

## **TGS Evaluation: An Overview of Key Challenges and Best Practices for Resource Evaluation**

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### **Abstract**

The unconventional gas resources continue to be a growing part of the total gas production globally and have captured the interest of oil & gas companies around the world. Pakistan is currently undergoing severe energy crisis with rapidly declining conventional hydrocarbon reserves. It is high time for oil industry to focus on tapping the unconventional reserves. The unconventional resources comprise three major categories: tight-gas sandstones (low-permeability), shale gas, and coal-bed methane (CBM). According to published figures, Pakistan is endowed with sufficient reserves of both shale gas and tight gas sands with estimated reserves in the range of ~35-40 TCF.

As per the Government of Pakistan regulations, the tight gas reservoir is defined as a natural gas bearing zone that has estimated value of effective permeability less than 1.0 millidarcy (md). The reservoir may also be defined as “tight”, if the effective permeability is less than 1 md and the unstimulated gas flow rates are less than 1 MMSCFD. The tight gas reservoirs exhibit storage and flow characteristics that are intimately tied to depositional and diagenetic processes. Consequently, the exploitation of these resources requires a comprehensive reservoir description and characterization that control resource volumes.

Through this paper an attempt has been made to demonstrate the TGS evaluation process and highlights of significant technical challenges, as matter of fact, the reserve estimation in tight gas reservoirs is influenced by structural trap/integrity, uncertainties on the size of gas pool and subsequent recoveries using different reserves estimation methods, and practical aspects of integrated G&G and reservoir sector modeling results in TGS exploitation. For practical purposes, a complete tight gas sand evaluation process has been demonstrated through example of a tight gas sand discovery in the Middle Indus Basin, Pakistan. This paper will take the readers through different approaches that cover simple to complex but more realistic processes used for evaluation. A comprehensive discussion has been made highlighting different technical challenges that confront tight gas sands evaluation and is broadly grouped into three categories: (1) Closure size based on SSP/GWC sensitivities, (2) Petrophysical approach used for tight gas reservoir parameters estimation, (3) Different reserves estimation methods. There are, of course, complex inter-dependencies between each of these general categories. The tight gas evaluation remains incomplete without reservoir engineering part hence the process has been discussed for different sector modeling approaches in close collaboration with the G&G.