

MONTNEY GROWTH

GAS INFRASTRUCTURE REPOSITIONING STUDY

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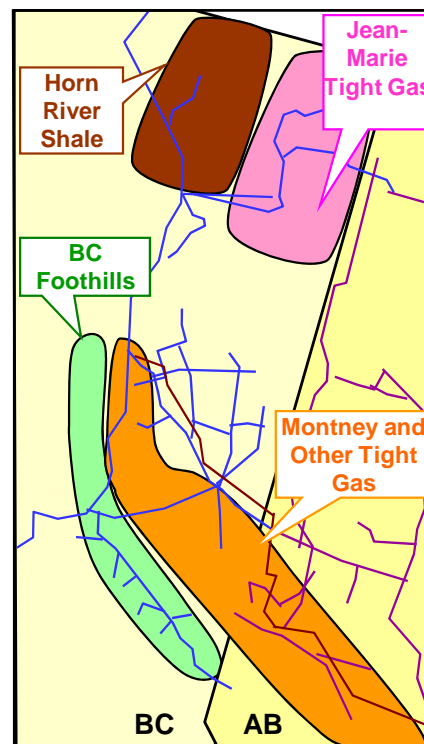
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I. INTRODUCTION

Study Background

The growth of Montney Tight Gas and other new gas opportunities in the northern region of N.W. Alberta and N.E. British Columbia has changed the dynamics of the infrastructure systems that are gathering, processing, and transporting products in that area. While conventional natural gas production in most areas of Western Canada has steadily declined over the past decade, growth of these new opportunities is contributing to the arrest of the overall decline with real supply growth in the study area.

Opportunity exists to make a step change in how existing and additional infrastructure in this area is developed, managed, and operated. Significant new investment will be required to construct additional gathering, processing, and transportation infrastructure to handle new Tight Gas production as well as to reconfigure the existing facilities to optimize their use with growing production in this area. Industry can work cooperatively to develop new dedicated infrastructure and to use the area's existing infrastructure for the benefit of both the developing and current resource base. The study's assessment of total infrastructure required has quantified opportunities to decrease capital investment, decrease per unit operating expenses for both new and existing production, and increase recovery of the existing gas resource base.



Independent Assessment

Ziff Energy and Gas Processing Management, two independent gas consulting groups¹, jointly analyzed and developed the strategic alternatives for investors, production owners, and infrastructure operators to consider. We believe that a structured approach to developing a common gas processing strategy in gas growth regions, along with a repositioning analysis in maturing regions, will improve utilization and effectiveness of the gas processing infrastructure and extend overall gas field production resulting in recovery of more resource. This independent assessment is a first step towards this goal.

Data Sources

The analysis is based on publically available data sources². Data was not requested from clients. Due to the developing nature of the Montney area infrastructure, Ziff Energy and Gas Processing Management conducted interviews with operators of existing and developing facilities to ensure that the study uses the most currently available infrastructure data.

¹ background on key individuals from both firms working on this study are at the end of this chapter

² Alberta Energy Resources Conservation Board (ERCB), British Columbia Oil and Gas Commission and British Columbia Oil and Gas Division Public Records, Company Websites, GeoScout, and GeoVista

Objectives

The study examines growth opportunities and existing gas production within the Montney Area and its required gathering, processing, and transportation infrastructure to build a logical case for Industry to change how infrastructure is managed using the Western Canadian and Montney detailed gas supply outlook analysis. It lays out a blue print to cooperatively develop new area infrastructure, and reposition existing gas gathering and processing infrastructure to effectively and efficiently process growing gas production. Where infrastructure is not forecast to be directly impacted by developing the resource, the study analyzes and recommends repositioning scenarios that will increase processing effectiveness for existing conventional production.

