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Montney vs. Marcellus Cost Benchmarking Study

Q2 2017

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Overview of Study

This study compares nine companies with the majority of their production in the Montney and seven companies with the majority of their production in the Marcellus. It benchmarks full cycle supply costs, using the following metrics:

1. Three-year average finding and development costs
2. Operating and transportation expenses
3. General and Administrative costs
4. Interest expenses

This study also reviews the production mix of natural gas and natural gas liquids (NGLs) coming out of each play, and provides field netbacks based on that production to give a more comprehensive understanding of the economics of the Montney and Marcellus.

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Key Findings

The Montney tight gas play straddling the Alberta and British Columbia border and the Marcellus shale gas play stretching over four states in the Northeastern US are the two fastest growing gas plays in their respective countries. To understand how the two plays compare and how they are changing over time, JWN leveraged its CanOils database to develop this benchmarking study based on Q2/2016 and Q2/2017 financial and operating data.

The key findings allow us greater understanding of the costs and opportunities that exist for companies looking to capitalize within the two plays.

SUPPLY COSTS ARE DECLINING – WITH THE MARCELLUS ENJOYING A SIGNIFICANT ADVANTAGE

Both Montney and Marcellus operators continued cutting costs and improving productivity year-over-year, with Montney supply costs declining 13 per cent and Marcellus costs declining seven per cent. But operators in each play face different structural challenges in reducing costs. For example, Marcellus operators have extremely low operating costs as most wells are dry gas. A lack of take-away capacity, however, means very high transportation costs.

While Montney operating costs are higher than the Marcellus due partly to high liquids volumes, operators in the play enjoy transportation costs less than half of their Marcellus counterparts.

Montney operators also have lower general and administrative costs compared to Marcellus players, although that cost spread has narrowed rapidly in the last year as operators in the Marcellus cut G&A expenses by one-third.

Both Montney and Marcellus producers reduced interest expenses per boe significantly in the last year.

Overall, Marcellus operators enjoyed a $2.42 per boe supply cost advantage over Montney operators, but it is important to note that within the companies tracked there was a large variation in supply costs with some Montney producers having lower costs than Marcellus operators.

MONTNEY PRODUCTION MIX CREATES HIGHER NETBACKS

While the Marcellus has lower supply costs, the value of Montney production delivers higher netbacks than its US counterpart. Marcellus production was weighted at 82 per cent natural gas compared to Montney production weighted at 64 per cent natural gas with the remainder liquids. As a result, Marcellus operators reported average netbacks of $15.07 per boe in Q2/2017, while Montney operators reported netbacks of $18.30 per boe.

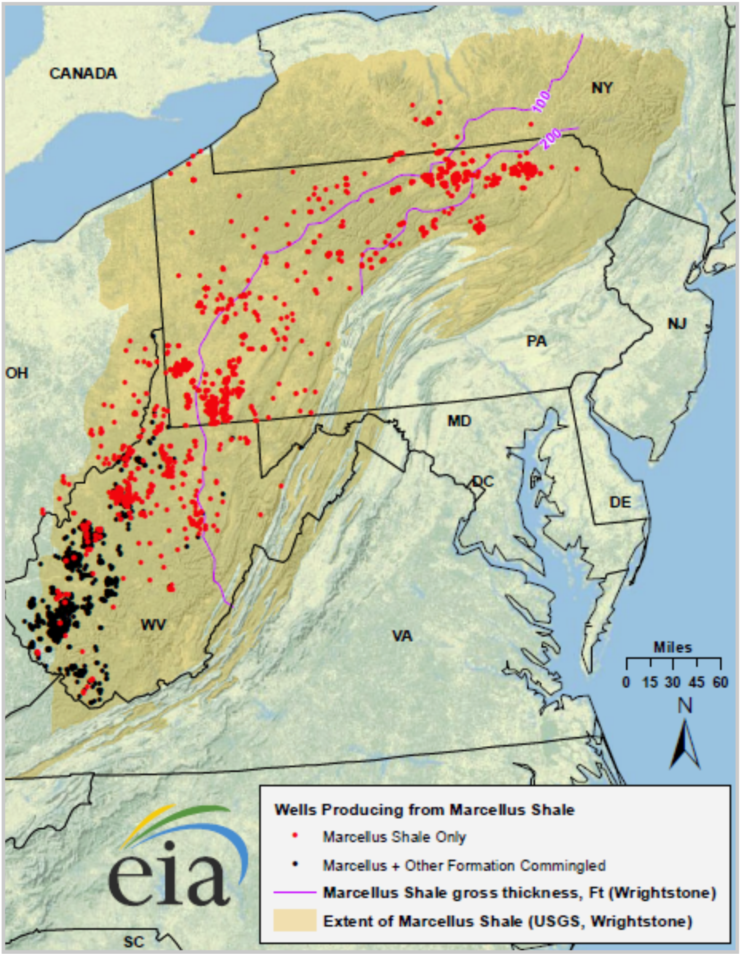
LOOKING AHEAD

We conclude that while both Montney and Marcellus operators have managed to cut average supply costs in the last year, Marcellus operators have the greatest opportunity for further cuts as new transportation infrastructure is constructed. There are also opportunities for Marcellus operators to improve G&A costs.

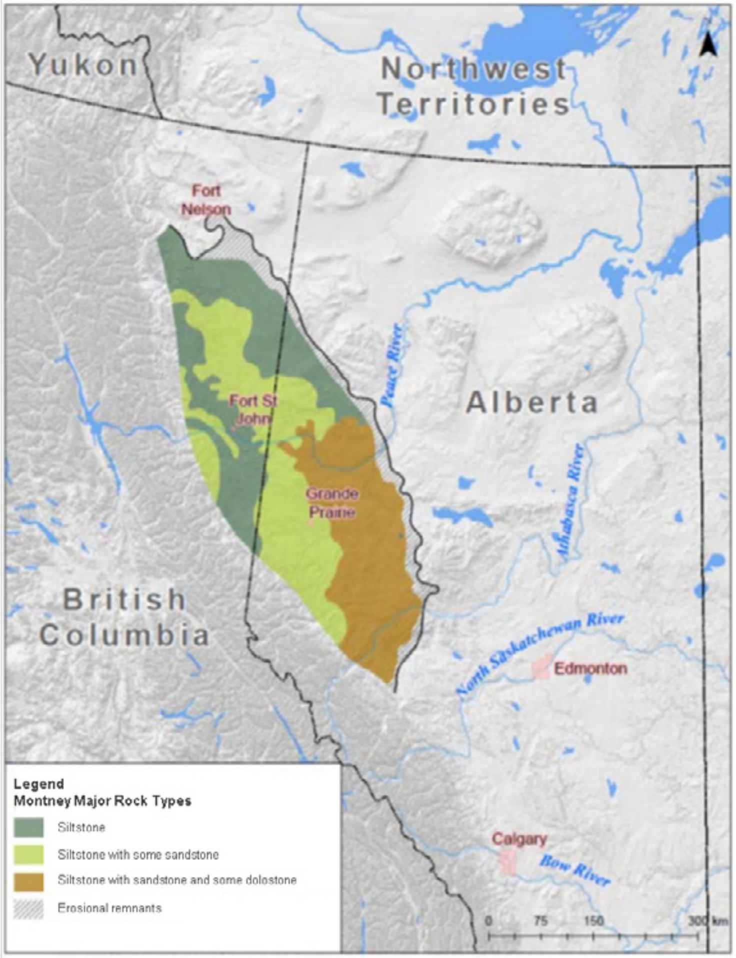
For Montney operators, there is a need to maintain the 35 per cent finding and development cost decline of the last three years resulting from lower service and supply costs and improved productivity as activity picks up in western Canada. Operators also need to continue driving down operating costs, which are almost five times higher than in the Marcellus.

