Trisha Curtis, Director of Research, Upstream and Midstream Energy Policy Research Foundation, Inc. (EPRINC)
Energy Bar Association
May 6, 2015
Lots of Light Tight Oil
Understanding North American Unconventional Production in
the Midst of Low Oil Prices
About EPRINC

• www.eprinc.org

• Publications

• Embassy Series

• Presentations at Imperial College London, Colombia University, Wyoming Pipeline Authority, EPA, Oxford Institute for Energy Studies


• Department of Energy – Quadrennial Energy Review

• Department of Defense

• Rin App http://eprinc.org/2014/02/rins-around-rosy-app-available-ios/

• Forth Coming research paper on U.S. Unconventionals with Oxford Institute for Energy Studies
When oil prices started to slip

Several events taken together along with lowered expectations of Chinese and European economic growth caused oil prices to weaken

- 9 mbd plus U.S. production
- Some strong non-OPEC production in 2014
- Significant volumes of crude moving from the U.S. to Canada displacing African barrels
- Libyan crude unexpectedly comes on the market
- ISIS is pushing barrels on the market
- Draghi spooks markets with negative inflation expectations for Europe in Jackson Hole Sept 2014
- People begin to actually believe the negative data out of China
- Saudi’s share of crude into China and Asia eroded by volumes from Iran and Iraq

Source: China Customs, Energy Aspects
What sets the Bakken (and other tight oil) apart?

- Globally coveted rocks
  - 10,000 plus feet so more expensive to drill
  - Break evens vary
- Good and stable crude quality
- Distance from markets – cost of transportation
  - Rail accidents
  - And other crudes going to those markets (has to go east or west)
- Bakken’s complexities make it tricky in short-term in a low oil price environment
- The Bakken is the best known shale/tight/unconventional oil play in the world and there is still a lot to learn. Long-term attraction/investment will continue
- This is a boom and bust business. Right now it is busting, but it will boom again.

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- Broader market
- Put Bakken in context
- Issues
North American Oil Production

U.S. 9.2 mbd (Feb 2015)
Canada 3.7 mbd (Dec 2014)

North America = 12.9 mbd

Source: EIA
EPRINC Production Evaluation...what production could be...

Potential outcome with decline in prices

Source: EPRINC/Ponderosa
CAPP’s Canadian crude oil forecast


EPRINC LINE - 2015 likely to be revised slightly lower with additional postponements and cancellations in some future projects
US Crude Oil Production and 2015/2016 Possible Projection

Feb 2015 (latest available data) oil production was just below 9.2 mbd (flat from Dec 2014)

Likely trend prior to oil price drop

Possible outcome of modest growth with a slight uptick in late 2016 should prices begin to improve

Source: EIA, EPRINC
U.S. exports of crude oil

Bakken and Gulf Coast crude being sent to eastern Canada pushing out light MENA barrels

Over 500,000 b/d to Canada in Jan 2015 with most to eastern Canadian refineries – capacity about 800,000 b/d

-over 100,000 b/d from ND

Source: EIA
U.S. imports of Canadian crude oil

Feb 2015 - 3.207 mbd

Source: EIA
Storage and Rig Count
Cushing stockpiles and WTI

Weekly Cushing OK Ending Stocks excluding SPR of Crude Oil Thousand Barrels

Cushing OK WTI Spot Price FOB $/bbl

Source: EIA

514,000 barrel drop
U.S. rigs and WTI

Source: Baker Hughes, EIA
Permian rigs take the biggest dive

Source: Baker Hughes
Production and Technology
Shale oil play production

Source: HPDI April 10 2015, EIA, NDPA
ND Crude Forecast

Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
Optimism and yield prevail

“Standard & Poor’s keeps a list of the number of ‘weakest link’ companies globally — those rated B- or worse and with negative outlooks. Of the 13 new entrants in March, seven were in the oil and gas sector. Of the 157 ‘weakest link’ companies monitored by the agency, 13 per cent are from the energy industry.”

