NORTH DAKOTA FRACKING MARKET
PRELIMINARY REVIEW FOR SALES & MARKETING TEAM

http://www.sei-ind.com/products/frac-tank

INDUSTRY		NORTHERN USA
TARGET		BAKKEN – FRACKING FIELD OPERATORS
BEACHHEAD		MCLEAN COUNTY, ND
CITY		WASHBURN, ND
PERIOD		**ACTIVITIES**
1-2 Weeks	**PRE-PHASE**	Determine/Negotiate Sales Targets & Metrics.
30 to 90 Days	**PHASE 1**	1) Identify Bakken Formation Counties that have lower production. 2) Identify Counties that do not or are not expected to have Pipeline capacity. 3) Select Top 3 Counties and Top 1 of 3. 4) Here, **McLean County is shown as Target.** 5) Build Sales in Target Region.
		Research Target County for Beachhead activity.
		Scout/initiate relationships to start building network to reach across the region. Starting with State Capital (Bismark, ND), State Officials & McLean County officials, Operators in County. Meet and/or network with Dealers or Potentials (Farm Equipment Suppliers, O&G vendors, etc).
	PHASE 2	Determine Tax & Cost Issues for Market Operators. Identify Hot Buttons through interviews/site visits.
	PHASE 3	Design/test packages. Identify/pitch Early Adopters.

A) KEY NOTES
Target Selection working file p.3. Background Notes p.4-18.

1) Flaring now consumes 29-33% of Associated Gas.
2) Many wells are not yet connected with gas-gathering systems.
3) **Connect-up is challenged in a largely rural area.** Without Pipelines in play, Industry has to share rig drilling and fracking resources that are moved around on poor-to-non-existent rural road network in area with large farm acreages.
4) State Government is pushing hard for Fresh/Saltwater Fracking Pipelines.
5) **This push could threaten SEI's ability to grow Hippo sales.**
6) **Issues for State Government:**
    a. **Political:** Flaring and Venting contaminates soil, water, atmosphere, which affects the influential farming and visitor/tourism industry
    b. **Economic:** gas-gathering systems = local construction jobs
    c. **Efficiency:** Pipelines can be dual-purpose reversed to take oil and/or gas
    d. **Loss of Resource:** Flaring and Venting
    e. **Lost Taxes (a)** from Flaring
    f. **Lost Taxes (b) from concurrent 1-Year Tax Exemption** (encourages exploration)

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MARKET DEVELOPMENT – BEACHHEAD TARGET ASSESSMENT WORKSHEET

HIGH RECOVERABLE PRODUCTION BY COUNTY (See Chart 5)

FCR — FRACKING CANDIDATE RATING (Proposed Likelihood of Need for Fracking Services)

FCR COLOUR	SAMPLE	RATINGS	Production	Econ Rec	Reserves	Year 1	Year2	Year3	Mid-Decline	FCR Pipeline Known Reliable $Cost: Very High	FCR Econ/Tank Known Reliable $Cost: Mid	FCR Econ/Product New Untested $Cost: Mid to Low	Challenge for Innovative Prospect (Innov ROI)
LIGHTEST	**Oliver**	5	Lowest	Lowest	Lowest	Lowest	Good	Sharp Neg	Leveling Off	Removes need for Portable Frak Tanks		Lowest Competition	Worst IROI
	Morton	4				Low	Good	Sharp Neg	Leveling Off			Lower	** TARGET **
	Stark	3				Mid	Good	Sharp Neg	Leveling Off			Mid	
	Dunn	2				High	Good	Sharp Neg	Leveling Off			Greater	
	Williams	1				Highest	Good	Sharp Neg	Leveling Off		More Competition	Greatest	Best IROI
DARKEST	**McKenzie**	0	Max	Max	Max	Max	Good	Sharp Neg	Leveling Off		More Competition	Greatest	Best IROI

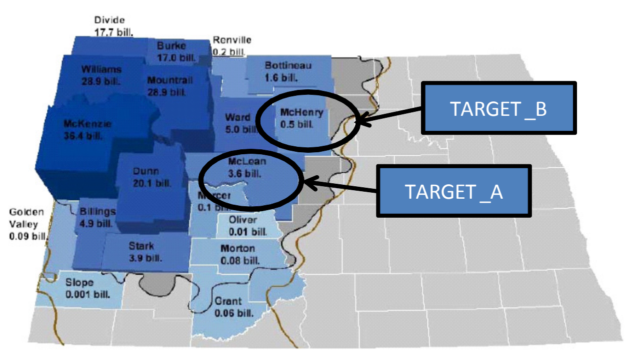
NORTH TO SOUTH LISTING

FORMATION WEST

Line	County	Gas Plant	Planned	Vol Range	Apparent FCR	Est Actual FCR	BBL
NORTH-LINE	Divide	1		High	2		17.70
	Burke	2		High	2		17.00
	Williams	3	1	High	1		28.90
	Mountrail	2	2	High	1		28.90
MID-LINE	McKenzie	5		High	0		36.40
	Dunn	2	1	High	2		20.10
	Billings	1.5	0.5	Mid	4	** TARGET **	4.90
	Stark		0.5	Mid	4	** TARGET **	3.90
	GoldenV		0.5	Low			0.09
SOUTH-LINE	Slope	1		Low	5		0.00
	Other Cty	1					

FORMATION EAST

Line	County	Gas Plant	Planned	Vol Range	Apparent FCR	Est Actual FCR	BBL
NORTH-LINE	Renville	0	0	Low	4	** TARGET **	0.20
	Bottineau	0	0	Mid	3		1.60
	McHenry	0	0	Low	4	** TARGET **	0.50
	Ward	0	0	Mid	3		5.00
MID-LINE	McLean	0	0	Mid	4	** TARGET **	3.60
	Mercer	0	0	Low	5		0.10
	Oliver	0	0	Low	5		0.01
	Morton	0	0	Low	5		0.08
SOUTH-LINE	Grant	0	0	Low	5		0.06



