Chapter 4
Exponential Decline

ABSTRACT

The Decline Curve analysis of the oil and gas wells model examines the production forecasting for oil and gas wells, i.e., the exponential decline curve. The standard equation, q = qie-at (3.3), can be used with random variables for both qi (the initial production rate, sometimes called IP) and a (the constant decline rate). Here the model has an additional parameter, t (time), which makes the output (Rate, STB/YR) more complicated than the volumetric reserves output. The distributions of numbers for output and forecasts or graphs are needed. The worksheet has two input cells, IP and Decline, and a column of outputs for the Rate of production in STB/YR over 15 years. After the simulation, a summary graph is generated. This graph shows uncertainty over the 15 years. Two colors signify 1) the 5th and 95th percentiles and 2) the 25th and 75th percentiles, thus representing a 90% confidence interval.

INTRODUCTION

Exponential Decline

The decline curve is a method for estimating reserves and predicting the rate of oil or gas production. It typically shows the pace at which production is expected to decline over the lifetime of an energy asset.

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- The decline curve is a method for estimating reserves and predicting the rate of oil or gas production.
- The decline curve is a method used to determine the estimated ultimate recovery (EUR) for an oil or gas reserve.
- Primarily based on good conditions, three types of decline curves can apply to the future trend: exponential, hyperbolic, and harmonic.

Knowing the decline curve can help a producer estimate the number of oil reserves that can come from a well over its lifetime, the present and future value of a well, and the rate at which assets should depreciate on a company's books. In aggregate, the decline curve can also help determine the rate of production for a total reservoir or even multiple reservoirs.

The decline curve is a method used to determine the estimated ultimate recovery (EUR) for an oil or gas reserve. This calculation rests on a set of equations that U.S. geologist J.J. Arps developed in 1945. It is of the utmost importance that drilling projects meet an acceptable EUR threshold for a project to be considered viable and profitable.

In theory, the decline curve can apply to most wells in the industry. Underlying the decline curve equations is an expectation that well-production typically follows a three-part pattern.

1. In the initial phase production phase, the flow of oil or gas remains relatively steady, as pressure stays nearly constant.
2. Next is a transient period in which the flow of oil or gas declines rapidly, as the quantity of recoverable assets and pressure in the wellbore decreases.
3. Lastly, assets deplete to a level at which they approach the well's defined boundaries.

Arps decline curve equations most often apply to the boundary-defined production phase.

Calculating the decline curve involves a curve-fitting exercise to interpolate the future rate of production based on past production levels. Therefore, a somewhat lengthy period of time-series data is needed to estimate the projected trend. Also, the decline-curve equations assume

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