Marcellus and Montney Activity 2016-2017 and the Companies Involved

Marcellus and Montney Formation Outlines



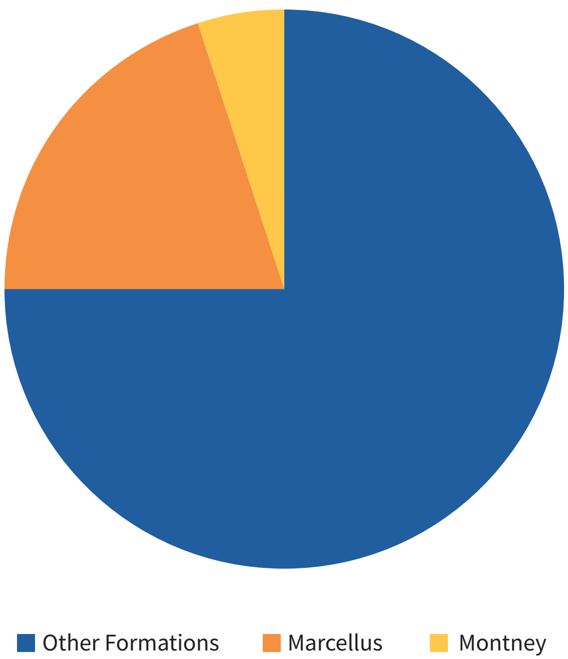
Source: EIA, 2011



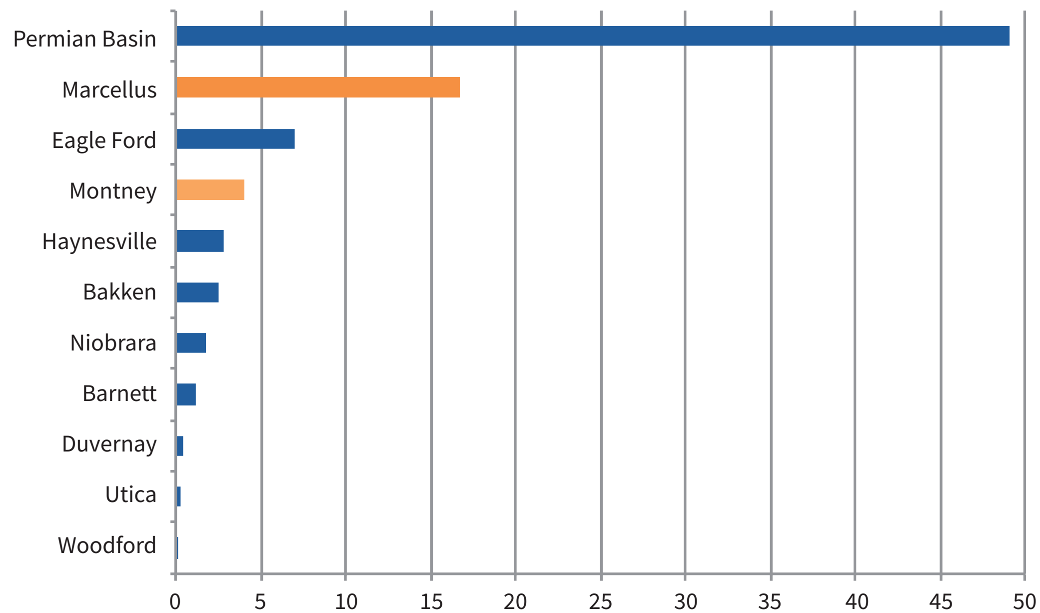
Source: National Energy Board

Deal Activity - Marcellus and Montney Compared to Other Unconventional Formations

All Deals in Shale/Tight Gas or Liquid Formations Worldwide Jan 2016 to June 2017



North American Unconventional Deals by Formation between Jan 2016 to June 2017 (US$B)



Since the start of 2016, the two plays have seen around a quarter of all deal value for shale or similar basin types around the world (~US$20.7 billion). In North America, the Marcellus has seen the second highest amount of deals compared to other unconventional basins in terms of overall deal value at US$16.7 billion, while the Montney is fourth in the list behind the Eagle Ford in Texas at just over US$4 billion.

Marcellus and Montney Deal Activity Largest Deals in 2016 and 2017 So Far

Announce Date	Acquirer	Target Company	Play	Description	Total Cost (US$M)	Cost per Flowing Barrel (US$/boe)
19 June 2017	EQT Corp.	Rice Energy Inc.	Marcellus	EQT Corp acquires Rice Energy Inc.	8,200	36,044
26 Sept 2016	Rice Energy Inc.	Vantage Energy, LLC	Marcellus	Rice Energy Inc. acquires Vantage Energy, LLC and Vantage Energy II, LLC	2,773	41,693
06 July 2016	Seven Generations Energy Ltd.	Paramount Resources Ltd.	Montney	Seven Generations Energy Ltd. acquires 310 net sections of Paramount's Deep Basin oil and gas properties	1,482	49,394
21 Dec 2016	Alta Resources LLC	Anardarko Petroleum Corporation	Marcellus	Alta Resources acquires upstream and midstream assets in the Marcellus Shale from Anadarko Petroleum Corporation	1,240	15,830
01 May 2017	HG Energy LLC	Noble Energy Inc.	Marcellus	HG Energy acquires Noble Energy's upstream assets in northern West Virginia and southern Pennsylvania	1,125	16,265
20 Oct 2016	Tourmaline Oil Corp.	Shell Canada Energy	Montney	Tourmaline Oil Corp acquires assets located in the Alberta Deep Basin and the NEBC Montney Complex from Shell Canada Energy	1,047	42,153
06 July 2017	Paramount Resources Ltd.	Trilogy Energy Corp.	Montney	Paramount Resources Ltd acquires the remaining 85% of Trilogy Energy Corp.	654	35,417
08 Feb 2017	EQT Corp.	Stone Energy Corporation	Marcellus	EQT Production Company acquires Appalachian Basin assets from Stone Energy	527	25,296
25 Oct 2016	EQT Corp.	Trans Energy Inc., and Republic Energy	Marcellus	EQT Corp acquires 42,600 core Marcellus acres located in West Virginia from Trans Energy, Inc and Republic Energy	513	73,286
21 June 2016	Birchcliff Energy Ltd.	Encana Corporation	Montney	Birchcliff Energy Ltd. acquires Encana Corporation's Gordondale assets in northwestern Alberta	479	18,990

The Companies in this Cost Comparison Study

There are a number of companies that are either exclusive to, or have the majority of their production in the Montney formation in Canada or the Marcellus formation in, the United States. Companies that gave sufficiently detailed financial and operating data have been carefully selected to inform this cost comparison between the two prolific gas and liquids producing formations.