	Gas Plants Existing	Gas Plants Planned	Oil Pipeline Y=1, N=0	Gas Pipeline Y=1, N=0	Apparent FCR	TEST TARGET 1 = Top Choice
Renville	0	0	1 (1 Main)	1 (1 Main + Feed)	4	3
McHenry	0	0	1 (1 Main)	1 (2 Main)	4	2
McLean	0	0	0	1 (1 Main + Feed)	4	1
Billings	1.5	0.5	1 (2 Main + 1 Feed)	1 (1 Main + Feed)	4	5
Stark		0.5	1 (1 Main)	1 (1 Main + Feed)	4	4

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BACKGROUND / REFERENCE NOTES COMMENCE HERE:

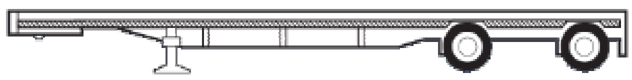
B	STATE GOVERNMENT'S TARGET – BUILD WATER FRACKING PIPELINES
C	SWOT – BAKKEN FRACKING OVERVIEW
D	GEOLOGICAL FRAMEWORK
E	KEY RESERVOIR PROPERTIES
F	POROSITY AND PERMEABILITY
G	NOTE ON BAKKEN RECOVERABILITY
H	CHARTS AND IMAGERY

B) STATE GOVERNMENT'S TARGET – BUILD WATER FRACKING PIPELINES
: Cut time to share/move frack trucks, reduces interference & road damage.

Bakken Wells 2-4 - Truckload Timeline				
https://www.dmr.nd.gov/oilgas/presentations/HouseApprop01102013.pdf				
FRACKING TIME SAVINGS WITHOUT NEED FOR TANKS				
PRODUCTION WITHOUT PIPELINE CONNECTION				
	Max Loads	Min	Max	Max Days (Total or Average)
Location & Production Prep completed with first well. No additional trucks.				
Drilling Preparation	25			3
Drilling Phase	167			19
Rig Down	6			2
Wait for Frack	0	90	120	120
Fracturing Phase	584			15
454 Tank Loads + 130 Trucks per Well				
Production Equipment Move	14			150
Pit Reclamation (36 to 41)				
Pit (6)	6			76
Emptying Water & Drilling Fluid (30 to 35)	35	7	14	10
Production Phase	0			0
	837			395
PRODUCTION WITH PIPELINE CONNECTION				
	Max Loads	Min	Max	Max Days (Total or Average)
Location & Production Prep completed with first well. No additional trucks.				
Drilling Preparation	25			3
Drilling Phase	167			19
Rig Down	6			2
Wait for Frack	0			0
Fracturing Phase	32			15
With Reduced Loads + Trucks per Well				
Incl an estimated 250 less Frack Loads				
Production Equipment Move	14			150
Pit Reclamation (36 to 41)				
Pit (6)	6			76
Emptying Water & Drilling Fluid (30 to 35)	0	7	14	10
Production Phase	0			0
	250			275

C) SWOT – BAKKEN FRACKING OVERVIEW

VARIABLE	MARKET	SEI CONDITION OR RESPONSE
STRENGTHS	Some of the most productive wells are located in the west of the state. McLean is a mid-volume county which has a gap in the middle that does not have pipelines.	Well known in O&G industry. **Test the market in counties that appear to have less likelihood of getting pipelines** (confirming initial assessment with residency over 90 days).
	65% of activity is conducted by 7 major companies (in order, from largest to smallest): Continental Resources Hess Whiting Petroleum Statoil/Brigham Oasis Petroleum Marathon EOG Resources	Larger companies can carry the cost of different systems across many fields. **We may find a niche here.**
WEAKNESSES	This is a Tight Reservoir. Unpredictability of geology = unpredictability of production = higher costs = higher risks. The 7 majors may force a cartel on SEI. This may, however, produce volume sales overall.	Hippo may have perceived time cost to: unpack, unroll, use, undog, flush to regulation, roll-up, box, stack. Flatbed trucks quickly travel; traditional metal containers may be perceptibly stronger. Traditional Tanks may be amortized assets or leased expenses with known costs.
	We are not a “neighbor” – we are not known vs Saskatchewan firm.	We are not a “neighbor” – not directly contributing to local jobs. **Get dealership for region?**
OPPORTUNITIES	Pitch Air Delivery as an efficiency & environmental measure that supports State’s contention that road network is a problem.	**Hippos could be stacked flat, then helicoptered** to new sites, saving truckload time negotiating poor road network to sites. Flight vs environmental costs could be factored in by State.
		Partner with BC’s CHC to build shared Dakotas’ presence
	Assess State’s “Total Cost of No Road Network” [roads must be in place to build hydrocarbon-gathering systems]	**Develop Rationale for Tax Credit** to accomplish road network in high production counties (away from our initial target areas). Large operators credits will cover off now higher value/lower cost Hippo option.
	We could propose a volume	**SEI could develop a leasing**

	system, where members cut costs through a leasing co-op. This spreads the risk for members.	**subsidiary** in partnership with a ND bank or farmer's co-op.
THREATS	Push for Pipelines by State & County officials. Connect-up threatens market base. Steel Frack Tank companies could seek to operate pipeline system, further blocking us.	**Can Hippo be used as a Head Pool for water storage from the pipeline?**
TYPICAL FLATBED TRAILER DIMENSIONS:		
Deck: 48' long x 102" wide Height: 60" x 62" high Maximum Freight Height 8'4" http://www.jcnester.com/Flatbed%20Trailer%20Dimensions.htm		
TYPICAL STEEL FRAC TANKER DIMENSIONS:		
Generally, off standard container truck. http://www.dragonproductsltd.com/tanks/fr-corrugated-wall.html		

