1. Current market state and production forecasts
2. Canada resource plays
3. US resource plays
4. Benchmarking and conclusions
Overview of North America

In 2015 North America is poised to produce 11.6 mmbbl/d of oil and condensate. Globally this is ~15% but grows to 19% in 2020.
Lower 48 still growing, but slowing

We expect US production to slow with lower investment. Tight oil still grows. Gas production growth remains underpinned by the Marcellus.
Canada’s production growth is more muted

The oil sands is fundamental to growth in Canada’s oil production.
Gas production becomes increasingly reliant on the Deep Basin (including Montney and Duvernay).
## Agenda

1. Current market state and production forecasts
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Risk profiles, economics and resource all differ

It is not just which play, but where in the play, and a company's financial strength that drives wellhead commerciality.

Source: Wood Mackenzie, note US deepwater excludes Lower Tertiary

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Montney company positions

Montney
1 - Northern BC
2 - Southern BC
3 - Sundown/Groundbirch
4 - Heritage Liquids
5 - Dawson Creek
6 - Swan
7 - AB Sands
8 - Mulligan
9 - Pouce Coupe/Glacier
10 - Grande Prairie
11 - Ante Creek
12 - Kaybob Elmworth
13 - Karr Resthaven

Wells Completed (Operator)
- Other
- ARC
- CNRL
- Encana
- Long Run
- Murphy
- Progress
- Shell Canada
- Spyglass
- Talisman
- Tourmaline

Source: Wood Mackenzie; Xi Technologies

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Several junior players ahead of the pack in terms of average IP rates

Montney IP rates by hydrocarbon

Liquids or gas wells by operator

Initial three-month rate (mmcfe/d)

Source: Wood Mackenzie and XI Technologies

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Liquids-rich areas and LNG aspirations support production growth

LNG underpins growth

LNG players have much higher capital commitments

Source: Wood Mackenzie, XI Technologies

Source: Wood Mackenzie

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Duvernay company positions

1 - Kaybob
2 - Edson
3 - Pembina
4 - Gas
5 - Oil

Wells Drilled (Operator)
- Others
- Athabasca
- Chevron
- ConocoPhillips
- Encana Corporation
- ExxonMobil
- Husky
- Shell
- Talisman
- Trilogy

Source: Wood Mackenzie
Duvernay production, acreage and capex

Oil sands need >1mm b/d of diluent by 2025

Duvernay NGLs
Duvernay gas
Duvernay oil / condensate

Striving to be commercial or awaiting cost reductions

Est. net acres ('000)
Remaining capex PV10

Source: Wood Mackenzie, XI Technologies

Source: Wood Mackenzie

Oil sands need >1mm b/d of diluent by 2025

Net acreage ('000 acres)

Duvernay production (mboe/d)

Source: Wood Mackenzie, XI Technologies

Remaining capex (PV10 Cdn$ billion)

Source: Wood Mackenzie

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Duvernay liquids-rich areas support production growth

Rate increases expected as learning curve mastered

Average of 47% Gas : 33% NGLs : 20% Condensate

Source: Wood Mackenzie and XI Technologies

Source: Wood Mackenzie

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Commercial development spend overview

Canadian 2015 capex

- Oil Sands, Cdn$20bn
- Montney, Cdn$4bn
- Cardium, Cdn$3bn
- SK Bakken, US$1bn
- East Coast Canada, Cdn$3bn
- Other Canada, US$15bn

Source: Wood Mackenzie

Less than a third of required capital has been spent

- Capex remaining
- Capex spent
- % spent

Source: Wood Mackenzie

Percentage spent through 2013

- Oil Sands (in-situ)
- Oil Sands (mining)
- Marcellus
- Eagle Ford
- Bakken
- Niobrara
- Montney
- Wolfcamp Cline
- Utica
- Cardium
- Haynesville
- Bone Spring
- Duvernay

Source: Wood Mackenzie
Pricing environment has had minimal impact on future bitumen barrels

89% of 2020 production is either on-stream or sanctioned

Source: Wood Mackenzie

*Unadjusted for shrinkage incurred at upgraded projects
*Based on an assumed project by project commercial view

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Benchmarking Projects on Value and IRR

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Benchmarking projects on value and IRR

Mining phases
Rem. PV10 post-tax (Cdn$ million)

In-situ projects
Rem. PV10 post-tax (Cdn$ million)

Source: Wood Mackenzie
## Agenda

1. Current market state and production forecasts
2. Canada resource plays
3. **US resource plays**
4. Benchmarking and conclusions
Lower 48 assets: variations in breakevens for a massive resource

Wide range of breakevens belies the fact that, in the Key Plays, assets in the core areas are still in the money with plenty of upside at higher prices

Lower 48 liquid assets: breakevens and resource base by company

Source: Wood Mackenzie

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Lower 48 liquids assets: upside exists for best areas & operators

The front of the supply curve remains profitable despite the price fall; nearly all major plays are commercial at our 2018 price forecast.