MONTNEY PRODUCERS

There were nine Toronto-listed companies chosen for the Montney formation portion of this study (all companies are listed on the TSX unless otherwise stated):

- Advantage Oil & Gas Ltd. (AAV)
- ARC Resources Ltd. (ARX)
- Birchcliff Energy Ltd. (BIR)
- Delphi Energy Corp. (DEE)
- Kelt Exploration Ltd. (KEL)
- Paramount Resources Ltd. (POU)
- Painted Pony Energy Ltd. (PONY)
- Seven Generations Energy Ltd. (VII)
- Storm Resources Ltd. (TSX-V:SRX)

MARCELLUS PRODUCERS

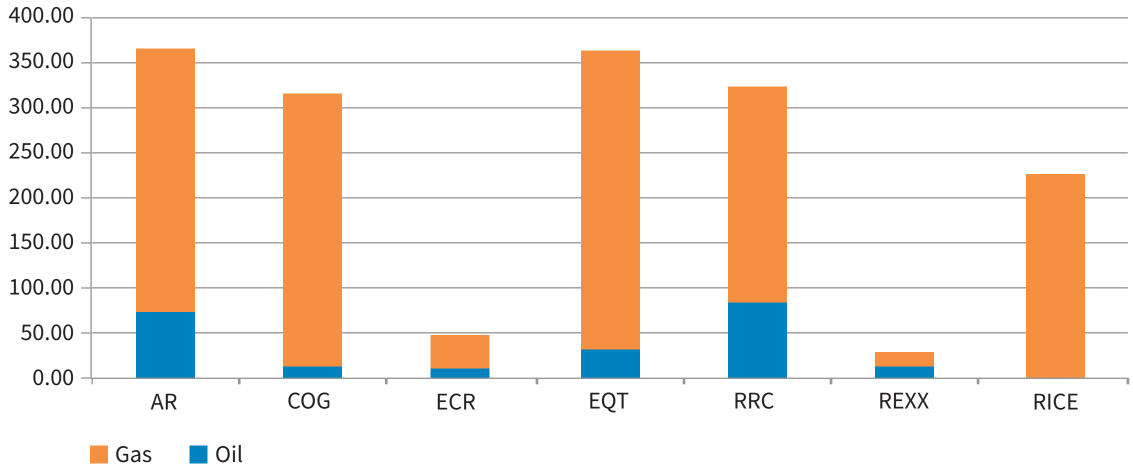
There were seven U.S.-listed companies chosen for the Marcellus formation portion of this study (all companies are listed on the NYSE unless otherwise stated):

- Antero Resources Corp. (AR)
- Cabot Oil & Gas Corp. (COG)
- Eclipse Resources Corp. (ECR)
- EQT Corp. (EQT)
- Range Resources Corp. (RRC)
- Rex Energy Corp. (NASDAQ:REXX)
- Rice Energy Inc. (RICE)[1]

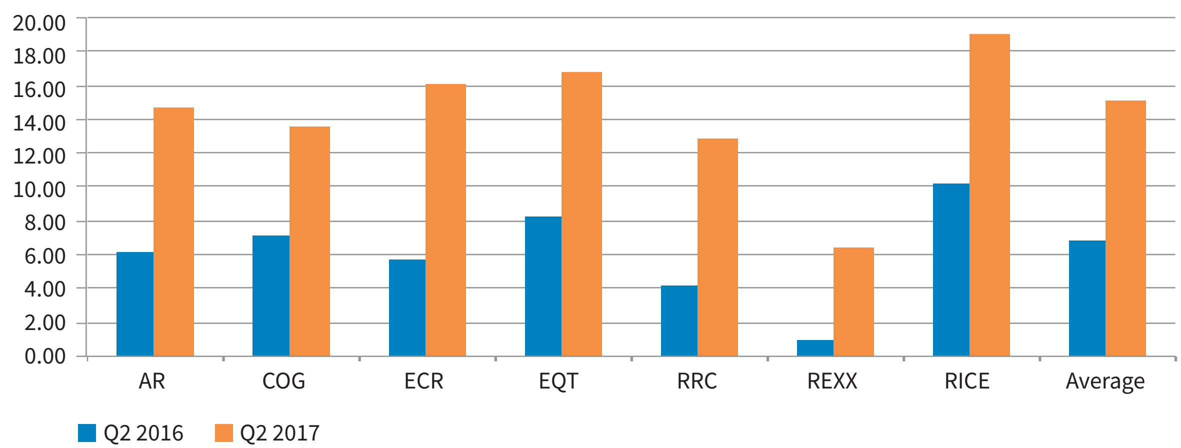
[1] Rice Energy Inc. is currently in the process of being acquired by EQT Corp., but both companies' data for Q2 2017 and Q2 2016 is independent of the other.

Marcellus Companies

Daily Oil & Gas Production ('000 boe/d)



Operating Netback Per Boe Produced (C$boe)



PRODUCTION: The Marcellus companies in this study combined to produce 1.7 million barrels of oil equivalent per day in Q2 2017. The production is, on average, heavily weighted towards natural gas for the group at 82 per cent.