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D) GEOLOGICAL FRAMEWORK

http://geology.com/usgs/bakken-formation-oil.shtml

O&G PROVINCE	WILLISTON BASIN	A sedimentary basin covering parts of three states and two provinces. The total layer of sediments in the basin can be up to 15,000 ft thick. The Bakken is one of many hydrocarbon producing formations in the Basin	
TOTAL PETROLEUM SYSTEM	BAKKEN-LODGEPOLE TPS	Maximum thickness of about 150 ft., but is thinner in most areas. The depth to the top of Bakken can vary from a few thousand feet in Canada to 10,000+ feet deeper areas in ND.	
	BAKKEN SHALE FORMATION	Upper Devonian-Lower Mississippian	about 360 million years ago
		Each succeeding member is of greater geographic extent than underlying member. Note: upper and lower shale members of Bakken Formation are also the source for oil reservoirs of the Mississippian Lodgepole Formation.	
	Upper Shale Member	Petroleum source rocks and part of the continuous reservoir: Organic-rich marine shale of fairly consistent lithology.	
	Middle Sandstone Member	varies in thickness, lithology, and petrophysical properties, and local development of matrix porosity enhances oil production in both continuous and conventional Bakken reservoirs.	
	Lower Shale Member	Petroleum source rocks and part of the continuous reservoir: Organic-rich marine shale of fairly consistent lithology.	
PRODUCTION ESTIMATES	**Estimated Mean Undiscovered Volumes:** USGS: geology-based assessment methodology for North Dakota and Montana	Oil	3.65 billion barrels
		Associated/Dissolved Natural Gas	1.85 trillion cubic feet
		Natural Gas Liquids	148 million barrels

E) KEY RESERVOIR PROPERTIES:

http://www.theoildrum.com/node/3905

Oil in Place and Reserves		
100%	**200-400 billion bbl**	**Oil in Place**: 200 to 400 billion barrels [Pittman/Price/ LeFever]. The Bakken is postulated to be both source rock and reservoir. In many areas, the oil created by the source rock slowly migrates to another location where it is trapped and later found as an oil or gas reservoir. In the case of the Bakken, these layers contain source material, but the hydrocarbon was cooked in place and little or none of the created hydrocarbon migrated to other potential reservoir rocks.
30%	**"Good"**	**Reserves** (Recoverable or Produceable): Range of recovery can very widely. Good reservoirs with "water drive" can have recoveries of more than 30% of oil in place.
~5% up to 15%.	**"Sweet Spots"**	higher porosity and lots of fracture permeability
1% to 10%	**"Tight"**	As reservoir quality decreases, so does recovery factor. In very tight reservoirs, recovery would probably be in the range of less than 1% to around 10%, depending on many factors: porosity, permeability, fractures, well spacing, etc.
< 1% to 5% OIP	**"Other areas"**	have lower porosity, lower permeability, and fewer fractures, and/or thinner beds of reservoir rock
RECOVERABILITY		
"Technically Recoverable" and "Economically Recoverable," a term which can be taken as the amount of producible reserves that will give a reasonable return on capital invested. Factors include spot price, cost of wells, cost of fuel and operations, labour availability, etc. and this will fluctuate as market conditions change, and areas with low reservoir estimates will never be drilled because of the risk of a tight/dry well (ie. $0 Return on Investment). **"Estimating recovery factor in shale reservoirs is more an art than a science; only after several years of production, and with very good data, can a reliable range of recovery be estimated."** **Example:**		
1% OIP	Technically Recoverable	**OIP estimates suggests 1% availability**
0% OIP	Economically Recoverable	**If operator decides against risking capital**
**** KEY POINT****	SEE: "Note On Bakken Recoverability." The Bakken is a "Tight Reservoir".	

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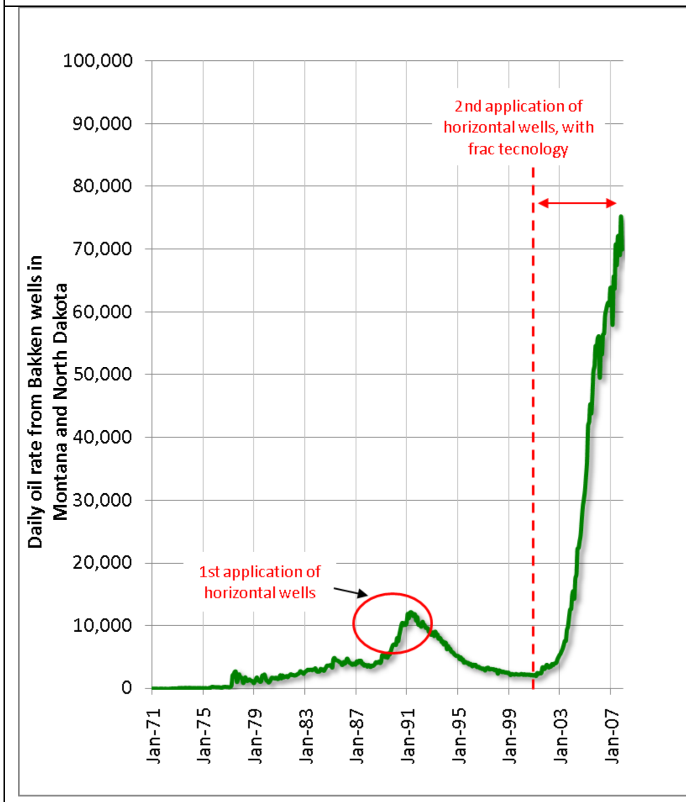
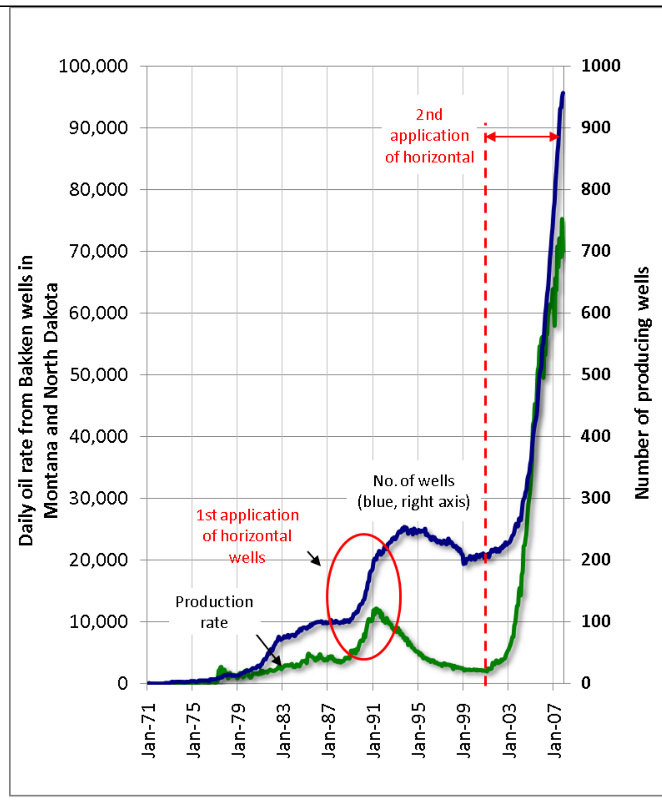
PRODUCTION HISTORY – KNOWN DATA