The primary driver for change in the Montney Area is the rapidly developing resource in the Montney play and other Tight Gas zones. The study includes a detailed outlook of gas and liquid production to 2020 and the impact forecasted production will have on area infrastructure. Growing Tight Gas production, when coupled with declining existing resource base, requires:

- construction of new infrastructure
- retooling and repositioning existing facilities
- consolidation of gas production into one or more area processing facilities
- construction of interconnecting pipelines to maximize use of existing facilities.

Where new processing infrastructure is required, the study emphasizes coordinated development on an industry basis to reduce capital employed and operating expenses. Where existing facilities are not forecast to play a role in the growing resource picture, the study presents alternatives to efficiently harvest related reserves through infrastructure consolidation. The study forecasts theoretical natural gas liquids (NGLs) and condensate production and assesses the impact that the forecast may have on the take away systems and identifies those Sub Regions where capacity concerns may develop. The study focuses on both new facilities, where required, and use of existing infrastructure where practical. The study includes those existing facilities with sufficient processing and gathering capacity to provide alternatives for handling growing production; it includes existing gas processing facilities and their associated gas gathering systems that have sulphur recovery, acid gas injection, and acid gas flaring capabilities with licensed raw gas **design capacities** greater than **40 MMcf/d** and sweet gas processing facilities with **design capacities** greater than **70 MMcf/d**.

The analysis includes the larger sweet gas processing facilities to identify processing and upgrade opportunities to process the developing Montney gas production which may contain H₂S and CO₂. The opportunity to include smaller facilities to further optimize the developing Montney can be assessed in future work within the defined area framework. The challenges related to repositioning an area for a step change in performance are much more than technical issues; any analysis must address business factors that will ultimately determine if solutions can be implemented. The study details a business way forward and addresses suggested commercial solutions for:

- access to capacity
- sharing of value uplift
- sharing new capital requirements.

Finally, it is recognized that a step change in infrastructure performance will affect the Gas Cost Allowance and Producer Cost of Service (Alberta and British Columbia programs) and may increase recovery of hydrocarbon reserves for the benefit of owners of the reserves and the Provinces in which the resource resides.

The Montney Growth Prize

The developing Montney (and other) resources present a unique opportunity to integrate and reposition the area infrastructure for the benefit of both current and developing resources. With the high level of industry activity, both infrastructure capacities and throughputs in the area are in a state of flux. We estimate that currently:

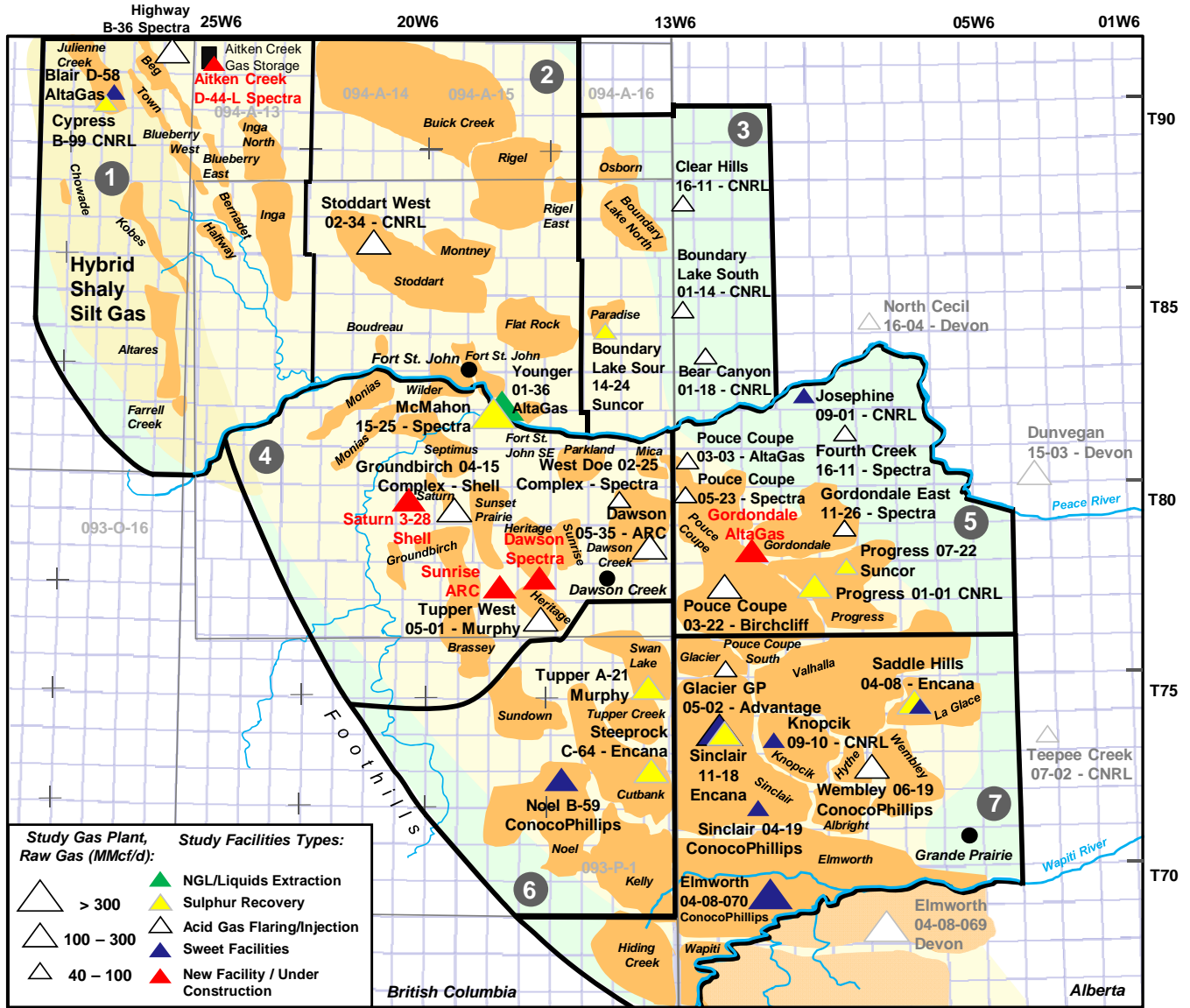
1. the Area infrastructure has a total processing capacity of just over 6 Bcf/d (existing and known currently planned) with surplus unused capacity approaching 2.7 Bcf/d. The capacities include 7 known facilities that are under construction or with planned expansions³ with capacity of 860 MMcf/d
2. there is over 3 Bcf/d of gas currently processed in the study infrastructure
3. operating expenses could be reduced by upwards of \$80 million/year assuming any new or expanded infrastructure will be developed on an industry basis and production through the remaining underused facilities will be consolidated as appropriate
4. capital investment can be reduced by upwards of \$1 billion; Montney growth in central and west regions of the study area will require construction of additional processing capacity; capital investment can be reduced by integrating and coordinating development of additional capacity on an area and industry basis
5. reduced capital investment and decreased operating expenses have potential to generate additional revenue for the Governments of Alberta and British Columbia through reduction in Gas Cost Allowance (GCA – Alberta and British Columbia) and Producer Cost of Service (PCOS – British Columbia).

Study Area

The Montney study area includes: NGL and sulfur recovery, acid gas flaring/injection, sweet facilities, and facilities under construction. To ensure the study carries adequate detail, the overall region has been subdivided into 7 sub-regions. This allows each gas and liquid production forecast to be developed more accurately, while concurrently simplifying the analysis of technical *and* commercial infrastructure options. The rationale of the sub-regions includes: natural geographic boundaries such as the Peace and Wapiti Rivers, the Alberta–British Columbia border, H₂S, CO₂, and NGL compositional differences, gas gathering system reach, known field boundaries, and our professional judgement. Figure 1.1 illustrates the entire study area and labels three sizes of triangles that represent each facility that is included in the study.