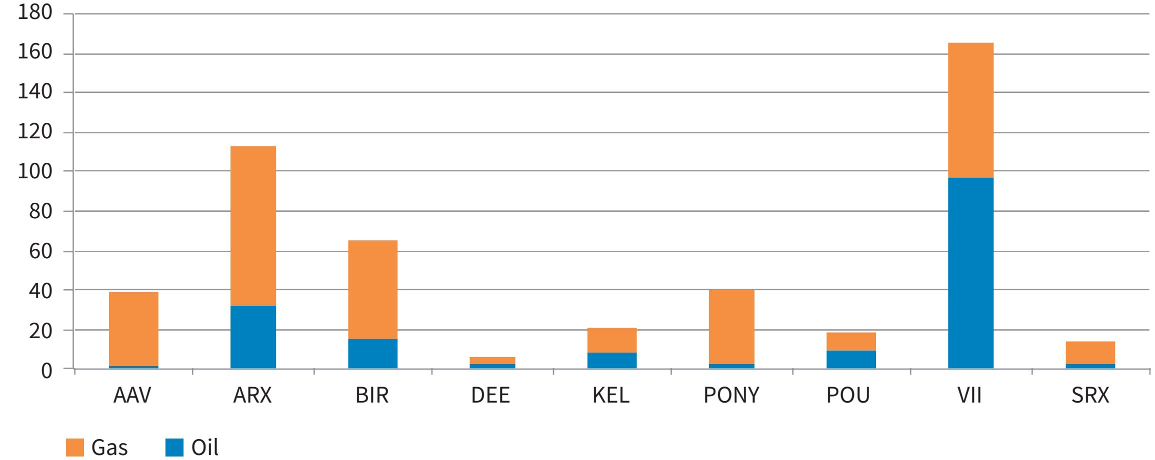
OPERATING NETBACKS: When operating and transportation costs are subtracted from oil and gas revenues after royalties, the Marcellus companies averaged netbacks of C$15.07 per boe in Q2 2017, more than double the average netback from the equivalent period a year earlier.

The netback data for the U.S. companies was originally reported in US dollars and converted for the purposes of this study. Please refer to the methodology section for notes on the exchange rate used to create the C$/boe netback chart.

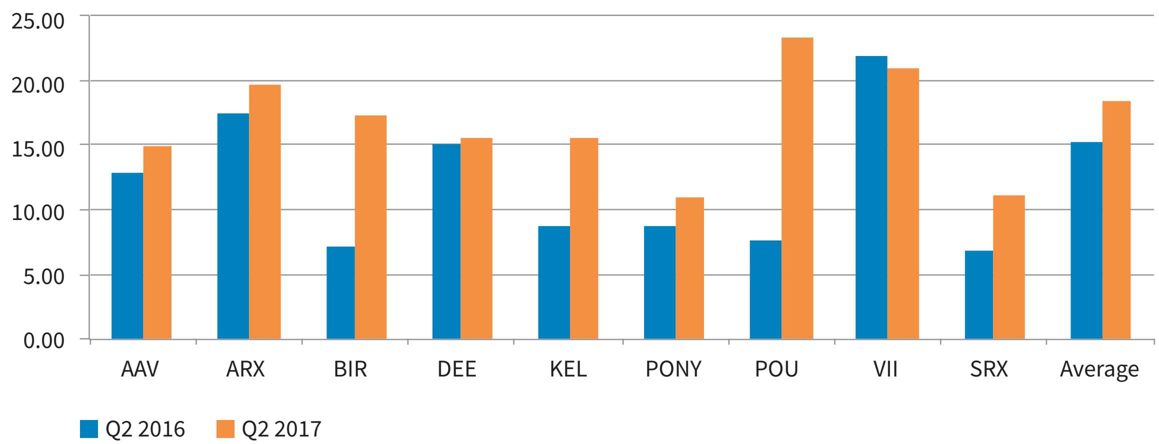
AR – Antero Resources Corp.
COG – Cabot Oil & Gas Corp.
ECR – Eclipse Resources Corp.
EQT – EQT Corp.
RRC – Range Resources Corp.
REXX – Rex Energy Corp.
RICE – Rice Energy Inc.

Montney Companies

Daily Oil & Gas Production ('000 boe/d)



Operating Netback Per Boe (C$boe)



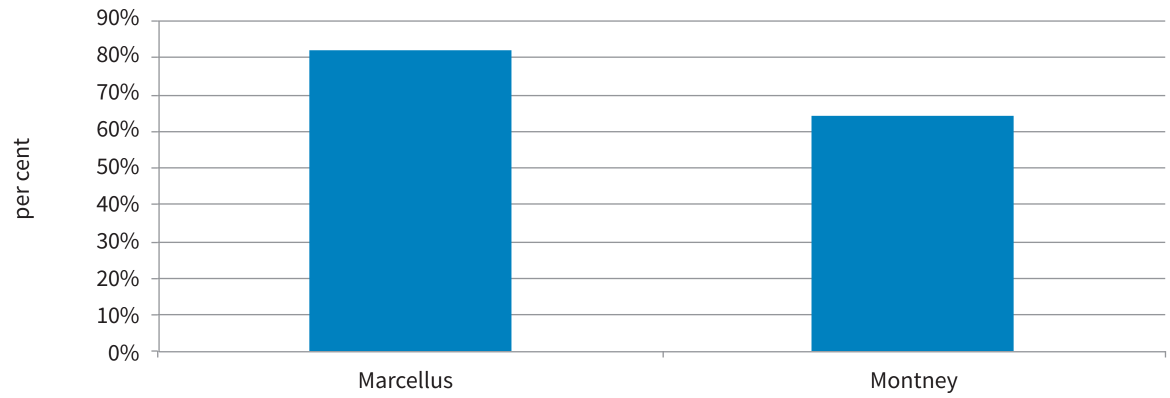
PRODUCTION: The nine Montney companies produced around 480,000 boe/d in Q2 2017. The production is, on average, 64 per cent weighed to natural gas production.

OPERATING NETBACKS: All companies except Seven Generations Energy saw an increase in operating netbacks in Q2 2017 compared to Q2 2016. The average for the group was higher this year at C$18.30, but did not increase as greatly as the Marcellus producers.

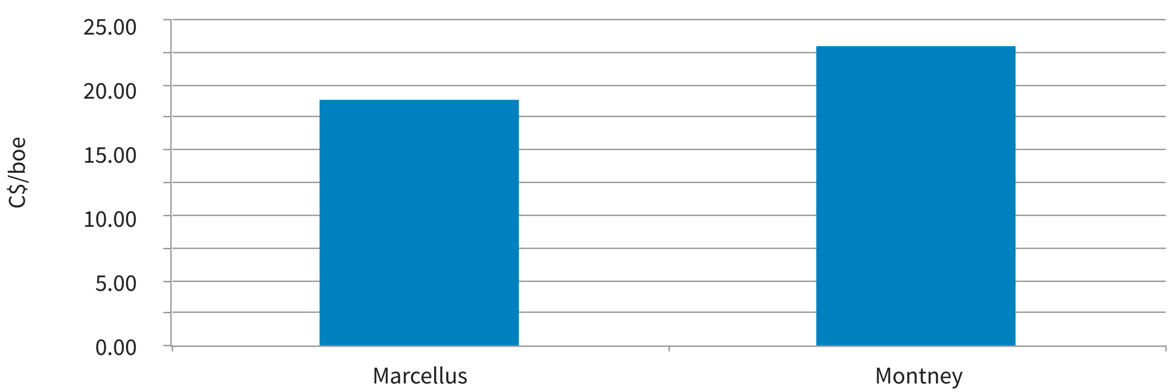
AAV – Advantage Oil & Gas Ltd.
ARX – ARC Resources Ltd.
BIR – Birchcliff Energy Ltd.
DEE – Delphi Energy Corp.
KEL – Kelt Exploration Ltd.
POU – Paramount Resources Ltd.
PONY – Painted Pony Energy Ltd.
VII – Seven Generations Energy Ltd.
SRX – Storm Resources Ltd.