Bakken Montana and North Dakota daily production rates since 1971



Bakken Montana and North Dakota daily production rates since 1971, with number of producing wells

PHASE 1 (prior to 1985)	**Vertical Well**	Data from this phase demonstrated that Bakken wells have a steep decline rate of ~ 1.0 years after production starts. This signals need for higher "drive" using fluids to bring hydrocarbons to surface.
PHASE 2 (1985-2004)	**Horizontal Well First Wave**	Production boost to an April 1991 peak of 11,790 BPOD. This phase's production increase arises from use of horizontal wells to expand the area of reach at a producing depth.
PHASE 3 (POST-2004)	**Horizontal Well Second Wave**	HW (including multilateral), as a percentage of total wells, increased from 0% in 1980, to 50% in 1990, 78% in 1995, and 95% today. 75,000 BOPD in Oct 2007. Technical improvements include such as ability to drill longer horizontal and multilateral wells from a single vertical wellbore, and improved hydraulic fracturing technology.

F) POROSITY AND PERMEABILITY

http://geology.com/usgs/bakken-formation-oil.shtml

Two key properties of reservoir rock are porosity and permeability. Porosity is a measure of how much "empty" volume the rock has space available to store hydrocarbons, water, or gas. Really good formations can have porosities of 20% to 30% or more. Permeability is a measure of how easily fluid can flow through the rock. The best reservoirs have permeabilities of 1 to 5 darcies or more. (1 Darcy = 1000 millidarcies: better reservoirs are usually measured in darcies, and poorer reservoirs in millidarcies.) high porosities and permeabilities can be found in many world class prolific oil and gas fields, such as offshore Gulf of Mexico, North Sea, and Saudi Arabia.

The majority of currently producing reservoirs in the onshore US **are by contrast much "tighter."** A pretty good reservoir might have porosities of 10% to 15% and permeabilities of 1 to 100 millidarcies (0.001 to 0.1 darcy). Reservoirs with those properties by and large would be considered very desirable reservoir in most of the onshore US and Canada.

Moving downward on the scale of reservoir quality, many thousands of wells in the US are now being drilled in so-called **"resource plays." These are thick, laterally extensive reservoirs usually covering thousands of square miles, and filled with hydrocarbons, but they are difficult to exploit. The Bakken Shale, along with formations like the Barnett, Fayetteville, and Woodford shales fall into this category.** Permeabilities can be in the range of .00001 to .01 millidarcies, with porosities in the range of near zero to maybe 10% or a bit higher.

Porosity and permeability can vary widely and unpredictably over short distances. There are many stories on oil field lore about dry holes drilled next to prolific producing wells, with little explanation geologically about why this might occur. **This phenomenon is one of the primary risks that oil producers take when they drill wells, especially in new areas or highly variable reservoirs.**

Studies reports a wide range of measured permeabilities and porosities in the Bakken, but the average is low. One part of the report gives the average porosity and permeability for the middle Bakken as being 5% and 0.04 millidarcies. In many of these very tight reservoirs, natural fractures play a big role. These are natural cracks which have low porosity but can have permeabilities one to several orders of magnitude greater than the rock fabric or matrix. Most of the better wells in the Bakken have encountered abundant natural fractures.

Even with an extensive natural fracture system, often times additional help is needed to create an economic well. This is where hydraulic fracturing comes in. Fluid, sometimes with sand or other material ("proppant") is pumped at high pressure into the formation. The pressure is high enough to create large artificial fractures that can extend hundreds of feet from a wellbore. Proppant holds the fracture open, and creates a permeable channel to allow hydrocarbons to flow to the wellbore. Production in many, or perhaps most, of the producing formations in the US is improved by hydraulic fracturing. When hydraulic fracturing is combined with horizontal wells (and high enough commodity prices), many of the shale or resource plays become economic to produce.

G) NOTE ON BAKKEN RECOVERABILITY

http://www.theoildrum.com/node/3905

"Production of wells in a field is usually log-normally distributed. A few wells produce at high rates, and most of the wells produce at less than average rates. In a typical field the best 20% of wells pay for the other 80%. It's a numbers game - unless one is lucky enough to hit a big well on the first try, one needs to stay in the game long enough to drill enough wells to achieve an acceptable statistical average.

The field decline during the period of February 1993 to February 1997 is about 25% per year. If many new wells were not being drilled and put into production during this decline period, the overall decline would be considerably steeper. Note that after January 1997, the decline flattens somewhat; this would be the beginning of the long "tail" period of production from existing wells, characterized by low producing rates with shallower decline."

The number of new wells being drilled will not necessarily improve the production of the field, because of the geological nature of tight, fractured reservoirs (ex. a dry well adjacent to a producing well). Individual wells may reach Peak Production Rate and then decline. In the Bakken, the record suggests a short-lived peak and then rapid decline that can be anywhere from 20% to 60% per year for up to two years, then a low and slowly declining rate over many succeeding years. Operators facing this high rate / rapid decline characteristic may achieve an initial high field production rate for a short time. Additional wells may not offset overall field decline. Also, geological oddities may make it unprofitable to drill new wells if production decline from the initial wet holes is sufficiently high to make total field production ROI unprofitable.