Source: FT, April 7, 2015, “Energy junk bonds find much needed support,” Robin Wigglesworth
Able to sell more bonds and issue more stock

Source: WSJ, March 9 2015, Investors Are Buying Stocks and Bonds From Energy Producers Amid Oil Price Drop, By CORRIE DRIEBUSCH, RYAN DEZEMBER and MIKE CHERNEYDeep Debt Keeps Oil Firms Pumping; Producers Have Increased Their Borrowings by 55% Since 2010 By ERIN AILWORTH, RUSSELL GOLD and TIMOTHY PUKO January 6, 2015
Drilling more and completing less

- Recent conference calls suggest completion costs are roughly 60% of well costs
- Pressuring service costs lower, drilling, but not completing
- ND wells waiting on completion are around 900 and likely similar across the country (at least a few thousand)
- Refracing can work, but need to test it and need a good wellbore to start with
- Reservoir performance, completion best practices, and cost reduction?
- Job losses and ability to quickly turn on production...? Swing producer?
- Companies forced to make complex economic and geologic decisions
- EURs – future production
Technology advances and then oil prices drop

A little dive into ND data

The drilling rig count dropped 27 from January to February, 25 more from February to March, and has since fallen 17 more from March to today. The number of well completions dropped from 63 (final) in January to 42 (preliminary) in February. Oil prices by far the biggest driver behind the slow-down, with operators reporting postponed completion work to avoid high initial oil production at very low prices and to achieve NDIC gas capture goals. There were no major precipitation events, 7 days with wind speeds in excess of 35 mph (too high for completion work), and 9 days with temperatures below -10°F.

Over 99% of drilling now targets the Bakken and Three Forks formations.

At the end of February there were an estimated 900 wells waiting on completion services¹, an increase of 75. Comparing December, January, and February completions and production increases results in a requirement of 110-120 completions per month to maintain production near 1.2 million barrels per day.

February 2015 – Estimated 900 Wells WOC
January 2015 – 825 wells WOC
Dec – 750
Nov – 775
Oct 2014 – 650
Sept 2014 – 610

2014 avg - 646
2013 avg - 478

Source: NDIC
Changes in ND Tax Law April 24, 2015

House Bill 1476 lowers the oil extraction tax from 6.5 percent to 5 percent starting Jan. 1, but allows that rate to increase to 6 percent if oil prices average above $90 a barrel for three consecutive months. It also removes the price-based tax breaks known as triggers starting Dec. 1, a policy supporters say will bring stability and predictability to state oil tax revenues.

It does not change the 5 percent gross production tax, bringing the state's overall tax rate down from 11.5 percent to 10 percent.

Source: Amy Dalrymple, April 24 2015, Inforum
Infrastructure and Pricing
Major chokepoints are still relevant

Source: EPRINC Choke Point Map using Hart ArcGIS Mapping software
February 2015 Williston Basin Crude Transportation

Williston Basin Production: 1.3 mbd
North Dakota: 1,177,094 b/d
South Dakota: 4,680* b/d
Eastern Montana: 78,000* b/d

Tesoro Refinery: 68,000 b/d

Truck to Canadian Pipeline: 17,000 b/d

Rail: 703,155 b/d

Pipeline: 495,619 b/d

Source: NDPA, EPRINC Estimates
Williston Basin Rail Estimates

Source: NDPA
Price Comparison

Source: EIA, Flint Hills, CME Group, Bloomberg
Regional Pricing Disparities

Source: Map from AFPM, Flint Hills, EIA, CME Group, and estimates
Bakken netbacks under pressure

Good crude, but not close to major markets

- West Coast by Rail: $10 - $15
- Gulf by Rail: $10 - $15
- Gulf by Pipe: $11*
- Cushing by Rail: $10 - $15
- Cushing by Pipe: $9*
- East Coast by Rail: $10 - $15

5/1/15
$44

$68
$61
$67
$68

Source: Flint Hills ND Light Sweet, *Estimates from RBN blog Feb 2015
EIA’s new rail data highlights Bakken

Source: U.S. Energy Information Administration based on data from the Surface Transportation Board and other information.