Marcellus and Montney Averages

Average Natural Gas Weighting of Production for Each Group, Q2 2017



Average Operating Netbacks for Each Group in Q2 2017 (C$/boe)



PRODUCTION: The Marcellus companies are not only much bigger, on the whole, than their Montney counterparts in this study, they also produce a greater level of natural gas compared to oil and liquids. Both of these factors heavily influence the shape of cost structures adopted by the two sets of companies shown later in this study.

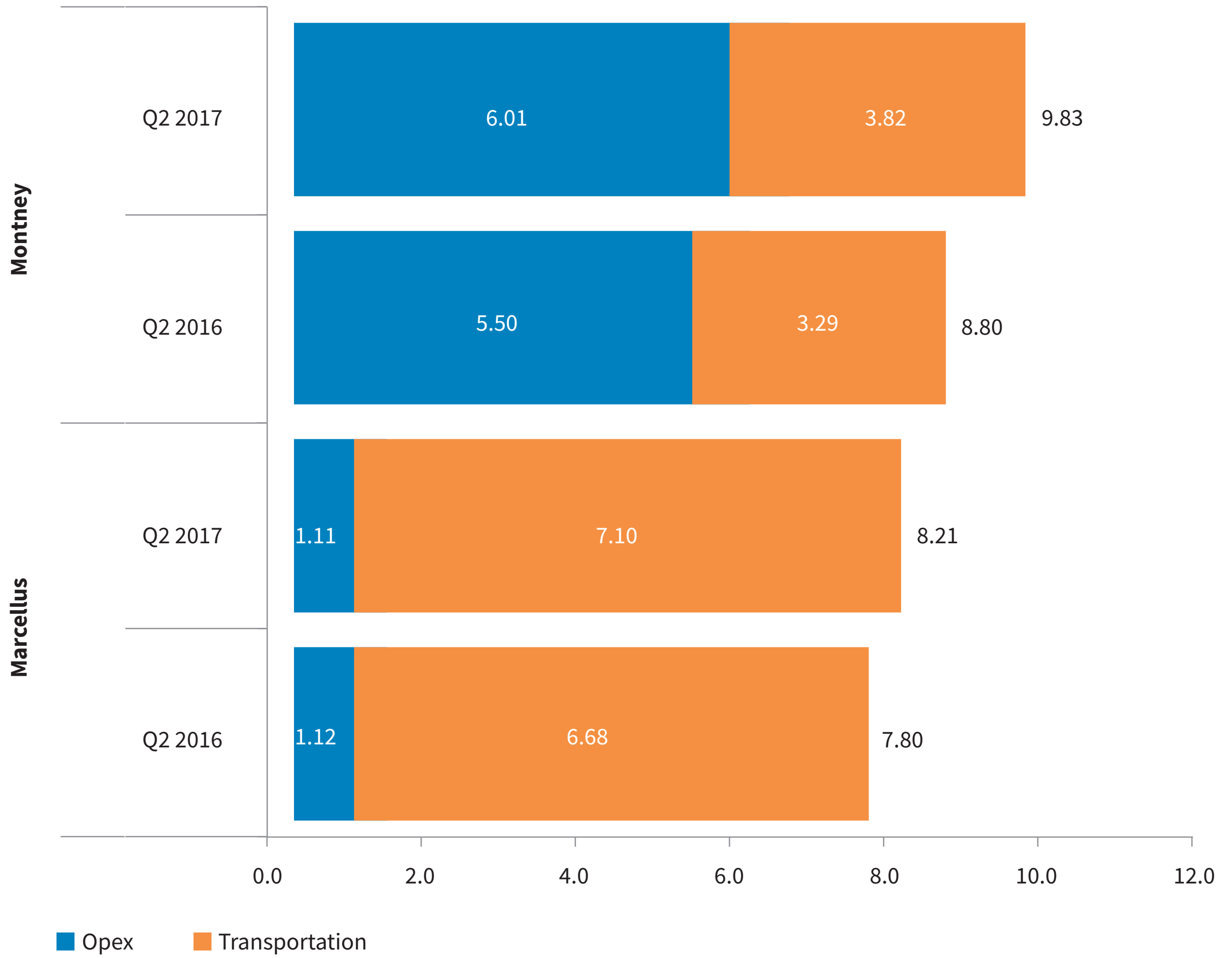
AVERAGE NETBACKS: Due to the higher liquids content in the Montney, the companies are achieving higher average operating netbacks per boe as a group than their Marcellus counterparts. Therefore, while some cost metrics may seem to place Marcellus companies at an advantage to Montney producers, for every barrel produced, a Montney company sees a greater margin before G&A and interest expenses.

Please note: The netback data for the U.S. companies was originally reported in US dollars and converted for the purposes of this study. Please refer to the methodology section for notes on the exchange rate used to create the C$/boe netback chart.

Comparison Charts

Montney and Marcellus Producers

Figure 1. Operating and Transportation Expenses Per Boe



OPEX: Marcellus producers enjoy a significant advantage in operating costs. The composition of this primarily dry gas play plus extremely high well productivity help to spread infrastructure costs across a greater number of boe/d of production.

TRANSPORTATION: A lack of transportation capacity in the Marcellus gives the well-connected Montney a major advantage. But capacity is coming in the Marcellus, meaning this advantage may erode in the near future.

When transport expenses are combined with operating expenses, the Marcellus has a slight advantage in costs per boe over the Montney.