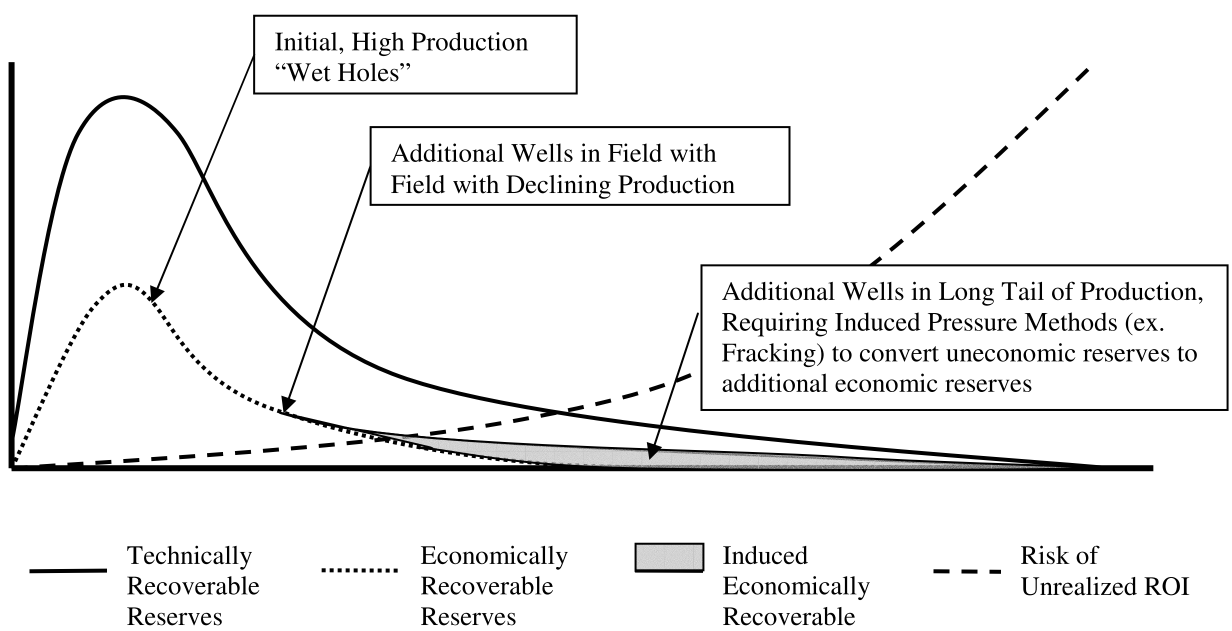
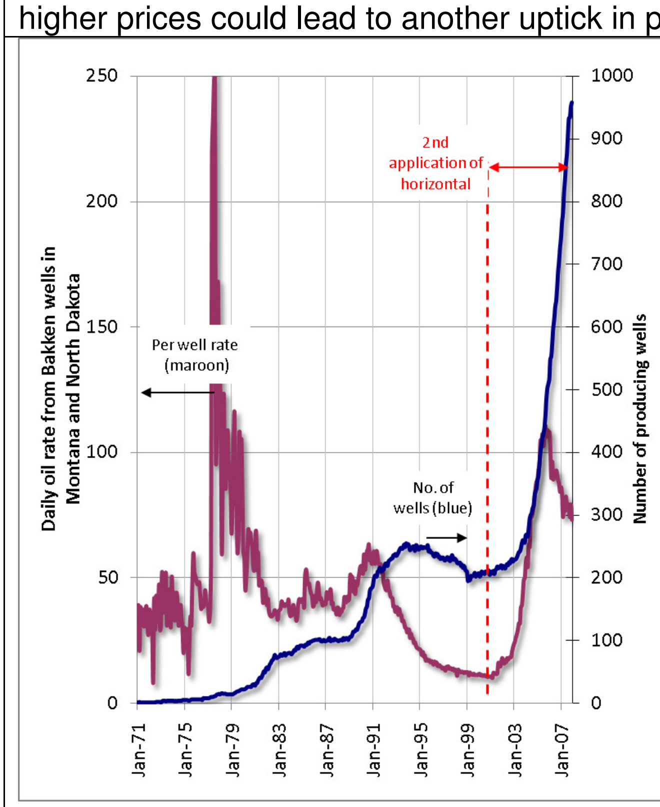


Diagram Only (For Example Purposes Only): Economic Activity in a Field

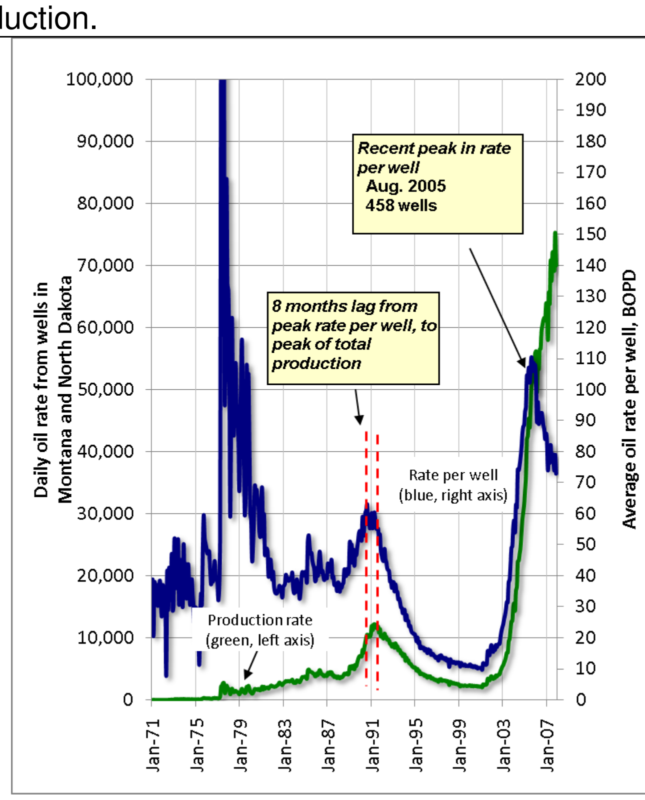
(Quote): If we consider average production per well, we find that its behavior may be predictive of later field decline. The average production per well is simply total reported Bakken production for the period, divided by the total number of wells producing during the period. If a well is drilled and goes on production in a certain period, the well count goes up by one, and the well's production gets added to the total. If a well becomes uneconomic during the period, and the operator stops producing the well, the well count goes down by one. In any given month, wells that come on at high rates of say, 1,000 BOPD, are averaged with wells already on production that may be producing 100 or 50 BOPD. If there is a population of wells already producing and on decline, bringing on more wells at temporarily high rates (the 1,000 BOPD may last for one month or two months max in most cases) will only raise the average production slightly.

