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The Effect of Finding and Development Costs and Gas Price on Basins in the Barnett Shale

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Abstract : Shale gas reservoirs have been of greater importance compared to shale oil reservoirs since 2009 and with the current nature of the oil market, understanding the technical and economic performance of shale gas reservoirs is of importance. Using the Barnett shale as a case study, an economic model was developed to quantify the effect of finding and development costs and gas prices on the basins in the Barnett shale using net present value as an evaluation parameter. A rate of return of 20% and a payback period of 60 months or less was used as the investment hurdle in the model. The Barnett was split into four basins (Strawn Basin, Ouachita Folded Belt, Forth-worth Syncline and Bend-arch Basin) with analysis conducted on each of the basin to provide a holistic outlook. The dataset consisted of only horizontal wells that started production from 2008 to at most 2015 with 1835 wells coming from the strawn basin, 137 wells from the Ouachita folded belt, 55 wells from the bend-arch basin and 724 wells from the forth-worth syncline. The data was analyzed initially on Microsoft Excel to determine the estimated ultimate recoverable (EUR). The range of EUR from each basin were loaded in the Palisade Risk software and a log normal distribution typical of Barnett shale wells was fitted to the dataset. Monte Carlo simulation was then carried out over a 1000 iterations to obtain a cumulative distribution plot showing the probabilistic distribution of EUR for each basin. From the cumulative distribution plot, the P10, P50 and P90 EUR values for each basin were used in the economic model. Gas production from an individual well with a EUR similar to the calculated EUR was chosen and rescaled to fit the calculated EUR values for each basin at the respective percentiles i.e. P10, P50 and P90. The rescaled production was entered into the economic model to determine the effect of the finding and development cost and gas price on the net present value (10% discount rate/year) as well as also determine the scenario that satisfied the proposed investment hurdle. The finding and development costs used in this paper (assumed to consist only of the drilling and completion costs) were £1 million, £2 million and £4 million while the gas price was varied from $2/MCF-$13/MCF based on Henry Hub spot prices from 2008-2015. One of the major findings in this study was that wells in the bend-arch basin were least economic, higher gas prices are needed in basins containing non-core counties and 90% of the Barnet shale wells were not economic at all finding and development costs irrespective of the gas price in all the basins. This study helps to determine the percentage of wells that are economic at different range of costs and gas prices, determine the basins that are most economic and the wells that satisfy the investment hurdle.

Keywords : shale gas, Barnett shale, unconventional gas, estimated ultimate recoverable
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