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A Better Way to Understand Recoverable Shale Gas in the Horn River Basin, British Columbia, Canada

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Abstract

There are many production decline models publically available for analyzing production performance and well estimated ultimate recovery (EUR) evaluation in unconventional resource plays. Each model is based on a set of assumptions or different boundary conditions, and applicable to those reservoirs that meet the application conditions. For example, Arps model (Arps, 1945) was designed for production decline for conventional reservoir and may over-estimate EUR if it is applied directly to a transient dominated flow regime in shale reservoir. In contrast Patzek model (Patzek et al., 2013) by assuming a linear and single-phase flow of gas into parallel, equidistant fractures may under-estimate the gas potential due to pre-existing natural fractures and desorption processes (Cueto-Felgueroso and Juanesa 2013). Geological and reservoir characteristics of the Horn River Shale in Northeast British Columbia, Canada may differ significantly from other shale gas producing formations in the United States. The selection of a proper production decline model is essential for reserve estimation, production performance analysis and economic evaluation.

This study compares production decline models using historical shale gas production data from the Horn River Basin. Monthly gas production records from 214 wells with record length greater than 12 months are collected and used for the analysis. The four most commonly used production decline models: Arps model (Arps, 1945), Stretched exponential model (Valko and Lee, 2010), Patzek model (Patzek, et al., 2013) and Duong model (Duong, et al., 2010), are tested for their stability, goodness-of-fit and predictability.

The preliminary results of the study suggest:

a) The Arps and Valko models are easy to apply for fitting to the historical production data, while the Patzek and Duong models may fail to fit data if a data set has record length less than 24 months, especially 12 months;

b) Arps and Duong models appear to yield optimistic 30-year EURs, while the Petzak model commonly gives a conservative 30-year EUR numbers. Both Valko and Patzek models project a practical 10-year EURs if 24 months production data are used.

c) Overall, the Valko model appears to produce a moderate EUR value than the other three models, and is more stable in most of the cases if longer production data are utilized.

d) The result shows an average 10-year EUR per well is 5.7 billion cubic feet (bcf).

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