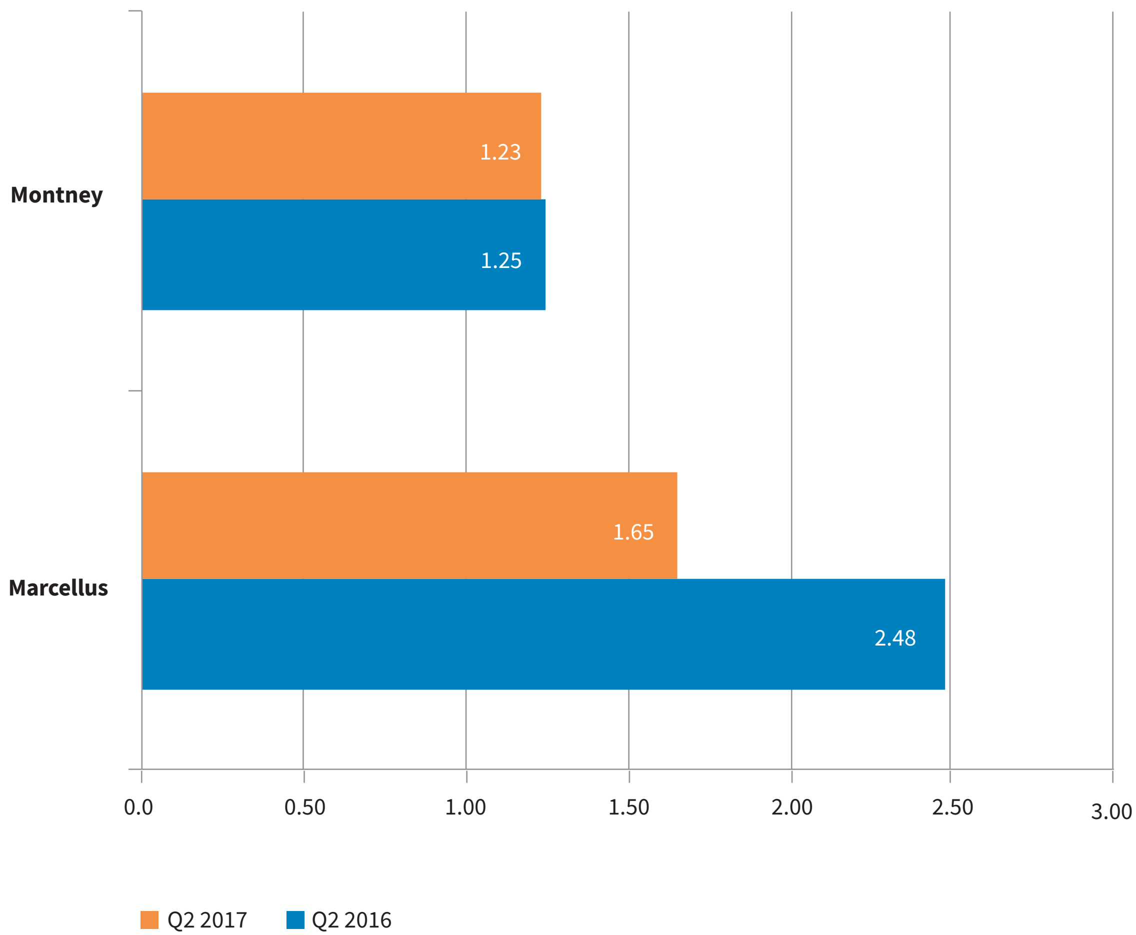
YOY Change

Marcellus	+5%
Montney	+12%

Note: Figures may not reconcile completely due to rounding

Montney and Marcellus Producers

Figure 2. General and Administrative (G&A) Expenses Per Boe



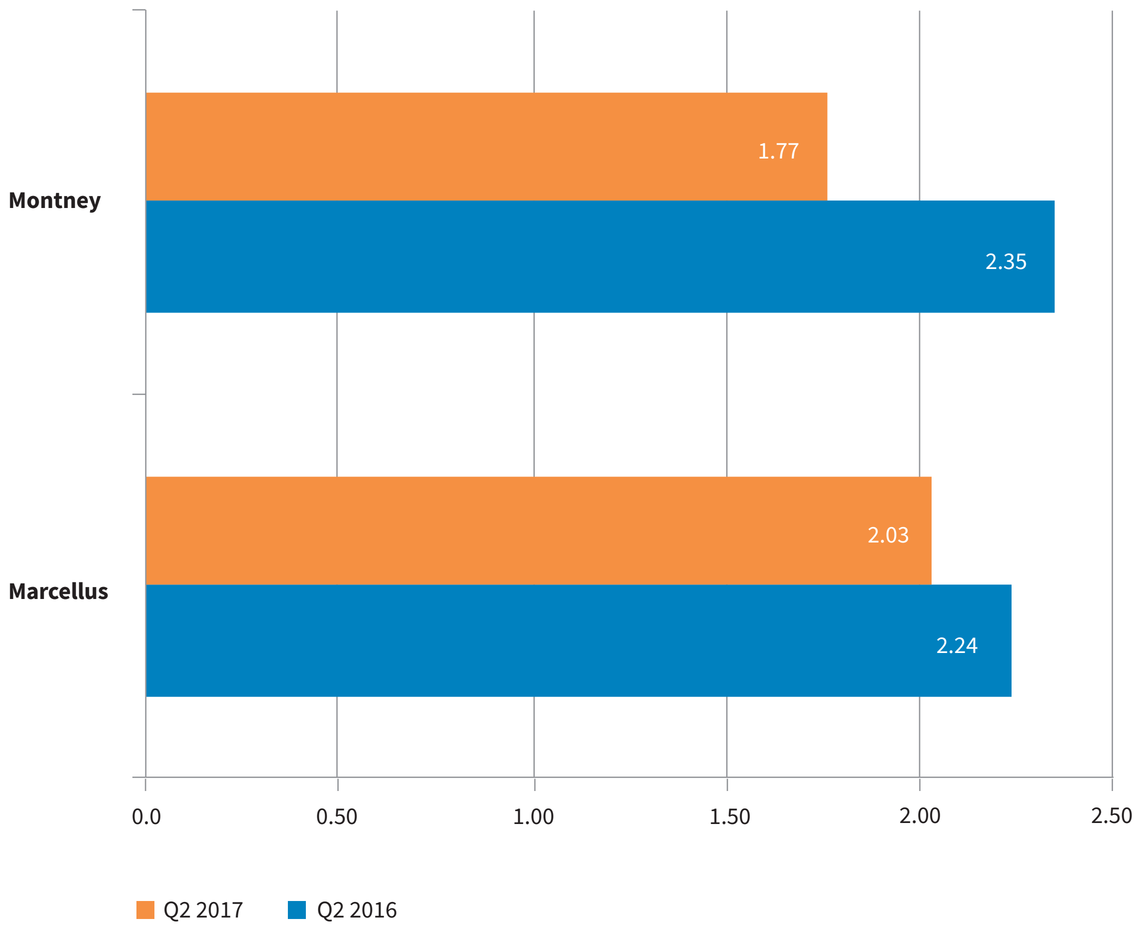
With natural gas prices depressed for the last eight years, both Montney and Marcellus operators run lean organizations.

