A technical and economic evaluation of coalbed methane production projects in the Bowen and Sydney Basins of Australia

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ABSTRACT

A two-part study was performed to technically and economically evaluate four coalbed methane (CBM) production experiments in the Bowen and Sydney Basins of Australia. Three experiments in the Bowen Basin were studied, namely at Moura (1976), the Leichhardt Colliery (1980) and Broadmeadow (near Moranbah, 1987) and one in the Sydney Basin at the Appin Colliery (1981). The technical study provided (1) descriptions of the geologic conditions, operational details and observed production results at each experiment site, (2) stimulation and reservoir performance modelling to ascertain the overriding mechanisms responsible for the observed production results at each site (i.e., permeability, fracture length), and (3) forecasting the likely production results at each site had current CBM extraction technology been available at the time.

The results of the study showed that the fracture stimulation treatments performed at the Moura, Leichhardt and Appin sites were largely, if not entirely, ineffective; the stimulation volumes were insufficient in size. This, in conjunction with the high stress/low permeability settings at each site, were the primary causes for the unencouraging production results. At the Broadmeadow experiment, the stimulation results were substantially superior to the earlier trials due mainly to the large fluid and sand volumes utilized.

Simulated production profiles improved considerably when the stimulation effects of current fracturing technology was applied, particularly, at Moura, Leichhardt and Appin. Multiple-seam completions could have provided additional production at Leichhardt, but more noticeably at Broadmeadow.

When the benefits of an advanced exploration program were incorporated (i.e., normal and relaxed stress settings with correspondingly higher coal permeabilities) well production forecasts were further improved.

The economic investigation assumed that current stimulation and multiple seam completion technologies had been applied. A total of 12 cases were evaluated, specifically three tectonic stress settings at each of the four experiment sites. The forecasts showed peak gas production rates ranging between 69-127 MSCF/D for high stress settings, 346-867 MSCF/D for normal settings and 840-2,451 MSCF/D for relaxed settings.

Well expenditures were estimated for each of the geographic locations studied. Field facilities costs such as gas gathering, compression and dehydration, and water collection and disposal were also included such that the total well expense represented that required for the sale of gas into a high pressure, common carrier pipeline. The estimated total well expenditures ranged from A$324,987-A$582,558 for high stress settings, A$461,335-A$882,366 for normal stress settings and A$682,229-A$1,524,571 for relaxed stress settings.

The production forecast and well expense data were then combined to calculate the cost of the gas in A$/MSCF. The results ranged from A$2.42-A$5.11/MSCF for high stress settings, A$0.81-A$1.18/MSCF for normal stress settings and A$0.53-A$0.73/MSCF for relaxed stress settings. These figures clearly indicate CBM is a commercially competitive energy resource under present technological and economic conditions in Australia, and can be highly profitable with the application of a successful exploration program aimed at identifying normal and relaxed tectonic environments.