For the first wave of horizontal technology, the per-well production peaked in August 1990 at 71 BOPD per well, with 142 wells producing. The per-well production then declined, even though additional wells were brought on production for the next 4 years. In August 1994, the peak well count of 235 wells was reached, but by then the average per well rate was only 22 BOPD. Interestingly and perhaps alarmingly, the 2nd wave of Bakken horizontal well production reached in August 2005 a peak per-well rate 116 BOPD per well, with 433 wells on production. Based on production in the early 90's this may portend a near term decline in Bakken total production. As of October 2007, however, the total Bakken production rate was still rising rapidly.

Even if Bakken production should peak, this doesn't necessarily mean a permanent decline in production. Past history shows that some combination of new technology, new discoveries, and higher prices could lead to another uptick in production.



Bakken Montana and North Dakota average daily production per well since 1971, with number of producing wells



Bakken Montana and North Dakota daily production rates since 1971, with average well rate

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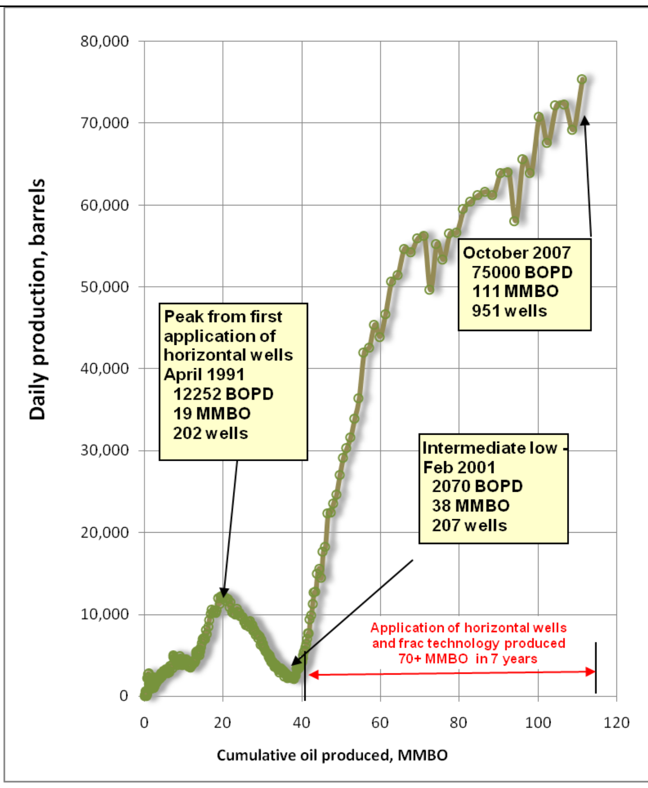
Looking at the total Bakken **Production vs. The Cumulative Production (right)** will allow us to approximate produced volumes of the two waves of horizontal technology. The first wave production curve indicates that if no new wells were drilled, the ultimate recovery would have been about 41 million barrels. The second wave of horizontal technology did indeed dwarf the first wave, and we can say that so far the second wave has added about 70+ million barrels of production.

The first wave of horizontal technology peaked at about 20 million barrels, with an ultimate recovery of about double that, or 41 million barrels. Using this analogy, if the industry were able to keep up the current rate of increase for the next two years, and reach a peak production at 150 million barrels cumulative recovery, ultimate recovery could reasonably be estimated as being around 300 million barrels, without additional new waves of development.



Bakken Montana and North Dakota daily production rates vs. cumulative oil produced