³ AltaGas Blair D-58, AltaGas Gordondale, ARC Sunrise 3-36, Birchcliff Pouce Coupe 03-22, Shell Saturn 3-28, Spectra Aitken Creek D-44, Spectra Dawson 11-26

Figure 1.1
Montney Study Area and Sub Regions



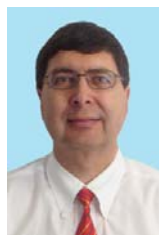
Overview of the Study Team



Bill Armstrong, P.Eng. – Principal, GPMi, 40 years of experience in business management, oil and gas production, operations, management, asset evaluation, process engineering, and design for a large integrated energy company. Bill has worked in Canada and the US and has lead teams responsible for the management of oil and gas development and operations including large sour gas and oil fields. Bill headed a team that separated midstream and liquids marketing functions from producing functions and set up, managed, and divested the midstream business. Bill is currently providing consulting services including asset evaluations, determining strategy for management of midstream assets, and front end evaluation of feasibility and options for development of facilities.



R. N. (Bob) Child, P.Eng. – Principal, GPMi, 3 dozen years of exploration, production, and midstream/gas infrastructure experience including a decade of hands on field oil and gas (sweet and sour) engineering and operational supervision; drilling, completions, land acquisition and reservoir optimization and management, project and operations engineering; the executive accountable for Gas Finding and Development for the Canadian Operations of a multinational oil and gas producer; President and CEO of a major Canadian midstream business and President of a Canadian midstream business for a U.S. based oil and gas producer.



W.P. (Bill) Gwozd, P.Eng. – Vice President, Gas Services, Ziff Energy, has over three decades of experience in gas contractual purchases and gas storage strategies, directing gas control functions for transportation contractual arrangements, and preparing written regulatory applications. Experience includes transportation planning of natural gas liquids pipelines and storage facilities, pipeline acquisitions, gas supply and demand forecasts, gas storage development, and transportation alternatives. He oversees assessments, semi-annual client debriefings, and leads our expert witness testimony service offerings. Focus is on long-term gas price outlooks for LNG, LDC, Pipeline, and power clients. He is a guest contributor to TV stations, radio, newspapers, and magazines.



Zuzana Jurickova – Gas Analyst, Ziff Energy, for the past half dozen years, has assisted with projects in the areas of gas supply and demand research and forecasting analysis. Over this period she has worked on the Western Canada Reserve Replacement (F&D) Cost Study, a study on North American Cost Inflation for a major producer, and a study of North American pipeline expansions for a major steel producer. She is currently working on North American Gas Supply costs for 20 basins (and LNG). Prior to joining Ziff, Ms. Jurickova worked in corporate credit and finance. Ms. Jurickova obtained her five-year Degree in Economics from University of Economics in Bratislava, Slovakia.



Simon Mauger, P.Geol. – Director, Gas Supply and Economics, Ziff Energy, has three decades of experience in the upstream oil and gas industry as an exploration and development geologist in Western Canadian and other locations. Mr. Mauger planned, evaluated, and economically modeled gas resources for a leading international exploration and production company; prepared and optimized long term gas supply plans for growing gas markets, and developed the regional exploration component of the North American integrated natural gas strategy. He develops a gas supply outlook for each North American gas producing region, authors technical research reports on supply, demand, and transport, issues, and assesses gas costs of North American gas basins.



Lev Virine, P.Eng., Ph.D. – Lead Analyst, Ziff Energy, has over 2 decades of technical experience, economic evaluation of oil and gas reserves, decision and risk analysis in oil and gas industry, portfolio management, and oil and gas reserves management. He assisted leading national and international exploration and production companies in establishing reserves evaluation and decision analysis processes. Dr. Virine is the author of more than 40 scientific papers and articles, 7 patents, and two books. His current focus is gas production outlooks, gas supply decline analysis, and full cycle cost assessment. He has spoken at conferences and symposiums around the world. Dr. Virine received his doctoral degree in engineering and computer science from Moscow State University of Railway Engineering.