Note: Crude-by-rail movements greater than 1,000 barrels per day are represented on the map; short-distance movements between rail yards within a region are excluded.

Source EIA March 31, 2015:
U.S. and Canadian crude by rail volumes

Source EIA
### Bakken Pipeline and Refinery Capacity

**Source:** EPRINC’s article in Oil and Gas Journal
March 2014

![Map of North Dakota showing pipeline and refinery locations](image)

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Source: NDPA
Pipeline hurdles continue

$2.6 billion Sandpiper pipeline, 610 miles – 225,000b/d from ND to Superior, Wisconsin

“approved by North Dakota regulators. But it remains under administrative review in Minnesota, where developers are seeking a certificate of need to ship the oil and a route permit to build the pipeline across 300 miles of the state's Lakes Belt.”

“TransCanada will be advising the NEB that the company will not be proceeding with a marine terminal in Cacouna and is evaluating other options….The result of this alteration to the project scope and further refinement of the project schedule is expected to result in an in service date of 2020. The 1.1 million barrels per day (bbl/d) Energy East project has secured approximately one million bbl/d of firm, long-term contracts. The $12 billion project is an important element of TransCanada’s $46 billion of commercially secured growth projects.”

Source: Energywire, April 10 2015, Daniel Cisick, “Bakken-bearing pipeline meets stiff opposition in the Land of 10,000 Lakes” and TransCanada
Refining/Downstream
Distillation yield comparison

Source: EIA, “Technical Options for Processing Additional Light Tight Oil Volumes within the United States,” April 2015
Do exports matter for Bakken crude?

One problem - varying grades of light crude in the Eagle Ford

Source: Drilling Info and EOG Investor Presentation
These differences have been impacting prices

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<th>FLINT HILLS RESOURCES CRUDE OIL POSTINGS</th>
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<td>P.O. BOX 2917, WICHITA, KS 67201</td>
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Effective 7:00 A.M., on dates shown below, and subject to its division orders as amended and supplemented, contracts and other agreements, FLINT HILLS RESOURCES, LP will pay the following prices per barrel of 42 U.S. gallons for merchantable crude oil purchased and delivered into pipelines or facilities authorized by FLINT HILLS RESOURCES, LP, in the fields or areas designated below. The following prices are for informational purposes only, do not constitute an offer, and are subject to change or revisions without notice.

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**Texas**

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<th>Grade</th>
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<td>Eagle Ford Condensate, equal to or greater than 60 API</td>
<td>46.5000 *</td>
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<tr>
<td>Eagle Ford Light, equal to or greater than 50 API and less than 60 API</td>
<td>51.5000 *</td>
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<tr>
<td>Eagle Ford Sour</td>
<td>50.7500 *</td>
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<tr>
<td>Eagle Ford West Condensate, equal to or greater than 60 API</td>
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</tr>
<tr>
<td>Eagle Ford West Light, equal to greater than 50 API and less 60 API</td>
<td>51.5000 *</td>
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<tr>
<td>Eagle Ford West Sour</td>
<td>50.7500 *</td>
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<td>Eagle Ford West, crude oil less than 50 API</td>
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<tr>
<td>Eagle Ford, crude oil less than 50 API</td>
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<td>Giddings Sweet Texas</td>
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<tr>
<td>Pearsall Sweet</td>
<td>53.2500 *</td>
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<td>South Texas Heavy</td>
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<tr>
<td>South Texas Light Sweet</td>
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<tr>
<td>South Texas Sour</td>
<td>50.7500 *</td>
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<tr>
<td>South Texas Sweet</td>
<td>53.0000 *</td>
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<tr>
<td>West Texas/New Mexico Intermediate</td>
<td>55.5000 *</td>
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May 5, 2015
WTI $61
Brent $68
Nat Gas $2.80
Additional Challenges and Regulatory Uncertainty
Issues and Regulatory Concerns

- Oil prices/costs/discounts
  - Exports
  - Infrastructure delays
  - Regulatory uncertainty: midstream and downstream companies trying to forecast crude exports etc.
- Safety
- Rail Safety
- Pipeline and Rail Spills
- Flaring
- Water: Spilling, disposing, frac usage
- Waste disposal
- Environmental Concerns - emissions
BLM Fracking Regulations