New cumulative liquids resource by breakeven for US assets

- **EOG - Karnes Trough**
- **Continental - Woodford**
- **Whiting - Bakken**
- **Chesapeake - Utica Condensate**
- **Occidental - Bone Spring**
- **Goodrich - TMS**

Nearly 23bn bbls at 2015 WTI price (US$55/bbl)

98% of modelled resource volumes generate 10% IRRs below US$85/bbl

Source: Wood Mackenzie

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Companies: debt-fuelled growth leaves smaller operators at risk

High debt levels are not necessarily indicative of weak assets; however, the most distressed companies tend to have relatively limited resource volumes and a smaller opportunity set.

Debt levels & quality of liquids assets

Low breakeven, high debt

- California Resources (81%)
- Oasis (90%)
- Denbury (97%)
- EOG (72%)
- Pioneer (85%)
- Anadarko (53%)
- Breitburn (81%)
- Continental (80%)
- Triangle (89%)
- Midstates (60%)

High breakeven, high debt

- Occidental (81%)
- SM Energy (72%)
- Apache (69%)
- Penn Virginia (87%)
- Halcon (89%)
- W&T (59%)
- Newfield (78%)
- SM Energy (72%)
- Goodrich (74%)
- Coast (57%)

Low breakeven, low debt

- Chesapeake (33%)
- SandRidge (65%)
- Newfield (78%)
- W&T (59%)
- Continental (80%)
- Triangle (89%)
- Midstates (60%)
- California Resources (81%)

High breakeven, low debt

- Occidental (81%)
- Apache (69%)
- Penn Virginia (87%)
- Halcon (89%)
- W&T (59%)
- Newfield (78%)
- SM Energy (72%)
- Goodrich (74%)
- Coast (57%)

Liquid Reserves* (x%) liquids weighted

Source: Wood Mackenzie

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Lower 48 assets: Marcellus dominates, but returns vary

Location is key in the Marcellus, as operators see a huge variation in breakevens across its massive extent; select assets in the Utica remain competitive but, ultimately, do not challenge the scale of the Marcellus.
Lower 48 gas assets: Marcellus provides flat front of the curve

The flat-front of the supply curve is dominated by assets in the Northeast; however, transportation costs remain critical and differentials to Henry Hub can shift the realized curve.

**New cumulative gas resource by breakeven for US assets**

- Southwestern - Marcellus
- Chesapeake - Marcellus
- Range - Marcellus
- Chesapeake - Barnett
- BHP - Haynesville
- AELP - Utica
- ExxonMobil - Cotton Valley
- Apache - Granite Wash

- Nearly 300tcf at 2015 Henry Hub price (US$3.40/Mcf)
- 93% of modeled resource volumes generate 10% IRRs below US$4.45/mcf

Source: Wood Mackenzie

**Henry Hub breakeven at 10% IRR (US$/mcf)**

**Cumulative undrilled commercial resource (bcf)**

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Companies: bigger players are largely insulated from lower prices

Distressed assets with upside potential exist in the market, but the resource base tends to be small; the relatively smaller decline in Henry Hub may preserve the borrowing base of indebted, gas-weighted companies.
Cash flow exposure: negative cash flows still common

Early stages of development leave many operators with negative cash flows from Lower 48 assets in 2015, even at higher than forecasted prices; cash flows exclude debt financing, dividends and exploration.

<table>
<thead>
<tr>
<th>Company</th>
<th>Breakeven Exposure (US$M)</th>
<th>Debt/Cap</th>
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<tbody>
<tr>
<td></td>
<td>$45 WTI</td>
<td>$55 WTI</td>
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<tr>
<td>Quicksilver Resources</td>
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<td>Energy XIX</td>
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<tr>
<td>Bonanza Creek Energy</td>
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<td>-$158.34</td>
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</tbody>
</table>

Source: Wood Mackenzie

* Debt to Cap as at end February 2015

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## Agenda

1. Current market state and production forecasts
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WCSB features low breakeven supplies, but far from market centres

**Key shale gas plays by gas breakeven**

[Bar chart showing breakeven costs for various shale gas plays in Canada and the US.]

