



Wood Mackenzie

Introduction

Wood Mackenzie has been engaged by the Newfoundland and Labrador Department of Natural Resources (DNR) for the purpose of reviewing and commenting on an analysis prepared for the DNR by Ziff Energy Group (Ziff) on a pipeline solution for grand banks gas. Wood Mackenzie has used its independent views and its in-depth knowledge of the costs of production and transportation of natural gas from off-shore plays, such as the White Rose field to reach the conclusions herein. Wood Mackenzie has not reviewed Ziff's modeling or internal processes, rather we have compared our independent views on the issues as compared to the conclusions of Ziff's analysis.

Review of “Grand Banks Natural Gas As An Island Electric Generation Option”

Cost analysis of offshore infrastructure

The Ziff analysis examines three scenarios for the development of gas resources in the Grand Banks. Cost estimates relate to the expense to produce gas in addition to existing oil production and are all in 2012 terms.

General cost assumptions

Ziff assumes the costs of wells for gas production will be Cdn\$50 million each. Wood Mackenzie believes this is a reasonable representation of expected well costs in this environment. For an oil and gas reservoir, operators may have the option to drill and complete wells that produce both oil and gas, thus reducing the element of costs per well that would be related to gas production. However, given the need for a reliable source of gas, dedicated gas wells would be more appropriate, thereby justifying the approach of assuming gas-only production wells.

An assumption of Cdn\$400 million for an offshore gas conditioning plant has been indicated. Ziff states that this will cost around twice the amount of an equivalent plant located onshore in Alberta. We feel that this is a reasonable assumption, given the more complex and sophisticated technology that would be required to install the facilities offshore with more limited space. There is however significant risk of higher costs, which could arise in particular due to regulatory specification requirements and installation.

Stand Alone Development

Ziff assumes the cost for a Gravity Based Structure (GBS) to manage gas production would be between Cdn\$1.5 and 2.4 billion. GBS facilities are notoriously expensive – Wood Mackenzie estimates that ExxonMobil's Hebron GBS, due onstream in 2018, will cost

approximately Cdn\$6 billion. The structure proposed in the Ziff paper would be smaller in scale and therefore less costly. Nevertheless, we expect costs would be right at the top end of Ziff's estimated range, and expect Cdn\$2.5 billion to be a more representative conservative estimate.

FPSO

To use the existing White Rose FPSO, Ziff assumes a refit would cost Cdn\$600 million (including Cdn\$400 million for the gas plant). Ziff states that turret and vessel modifications would make up the balancing Cdn\$200 million, and likely exceed this amount. We also feel that these modifications would likely be higher – a total cost of Cdn\$800 million would be more representative of a conservative estimate for FPSO refit.

The analysis assumes vessel replacement would be required by 2030, assigning a cost to represent the gas element of Cdn\$450 million. This is split as Cdn\$250 million for refit of an existing oil FPSO, and Cdn\$200 million to transfer the gas plant. This is representative of current costs that could be achieved, but there is considerable upside risk to these cost estimates. In addition to the cost risks in common with any offshore development, there is presently increasing demand in the FPSO market. While it is difficult to state the condition of the FPSO market in 2030, we feel it may be more prudent to assume a higher cost for the gas element of an FPSO replacement, in the order of Cdn\$600 million.

Integrated West White Rose

Ziff considers the scenario of expanding Husky's West White Rose GBS to incorporate gas production. Additional costs of 50% are assumed, equating to Cdn\$1.1 billion. We agree that an incremental cost factor of 50% is appropriate. However, the implied total cost of Cdn\$2.2 billion would represent the lowest end of the likely cost range. Ultimately the specifications of this smaller GBS will determine cost, but for a base estimate, Cdn\$3 billion would be more representative and better cover upside cost risks. Consequently, we feel the incremental cost for gas production would equate to Cdn\$1.5 billion.

Pipeline

Ziff estimates that a pipeline from production to shore would cost Cdn\$640 to 1,165 million. This estimate is based on an estimate of Cdn\$182,000/inch-mile which, under the assumption of a 16-inch diameter, equates to around Cdn\$1.8 million per kilometre. This is a reasonable representation of offshore pipeline costs.

The length of pipeline required ranges from 350 to 640 kilometres, depending on the route chosen. The choices are a short route to shore, or longer deeper route to avoid potential iceberg scour. Ziff rightly states that in the case of a short route, there would be additional cost for trenching the pipeline to avoid iceberg scour. Pipeline trenching costs would depend on requirements specific to the environment, and as such it is hard to place a definitive cost on them. Nevertheless, given that the shorter route would require more trenching, it is fair to say that the lower cost estimate provided should be used as a guide only and does not reflect this uncertainty, indicating a likely higher cost for the pipeline.

Comment on inflation

The Ziff analysis does not factor in any assumption for future cost inflation. In the Canadian upstream oil and gas sector there is ongoing expansion of operations in several sectors, most notably within tight/shale gas and oil sands. We expect inflationary pressures in the

sector to remain into the future, impacting the economics of an offshore development. This warrants a mention as part of the analysis.

Comments on presentation by Dr. Brunneau

Ziff's analysis comments on some of the assertions made by Dr Brunneau's presentation regarding the viability of natural gas production in the Grand Banks. For comments relating to the feasibility of an offshore gas production development, we find Ziff's comments to be reasonable. We will add to Ziff's comments that Dr. Brunneau's assumption that producers will sell gas to Newfoundland at a Henry Hub price is pure speculation, as the price must support the costs plus a reasonable profit in order for a producer to be incentivized to produce the gas.

Wood Mackenzie's Conclusions

Wood Mackenzie generally finds Ziff's analysis and conclusions relative to natural gas as a fuel source for Newfoundland to be reasonable in regards to the use of natural gas produced in the White Rose fields. If anything, Wood Mackenzie's estimates of costs in this area would tend to be higher, rather than lower than those determined by Ziff. Additionally, we believe that the Government of Newfoundland may find it difficult to enter a contract for that gas that would make the producers interested in producing the gas for market due to the costs of production and the low level of requirements that Newfoundland will have for power generation.