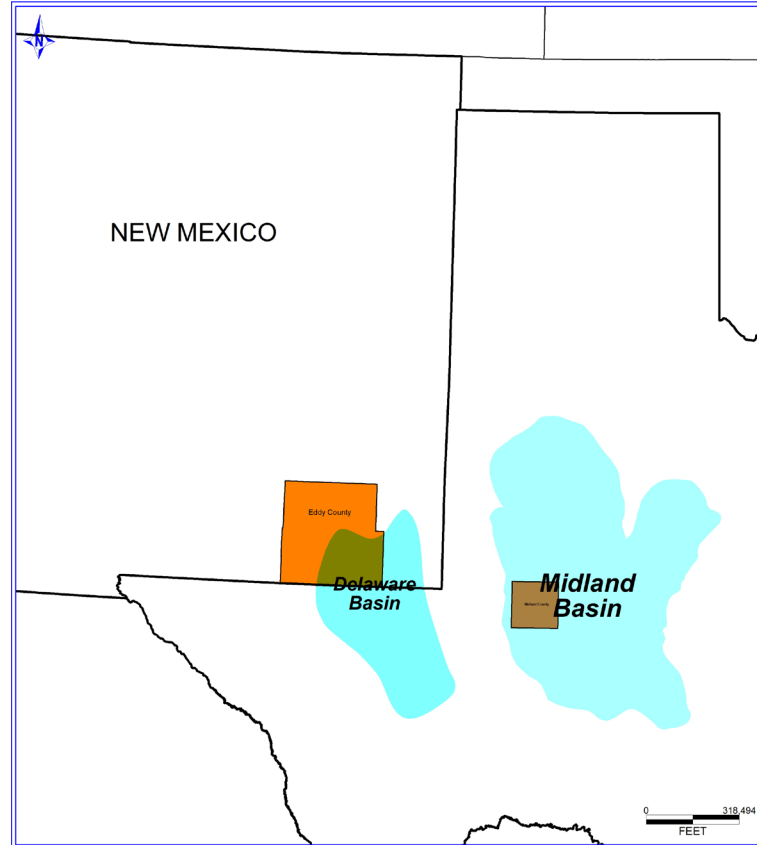


Breakevens (net oil price):

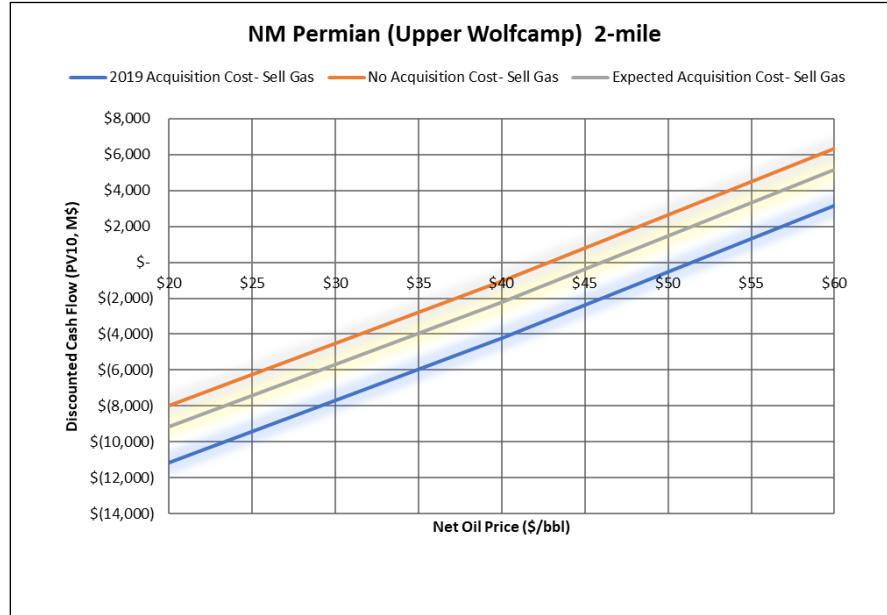
- 2020 - Without Acq. Costs = \$25/bbl
 - 2020 - Acquisition Costs = \$27/bbl
 - 2019 – Acquisition Costs = \$34.75/bbl
-
- Operators with strong acreage positions (legacy leases) could operate in free cash flow at lower net oil prices (\$25/bbl)
 - Capital flow into the DJ basin seemed to halt in 2019
 - Most activity was M&A as major players worked to consolidate positions
 - DJ Basin has seen similar fluctuations in oil differentials as the Williston Basin, breakeven prices are still in the \$30 - \$40/bbl range for WTI.
 - Two main issues in relation to capital investment in the DJ Basin:
 - Ongoing social and political risk of investment in Colorado. Despite low costs, this risk is expected to drive down future acquisition costs in the basin.
 - Return on capital invested not as high as in other basins

Highlights

- Located in Texas and New Mexico, the Permian includes the Delaware Basin, Midland Basin and Central Basin Platform.
- The main targets for unconventional drilling in the Delaware Basin are the Bone Springs and Wolfcamp formations.
- Crude density varies from 35-45° API. Water handling is an issue, given high water volumes (over 5bblwater/bboil) and rising associated gas volumes result in significant flaring.
- Oil Differentials: Was at \$6/bbl until production take away and shut-ins start to impact over supply.