**Gas price outlook**

[Line chart showing gas price outlook from 2015 to 2029, with projected prices for Henry Hub and AECO.]
Gulf Coast sub-play breakevens

Eagle Ford

1. Northeast Oil - ($50-$55/bbl)
2. Black Oil - ($70-$75/bbl)
3. Kennes Trough Condensate - ($55-$60/bbl)
4. Edwards Trough Condensate - ($55-$60/bbl)
5. SE Gas - (N/A)
6. SW Gas - (N/A)
7. Maverick Condensate - ($50-$55/bbl)
8. Maverick Oil - ($100+$bbl)
9. Hawkville Condensate - ($70-$75/bbl)

Oil price outlook

Source: History - Argus; Forecast - Wood Mackenzie

Brent

WTI

Source: Wood Mackenzie

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Permian sub-play breakevens

Bone Spring
1. Northwest Shelf - ($75-$80/bbl)
2. Eddy County/Torres - ($100-$105/bbl)
3. Central Basin Plain - ($90-$95/bbl)
4. Pecos River Region - ($70-$75/bbl)

Wolfcamp
1. Orla - ($125-$150/bbl)
2. Ector/ Reeves - ($250-$300/bbl)
3. Deep Basin - ($150-$200/bbl)
4. Carbonate Platform - ($200-$250/bbl)
5. Northern Extension - (N/A)
6. Reeves Core - ($150-$175/bbl)
7. Western Frontier - ($200-$225/bbl)
8. Southeast Extension - ($150-$200/bbl)

Breakeven Range / bbl
- $50 - $60
- $61 - $70
- $71 - $80
- $81 - $90
- $91 - $100
- $100+

Source: Wood Mackenzie

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Rockies and Mid-Con sub-play breakevens

Niobrara
1. Chad Bluff - $60 - $60/bbl
2. North Niobrara - $60 - $60/bbl
3. Greater Williston - $60 - $60/bbl
4. Edinburg - $60 - $60/bbl
5. Williston Core - $60 - $60/bbl
6. Northwest Colorado - $60 - $60/bbl
7. Powder River - $60 - $60/bbl
8. Powder River Niobrara - $60 - $60/bbl

Breakeven Range / bbl
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60

SCOOP / Woodford
1. SCOOP Gas/Condensate - ($71-80/bbl)
2. SCOOP Oil - ($60-70/bbl)
3. SCOOP Springer Oil - ($50-60/bbl)
4. Ardmore Woodford - ($71-80/bbl)

Breakeven Range / bbl
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60
- $60 - $60

Source: Wood Mackenzie

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Cardium and Bakken sub-play breakevens

Cardium

Bakken

Breakeven Range / bbl

Cardium
1. Lockhard - $51 - $60
2. Mannville Gething - $31 - $70
3. Ferris Willesden Green - $61 - $80
4. Pembina Central South - $61 - $80
5. Pembina East - $61 - $80
6. Pembina Central North - $61 - $80
7. Pembina West - $61 - $80
8. Bucking Whirlwind - $61 - $80
9. NW Cardium - $61 - $80
10. NE Cardium - $61 - $80

Bakken
1. North Wilkerton - $61 - $80
2. Dusin Culley - $61 - $80
3. West Kegley - $61 - $80
4. Northern Mountain - $61 - $80
5. Williams Creek - $61 - $80
6. Fairview Ranch - $61 - $80
7. Fort Belknap - $61 - $80
8. West McKenzie - $61 - $80
9. Williams Perimeter - $61 - $80
10. Kessler Midlakes - $61 - $80
11. Southern Bakken Fmgs - $61 - $80
12. Elvis Creek - $61 - $80
13. Montana Frontier - $61 - $80

Source: Wood Mackenzie

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Duvernay and Montney sub-play breakevens
Thank you for your time
Callan joined Wood Mackenzie in 2011 and has spent time working in both Houston and Calgary. His primary focus is on the commercial valuation and benchmarking of North American plays and companies.

Before joining Wood Mackenzie, Callan was an engineer for Schlumberger with experience in reservoir stimulation and completions. While specializing in unconsolidated formations and offshore operations, he also completed numerous projects throughout the Gulf Coast region.

Callan holds a BS in Mechanical Engineering from the University of Colorado and a MBA in Finance and Global Management from Boston College.
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