Montney Unconventional Shale Gas – Initial Deliverability and Liquid Content Have The Most Significant Impact On Rate of Return

Summary

- Original horizontal development of Montney shale gas began in the Dawson field and from there quickly spread to the Swan area of British Columbia, with the first modern horizontal wells with multiple fracs drilled in 2005/2006
- Currently 1,100 wells (702 horizontal) produce a total of 1.7 Bcf/d from the Montney unconventional gas fairway
- Early development focused on the Upper Montney which was only a portion of the full interval (which is often more 300 m (~1,000 ft) thick and completely gas charged)
- Successful development has proven deliverability from the Upper, Middle and Lower Montney
- Continued exploration has pushed the play boundaries to the north and west – we focused on a fairway that is approximately 190 by 80 miles or more than 15,000 square miles
- Each area of development distinguishes itself with subtle changes in characteristics which impact initial deliverability, decline, liquid content and ultimately economics
- The least developed of all the areas is the North Montney where the best performing wells from the entire fairway have been drilled with test rates as high as 19 MMcf/d (Shell a-A67-A/94-B-16)
- Using $4.00 AECO flat pricing, and assuming constant DC&C costs of $6.5MM per well, we were able to establish a relative play ranking for each of the Montney shale gas areas. The rate of return for Montney shale gas averages 34% and is as high as 56% depending on the specific area
- In a pressured gas pricing environment, Montney shale gas continues to provide positive returns and the North Montney has the potential to provide even better economics due to increased deliverability and higher liquid content. In any of the areas reviewed the efficiencies of the individual operator can increase or decrease the overall ROR

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The Montney trend is pushing north and west as new areas are being proven productive.

Much of the original Montney development occurred at Knopck, Pouce Coupe, Dawson and Swan where the Montney was targeted as a conventional vertical play. Subsequently these areas have been further developed in the tighter facies with horizontal wells.

The realization that the resource is stored in the less permeable portion of the Montney was significant and led to the initial horizontal development of this reservoir.

Led by Encana and then Murphy, Swan was the first major unconventional development using horizontal wells. Production from the Swan area is currently 463 MMcf/d.

Subsequently significant development has occurred at Groundbirch, Septimus, Parkland, Glacier and now in the North Montney along with continued development at Dawson.

The North Montney area (including Town, Altares, Kobes, Farrell Creek, Cypress and Gundy) is the most recent development in the fairway. Here we see the highest deliverability of the entire trend as well as significant liquid content.

### Montney Production Growth

- **1.7 Bcf/d** May 2011
- **1.0 Bcf/d** Jun 2010
- **0.5 Bcf/d** Nov 2008
As shown on the plot above, an averaged horizontal type well was created for each area. Liquid yields were estimated using publicly available gas analysis and reported condensate production.

Economics were calculated using the type well, calculated liquid yields and estimated DC&E costs of $6.5MM (as DC&E costs are reduced by individual operators the rates of return will improve).

On average, Montney shale gas is an economic play with a before-tax rate of return of 34% at $4.00 AECO.

Initial deliverability is key to optimizing overall rates of return. Parkland, Dawson and North Montney generate the best rates of return regardless of overall reserves capture.

Key in the development of Montney shale gas is maximizing initial deliverability. We would expect the rate of return for the North Montney to continue to increase given recently reported results.

The top six horizontal drillers are Encana, ARC, Shell, Murphy, Talisman and Progress. Both Talisman and Progress are dominant players in the North Montney.
Conclusions

- The Montney has expanded from a localized conventional vertical target to a world-class unconventional gas resource producing over 1.7 Bcf/d

- The Montney shale gas Fairway is expanding north and west with significant growth in the recently developed North Montney area. Currently, the best Montney producers are North Montney drills with initial deliverability of 11-19 MMcf/d

- Overall rate of return for each of the plays is directly tied to the initial deliverability but can be improved with increased NGL content and the efficiency of individual operators. Although our work shows RORs of 17-56% for the study areas the actual ROR of individual operators may be well in excess of this. True RORs reported by individual operators can be more than 100% at current pricing and conversely lower for higher cost operators

- The robust economics of the North Montney combined with the unique geographical positioning for access into the proposed LNG terminals sets North Montney shale gas apart from most other shale gas plays in North America

What To Watch For

- Consolidation of the smaller players such as Huron, Painted Pony, Canbriam and UGR

- Continued interest in Joint Ventures to accelerate development to meet the demands of West Coast LNG Facilities

- ARC’s development at Attachie and in particular the initial deliverability and NGL content

- Continued refinements in horizontal well drilling and completion technology to increase deliverability

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