H) CHARTS AND IMAGERY

CHART 1

https://www.dmr.nd.gov/oilgas/presentations/HouseApprop01102013.pdf

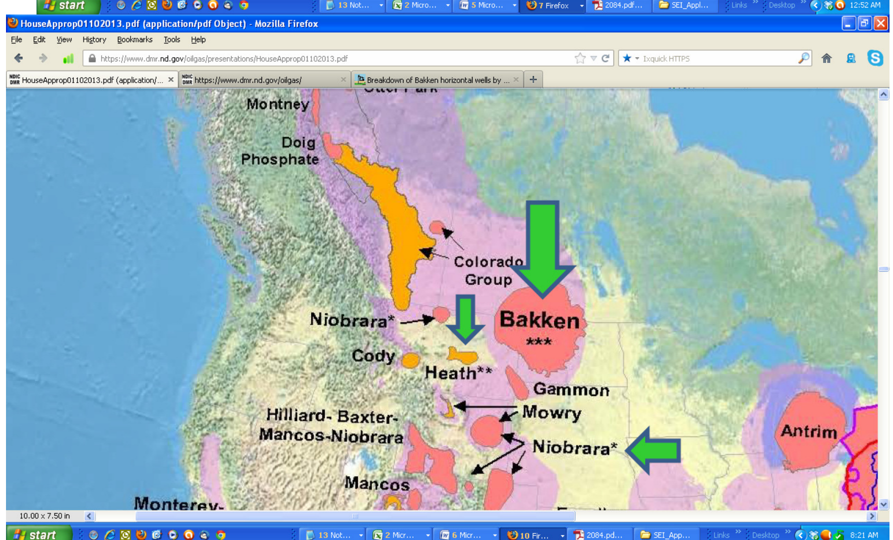


CHART 2

http://www.theoildrum.com/node/3905

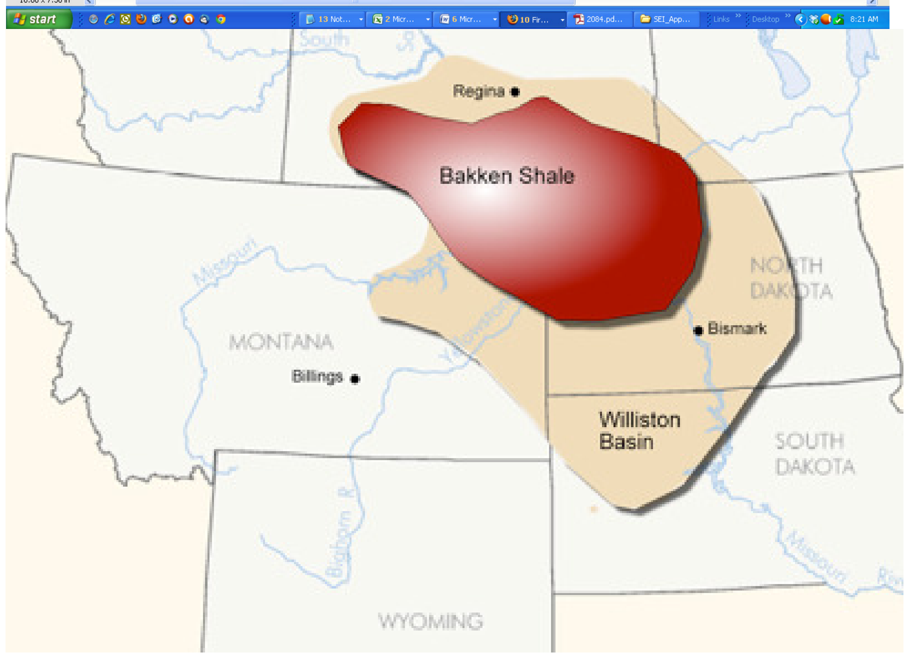


CHART 3
http://geology.com/usgs/bakken-formation-oil.shtml

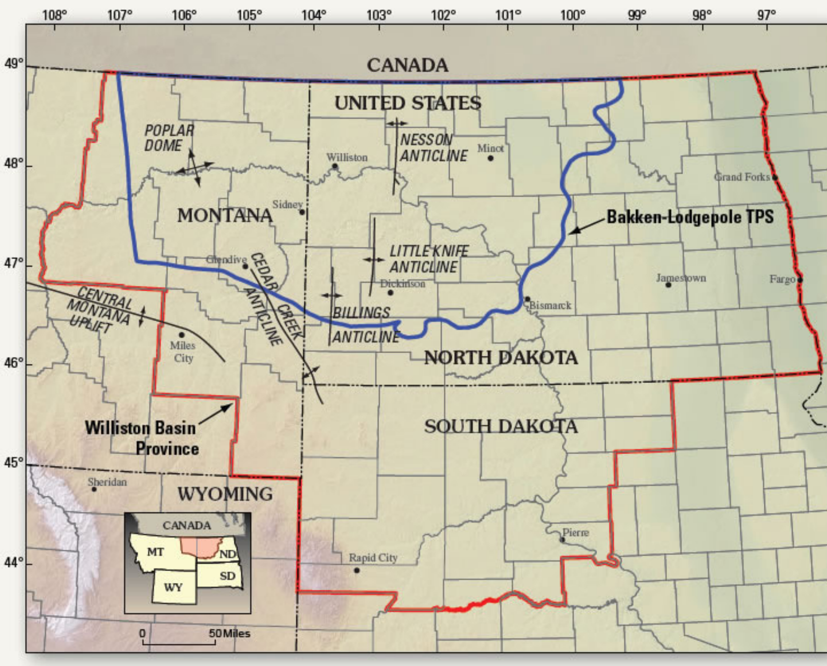


Figure 1. Map showing Williston Basin Province boundary (in red), Bakken-Lodgepole Total Petroleum System (TPS) (in blue), and major structural features in Montana, North Dakota, and South Dakota.

CHART 4
http://www.theoildrum.com/files/1%20OOIP%20by%20county%20ND%20.png

Original Oil in Place (OOIP)
OOIP estimates by county (North Dakota DMR)

☆ **State Capital: Bismark**

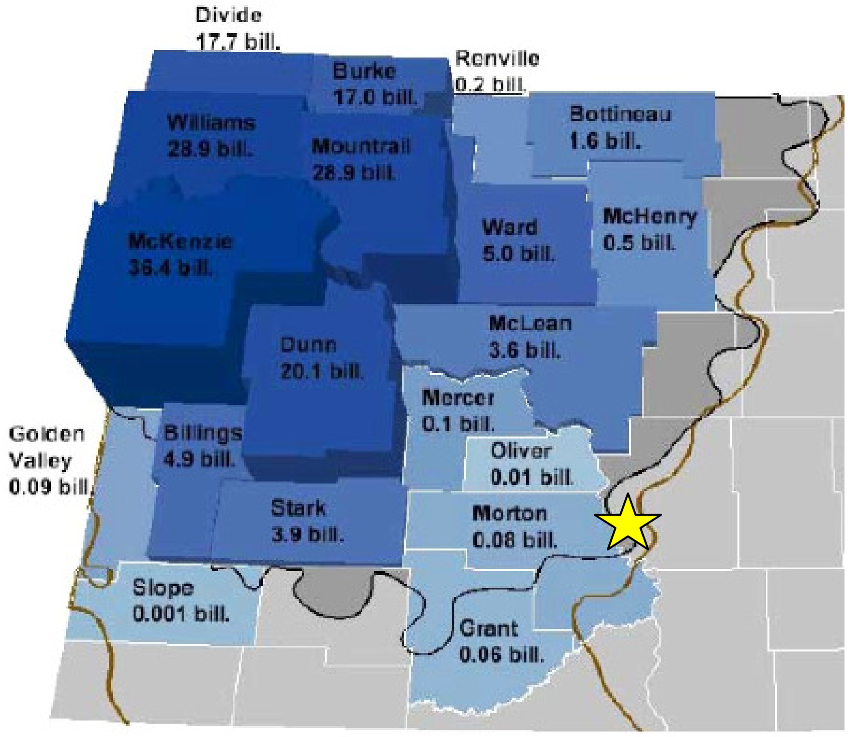


CHART 5
http://geology.com/county-map/north-dakota.shtml

Showing placement of Bakken-Lodgepole TPS

☆ State Capital: Bismarck

★ McLean Cty: Washburn

CHART 6
Region of North Dakota that modeled by imagery shown below. The sides of the yellow square cover is 135 miles.