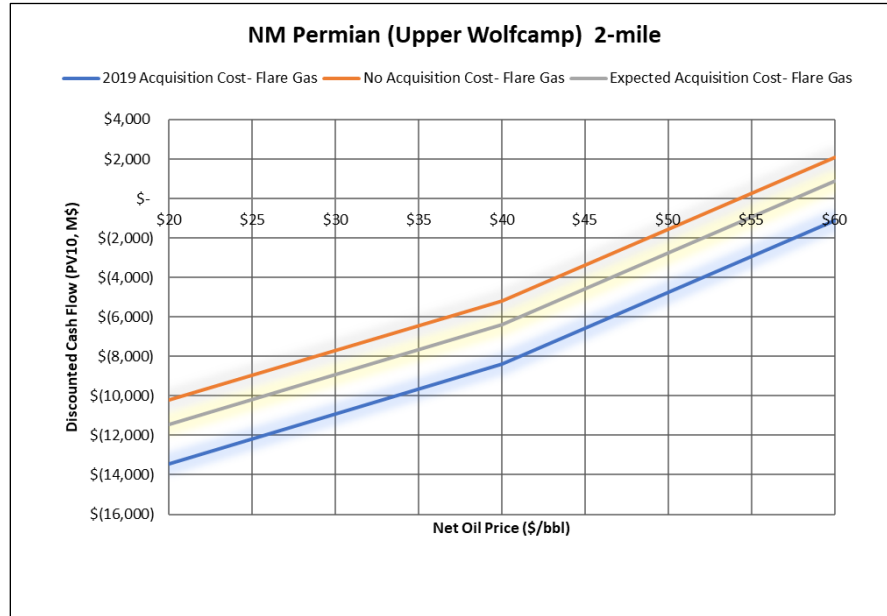


Source: Company Presentations, Sproule



Breakevens (net oil price):

- 2020 - Without Acq. Costs = \$43/bbl
 - 2020 - Acquisition Costs = \$46/bbl
 - 2019 - Acquisition Costs = \$52/bbl
- Oil differentials during 2019 were close to zero, and in some cases, operators received a premium.
 - Land acquisition costs continued to explode from 2017, resulting in significant capital expense.
 - When these capital costs are included, the net oil price for free cashflow over \$50/bbl.
 - High breakeven cost can explain very little M&A activity in 2019.
 - Well positioned companies that find cost synergies with existing operations, the cost of land acquisition is expected to drop so there should be opportunities.
 - If oil prices improve in the second half of 2020, cash flow from existing wells will improve encouraging more capital investment and consolidation of operations.



- New Mexico, operators can apply for temporary permits to flare.
- According to the New Mexico Oil Conservation Division (ENMRD) many operators are using this as a long-term solution and paying the fees to flare.
- Basin economics dependent on company's ability to sell gas.
- By flaring the gas, not only is there a significant environmental impact, but the gas and associated NGL revenue streams are literally burned. In New Mexico, where there are penalties associated with flaring permits, the economic impacts are dire.
- Texas has not imposed any penalties for flaring, if a company is not able to sell the gas, the breakeven values required to return capital to investors are impacted.



- **Williston Basin:** investment has yielded free cash flow for investors with long term positions, but accounting for acquisition costs and oil differentials explains very little merger and acquisition activity in recent years.
- **DJ Basin:** despite lower costs, production volumes, and breakeven prices, still not seeing capital investment due to political and regulatory uncertainty in Colorado.
- **Permian Basin:** has been the focus for a lot of investors since 2017. Despite increased capital, investors have not seen a return on investment due to high costs (land acquisition) and operating expenses (water disposal, flaring)



- When project economics includes full lifecycle land and well costs, the breakeven net oil prices tell the story on the investment operations
- Land acquisition costs become a large driving factor in the success or failure of a prospect
- 2019 saw companies looking to figure out balance sheets to generate free cash flow and repay capital investment and debt before 2020 downturn
- As prices stay lower for longer, a lot of companies are going to continue to struggle
- Access to outside investor capital is going to continue to be a challenge, as investors look to put their capital into other industries with better return on investment.



Thank You for Attending

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