British Columbia’s Montney play
More growth on the way
Mark Oberstoetter, Generate 2017
Building a competitive advantage on strong foundations

Over the last 40 years, Wood Mackenzie has evolved naturally along the energy value chain to capture all the key components affecting global markets. We are now a part of Verisk Analytics (NASDAQ:VRSK).

Our integrated approach allows us to spot trends and forecast future dynamics before anyone else.
Agenda

1. The high-level. Does the world even want gas anymore?

2. Trends and activity levels in the Montney

3. Forecasting activity by sub-play and operator
Province-level forecast

BC Montney production surpasses 4.5 bcf/d in 2025 and 5.4 bcf/d in 2030

British Columbia gas production

Source: Wood Mackenzie – North America Gas Service
Country-level forecast

Alberta’s Montney, Deep Basin and Duvernay contributions add to British Columbia’s growth

Canada’s gas production

Source: Wood Mackenzie – North America Gas Service
North America-level forecast

Lots of competition!

North America gas production

Source: Wood Mackenzie – North America Gas Service
Together, wind and solar grow more than threefold to 2035

Emerging markets, led by China & India, will see greatest capacity build

Source: Wood Mackenzie
Renewable costs are falling fast & surprising to the downside

Growth in China’s manufacturing capacity is the critical factor for solar markets

World PV bid prices vs. project size, 2009 – 2017

World solar module production, 2008 - 2016

Source: GTM Research
Agenda

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Montney by vintage year: 2014 vs. 2016

2014 marked the peak of drilling activity thus far, led by Northern BC LNG-aspirants and increased activity due to strong commodity prices.

2014 well locations

2016 well locations

Source: Wood Mackenzie
Operators have refined drilling and completion techniques

All or a combination of increased proppant placement, longer laterals and a greater number of more targeted frac stages has resulted in significantly improved recoveries.
The trend of longer laterals

Operator preference and geology is responsible for the varying lengths of laterals

Lateral lengths by year

Source: Wood Mackenzie
Frac stages, the more the better?

Refined completion techniques have seen a marked increase in frac stages per well.

**Operator reported frac stages per well**

<table>
<thead>
<tr>
<th>Operator</th>
<th>2013</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seven Generations</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Birchcliff</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Advantage</td>
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<td>20</td>
</tr>
<tr>
<td>Cequence</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Black Swan</td>
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<td>30</td>
</tr>
<tr>
<td>Bonavista</td>
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<td>Athabasca Oil</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>Paramount</td>
<td>20</td>
<td>70</td>
</tr>
</tbody>
</table>

**British Columbia’s top performing wells based on IP30 rates**

- **Bottom 75%**
- **Top 25%**
- **Top 10%**

Source: Wood Mackenzie, BCOCG, IPS ranged by mmcfe

Source: Wood Mackenzie
Fewer rigs are drilling more productive and cheaper Montney wells

Lowered costs are due to structural shifts in drilling and completion techniques, along with depressed service costs

Rig counts versus total gas production

Movements in well costs since 2012

Source: Wood Mackenzie, Nickles RigLocator
Montney and Deep Basin hold significant low-cost gas resource

At a wellhead breakeven, WCSB production is competitive with the Marcellus and Utica, but top tier areas lack in repeatability.

Source: Wood Mackenzie
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Wood Mackenzie’s Montney sub-plays

**Forecasting activity by sub-play and operator**

**NPV split by sub-play**
- Remaining value split 50/50 between AB and BC
- Liquids-rich gas areas including Kakwa Core, Heritage Liquids and Pouce Coupe hold 53% of remaining value

**Source:** Wood Mackenzie

**Map of Montney**
- **Northern BC (1):** Cdn$6.72 bn
- **Sundown Groundbirch (3):** Cdn$3.87 bn
- **Heritage Liquids (4):** Cdn$13.32 bn
- **Dawson Creek (5):** Cdn$0.71 bn
- **Swan (6):** Cdn$2.48 bn
- **Mulligan (8):** Cdn$0
- **AB Sands (7):** Cdn$0.49 bn
- **Pouce Coupe (9):** Cdn$6.29 bn
- **Grande Prairie (10):** Cdn$2.54 bn
- **Kaybob (12):** Cdn$1.14 bn
- **Ante Creek (11):** Cdn$2.43 bn
- **Elmworth Karr (13):** Cdn$4.54 bn
- **Kakwa Core (14):** Cdn$8.34 bn
- **Southern BC (2):** Cdn$0
Activity has shifted from LNG linked drilling to pure-play producers

» Near-term growth driven by investments in processing infrastructure
Sub-play area 4 – Heritage Liquids

High value British Columbia acreage given condensate and NGL yields

» Highest IRR (post-tax) of British Columbia sub-plays at 62%

Source: Wood Mackenzie, XI Technologies
Over 6,790 wells have been drilled in the Montney since 2013

We forecast over 10,000 more will be drilled in 2018-2026. Four areas stand out – Northern BC, Heritage Liquids, Kakwa and Pouce Coupe

Sub-play drilling history and forecast

Source: Wood Mackenzie, XI Technologies. Note this is our Canada Upstream unconstrained outlook, our markets teams take a risked view on these development levels.
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