Practical Aspects of Shale Reserves

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Abstract

The technology of reserves estimation in shale plays still lags the significance of the production, but the methods are developing rapidly. Of the six historical reserve methods, only three apply meaningfully to shales, if done correctly. Volumetrics is not a suitable reserve method for individual wells/programs. The appropriate bulk rock volume is too poorly defined in both the subject well and in supposed analogs, and the recovery factor for the rock volume must ultimately come from analogy. The recovery factor of analogs is not well-defined, and even if they are, the range of uncertainty is very broad by comparison to a central estimate. The uncertainty can easily be +/- 50% or more for oil and liquid-rich plays. (Volumetrics may, however, be useful for project screening and wide-ranging resource assessments.)

Rate-transient analysis has come a long way since the start of the shale revolution, and it can now generate reliable estimates. However, it begins with production decline analysis and should end with simulation, and the unique intermediate analysis necessarily involves a number of simplifying assumptions which may or may not suit the situation. While RTA is a powerful and fast technique, simulation is more robust and more flexible, and it need not be intimidating.

The most used technique is decline curve analysis, but this is particularly susceptible to improper application, and mistaken Arps analysis almost always overcalls reserves. About eight alternative decline methods have been proposed to replace Arps, but none has yet proven itself superior to the others. Moreover, the software application for the alternatives is limited, making Arps the de facto choice for the time being. In early time, the b-factor for an Arps fit of a tight or shale well should be around 1.5 to 2.0, and practice bears out this theory. Theory and simulation both suggest that the very late time behavior should have a low hyperbolic factor, probably around 0.5. The long transition in between represents a slow dropping of the bfactor. This intrinsic and well-established fact suggests that Arps forecasts should ignore the earliest data and choose modest b-factors with a conversion later in life. In this way Arps can approximation the established decline behaviors.