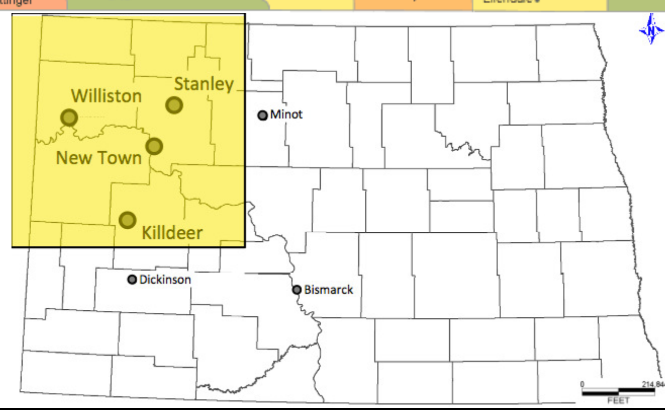
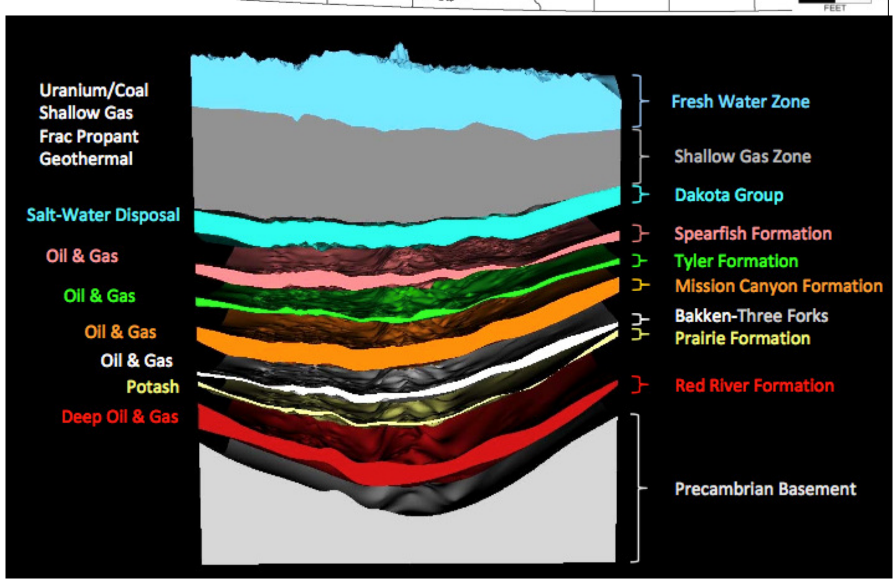


CHART 7
Depth of around 11,500 ft with the additional need for rigs to drill 20,000 ft coming from the use of horizontal drilling along the formation, which is typically only around 150 ft thick."



7A) Section through the ND geology

The beds lie "in a syncline, where oil might be expected to migrate out and up the sides away from the central dip, there is a central anticline where oil could be trapped, and the structure is not smooth. (Bear in mind also the scale of the model, so that small traps in the field are not picked up at this level.) The

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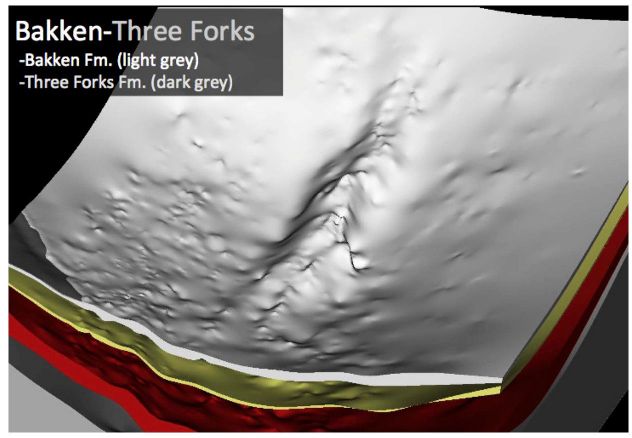
structure of the shale beds themselves also make it less sensitive to geological modifications which drive oil migration, though obviously not completely or else there would be little oil flow to the well."



7B) Model of the Bakken formation around Williston

AREA IN RED IS WESTERN PORTION OF MCLEAN COUNTY

(Western Portion of Target County)

7C) Location of wells in the modeled region of North Dakota. Note the dominant North-South feature through the centre—this is the location of many wells drilling into the reservoir.

CHART 8
http://ndpipelines.files.wordpress.com/2012/05/nd-crude-oil-map.pdf

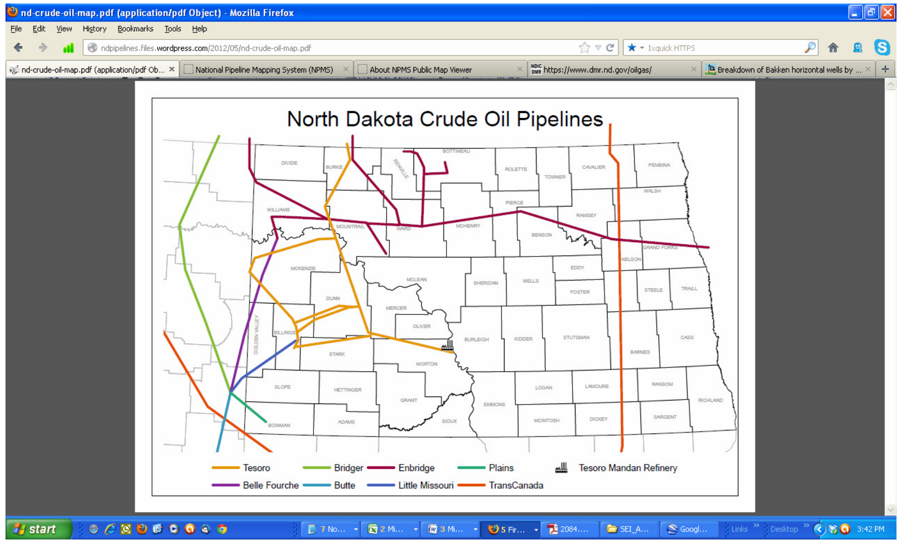


CHART 9
http://ndpipelines.files.wordpress.com/2012/05/nd-gas-pipeline-map-oct-2012.pdf