YOY Change

Marcellus	-33%
Montney	-2%

Montney and Marcellus Producers

Figure 3. Interest Expenses Per Boe



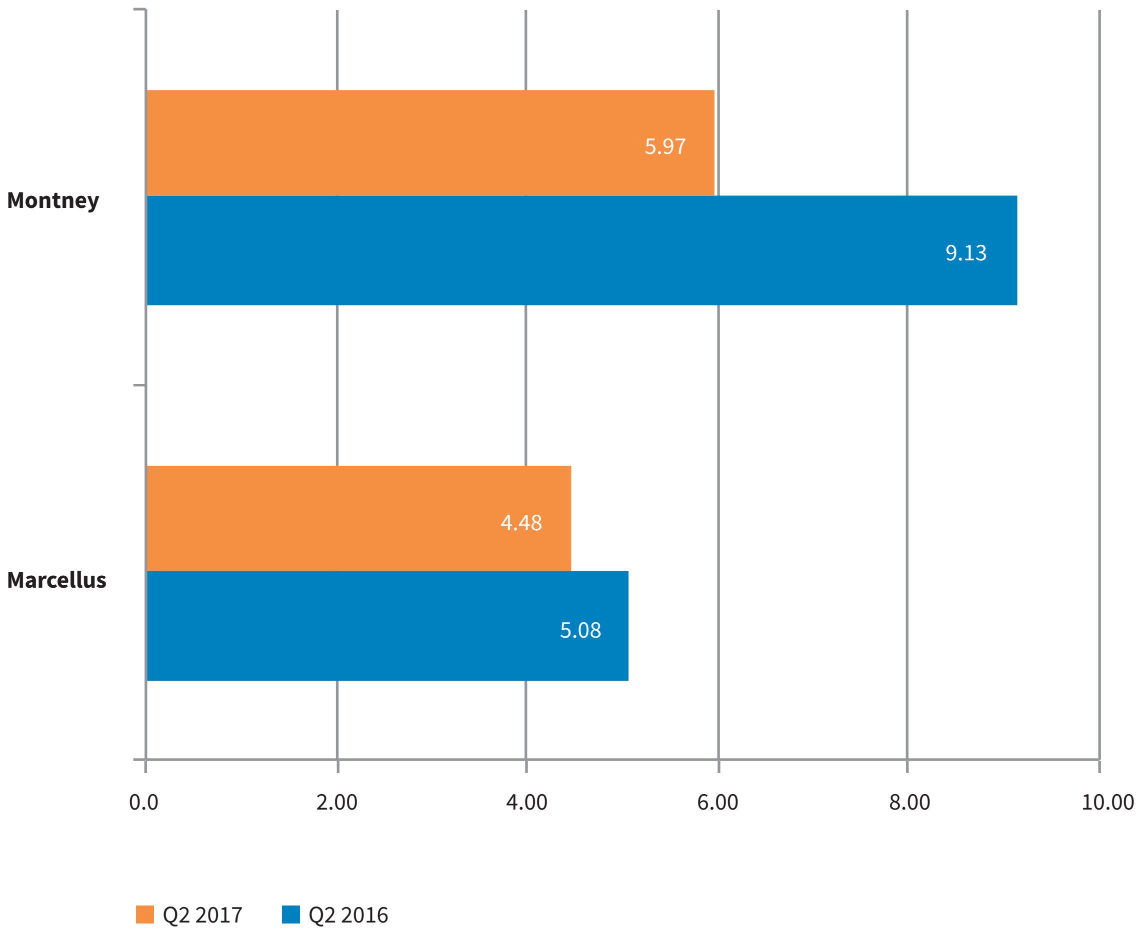
On a peer group basis, Montney and Marcellus producers reduced their respective interest expenses per boe this year. As individual companies, only two of each group saw their interest expenses increase relative to their production levels.

YOY Change

Marcellus	-10%
Montney	-25%

Montney and Marcellus Producers

Figure 4. Three-year Average F&D Costs Per Boe (2016 vs. 2015)



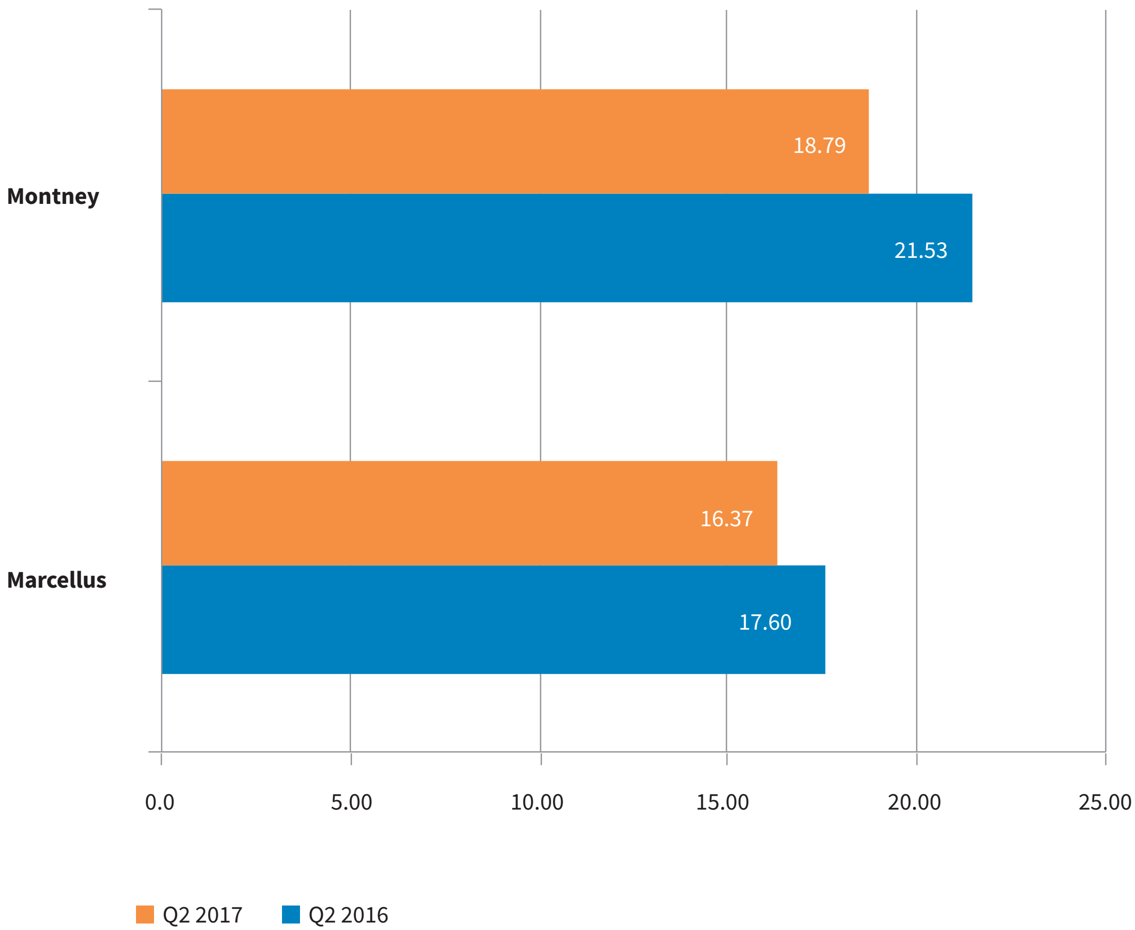
High-deliverability Marcellus wells spread the drilling, completion and equipment costs over more reserves, giving it an advantage over the Montney.