It is really going to be about implementation

Really seems to be about proper casing and frac water management

Submit detailed information about the proposed operation, including wellbore geology, the location of faults and fractures, the depths of all usable water, estimated volume of fluid to be used, and estimated direction and length of fractures, to the BLM with the APD or a Sundry Notice and Report on Wells (Form 3160–5) as a Notice of Intent (NOI) to hydraulically fracture an existing well;

Source, USGS

"The analysis suggests that a likely contributing factor to the increase in earthquakes is triggering by wastewater injected into deep geologic formations. This phenomenon is known as injection-induced seismicity, which has been documented for nearly half a century, with new cases identified recently in Arkansas, Ohio, Texas and Colorado."

Source: USGS, May 2014
Natural Gas Flaring - NDPA

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<th>Month</th>
<th>Monthly Total, MCF</th>
<th>Average, MCFD</th>
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<tr>
<td>Jan 2015 - Final</td>
<td>45,678,995</td>
<td>1,473,516</td>
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<td>Feb 2015 - Prelim.</td>
<td>41,267,123</td>
<td>1,473,826</td>
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February 2015 - Flaring 18% or roughly 265,289 mcf/day

Compare to August 2014 - Flaring 26/27% or roughly 362,000 mcf/day

Source: NDPA and NDIC
Crude by Rail Accidents

LAC MAGENTIC: AP PHOTO/THE CANADIAN PRESS, PAUL CHIASSON

Accident List

- July 6, 2013, a run-away train crashed and exploded in Lac-Mégantic, Quebec, killing 47 people and destroying parts of the town
- November 8, 2013, about 12 cars derailed in a unit train of 90 cars carrying crude oil near Aliceville, Alabama (45 miles SW Tuscaloosa). Nobody was injured, but three of the cars exploded.
- December 30, 2013, a train hauling grain derailed near Casselton, ND hitting a 106 car unit train of crude oil which caused 18 crude tank cars to derail causing a massive explosion and fireball
- January 7, 2014, a Canadian National train jumped tracks in Plaster Rock, New Brunswick. 15 cars derailed and caught fire. The train was carrying propane and crude oil from Western Canada
- January 20, 2014, a CSX train derailed in Pennsylvania on a railroad bridge and close a busy expressway (Schuylkill), but did not leak any crude oil.
- January 31, 2014, a CN train carry heavy Canadian crude and other products derailed and leaked in New Augusta, MS
- February 13, 2014, 21 of 120 NS cars carrying heavy Canadian crude derailed in Vandergrift, PA
- April 30, 2014, oil tanks cars on CSX derailed and caught fire in Lynchburg, VA (3 of 15 cars that derailed caught fire). Nobody was injured by 300 people were evacuated temporarily
- January 31, 2015, tank cars derailed in CSX in Philadelphia, PA, but did not rupture
- February 14, 2015, 29 of 100 cars derailed on CN in Timmins, Ontario transporting crude and product, 7 out of the 29 caught fire
- February 16, 2015, 26 cars in a 109 CSX unit train carrying Bakken crude derailed in Mount Carbon, VA. 19 of the 26 cars caught fire. A home was destroyed and a person was injured. Drinking water was contaminated. The psi was said to be 13.9 which would be above the new standard to set to be implemented in ND in April at 13.7.
- March 5, 2015, 21 of 105 carrying Bakken crude derailed on BNSF in Galena, IL. At least 2 cars caught fire
- March 7, 2015, 39 cars derailed on a 94 car CN train in Gogama, Ontario carrying heavy Canadian crude. 7 cars caught fire and 5 entered the Makami River
New regulations released May 1, 2015

Conclusions

• Tight/unconventional oil complexities will continue and potentially be exacerbated in a low oil price environment (drilling costs, transportation costs and issues, etc.)
• In the long run, the Bakken (in addition to Permian and Eagle Ford) is a stable and well understood production platform which will attract long-term investment
• Diamond in the rough