YOY Change

Marcellus	-12%
Montney	-35%

Montney and Marcellus Producers

Figure 5. Full Supply Costs per boe



Both the Montney and Marcellus are low-cost plays. Higher liquids content in the Montney means higher supply costs, but Montney producers also receive the benefit of condensate sales in Alberta's high value market.

YOY Change

Marcellus	-7%
Montney	-13%

Data Tables

Montney and Marcellus Company Data

Montney Companies	Ticker (TSX Unless Otherwise Stated)	Production (boe/d)		Full Supply Costs ($/boe)	
		Q2 2016	Q2 2017	Q2 2016	Q2 2017
Advantage Oil & Gas Ltd.	AAV	35,048	38,739	$9.98	$9.46
ARC Resources Ltd.	ARX	117,695	113,410	$25.11	$21.80
Birchcliff Energy Ltd.	BIR	39,513	64,636	$14.42	$12.93
Delphi Energy Corp.	DEE	5,802	6,484	$30.03	$38.04
Kelt Exploration Ltd.	KEL	20,208	20,684	$29.59	$24.26
Painted Pony Energy Ltd.	PONY	16,634	40,904	$10.28	$12.23
Paramount Resources Ltd.	POU	40,904	18,397	$33.81	$25.78
Seven Generations Energy Ltd.	VII	117,353	165,200	$20.32	$21.06
Storm Resources Ltd.	SPX (TSX-V)	12,852	13,991	$12.07	$13.53

Marcellus Companies	Ticker (NYSE Unless Otherwise Stated)	Production (boe/d)		Full Supply Costs ($/boe)	
		Q2 2016	Q2 2017	Q2 2016	Q2 2017
Antero Resources Corp.	AR	292,993	366,495	US$14.97	US$14.79
Cabot Oil & Gas Corp.	COG	278,046	316,993	US$10.28	US$9.88
Eclipse Resources Corp.	ECR	39,349	47,962	US$25.86	US$22.18
EQT Corp.	EQT	338,009	362,791	US$10.33	US$10.59
Range Resources Corp.	RRC	236,796	324,084	US$15.85	US$13.53
Rex Energy Corp.	REXX (NASDAQ)	33,179	29,509	US$19.02	US$21.84
Rice Energy Inc.	RICE	126,278	225,623	US$12.36	US$8.89

Methodology

Cost Metrics

To conduct the study, the following cost metrics were chosen, and looked at on a per barrel of oil equivalent (“boe”) basis:

1) Operating Expenses
2) Transportation Expenses
3) General and Administrative Expenses (“G&A Expenses”)
4) Interest Expenses
5) Finding and Development Costs (“F&D Costs”)
6) Full Supply Costs

The metrics were chosen by experienced industry analysts as the key components of reporting a full supply cost measure in an accurate and comparable fashion, from publicly available data.

ROYALTY EXPENSES ARE EXCLUDED FROM ALL COST CALCULATIONS

Given that U.S. companies do not report royalties per boe separate to their revenues per boe (report on a net of royalties basis), royalties per boe were excluded from the cost comparison analysis to keep the data as comparable as possible across countries.

EXCHANGE RATE

Some of the companies included in this report use U.S. dollars as their functional currency. For the purposes of this report, all data that was originally reported in U.S. dollars in both Q2 2016 and Q2 2017 has been converted into Canadian dollars at a rate of U.S.$1 to C$1.33720 (the average rate for Q2 2017).

The same rate has been used for both Q2 2016 and Q2 2017 so that costs can be compared on a like-for-like basis.

MCF TO BOE CONVERSION RATIO

This study has adopted the standard of 6 Mcf : 1 bbl when converting thousands of cubic feet of natural gas to barrels of oil equivalent (“boe”). Condensate and other natural gas liquids are converted to boe at a ratio of 1 bbl: 1 bbl and volumes of these products are included under “oil” in any production charts, figures or ratios. These ratios are estimates of the equivalent energy content of the products and do not reflect the relative economic value of each individual product.

GROSS AND NET PRODUCTION

U.S. producers report production net of royalties, while Canadian producers report on a gross basis. This could skew any cost and netback comparison slightly and should be kept in mind when analyzing any conclusions made.

Data Formula

1) Operating Expenses Per Boe

$$\frac{\text{E\&P operating expenses}}{\text{Total production}}$$

All operating expenses have been broken down to show purely E&P segment expenses for companies that have multiple segments.

2) Transportation Expenses Per Boe

$$\frac{\text{E\&P transportation expenses}}{\text{Total production}}$$

For multi-segment companies, all non-E&P related measures are excluded from this calculation where possible.

3) General and Administrative Expenses ("General & Admin. Expenses") Per Boe

$$\frac{\text{G\&A expenses excluding stock-based compensation}}{\text{Total production}}$$

This formula is for the full general and administrative expense amount for each company, and is not a pure E&P measure, as most companies do not report a clear split between segments. If stock-based compensation is reported, it is excluded from the full general and administrative amount for that company.

4) Interest Expenses Per Boe

$$\frac{\text{Interest expenses}}{\text{Total production}}$$

This formula is for the full interest expense amount for each company, and is not a pure E&P measure, as most companies do not report a clear split between segments.

Data Formula

5) Three-year Average Finding and Development Costs of Proved Reserves ("F&D Costs") Per Boe

$$\frac{\text{Sum of all exploration cost between 2014 and 2016} + \text{Sum of all development costs of proved reserves between 2014 and 2016}}{\text{Sum of all revisions between 2014 and 2016 (positive figures only)} + \text{Sum of all improved recovery between 2014 and 2016} + \text{Sum of all extensions and discoveries between 2014 and 2016}}$$

This item is only available on an annual basis, so for each quarterly period, the preceding 3 year average calculation has been used. The above formula was used for each company's Q2 2017 full supply cost calculation. For Q2 2016, figures from 2013 through to 2015 have been used. All reserve-related items are taken from the annual reserve reconciliations of proved reserves.

6) Full Supply Costs Per Boe
The sum of:
- Three-year Average Finding and Development Costs ("F&D Costs") per boe
- Operating Expenses per boe
- Transportation Expenses per boe
- General and Administrative Expenses ("G&A Expenses") per boe
- Interest Expenses per boe

7) Operating Netback Per Boe

E&P net revenue per boe – Operating expenses per boe – Transportation expenses per boe

The revenues used in this calculation for all companies are net of royalty expenses. For multi-segment companies, all non-E&P related amounts have been excluded.

Notes for F&D costs:

A three-year average is calculated to assuage the potential impact that spikes in the data on a single year basis can create. The formula also excludes the following items for the purposes of simplicity and comparability:

- Negative revisions
- Future development costs

The formula also uses "total revisions" in place of technical revisions, as US companies do not typically split between technical revisions and economic revisions.

For those interested in studying the F&D costs or reserve reconciliations of only Canadian producers, then CanOils has the data to support a far more robust and complex analysis, including this split between technical and economic revisions.

Find out more about CanOils by requesting a demo here.

Contact Us

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