

January 2021 – CSUR Technical Webinar

Applications of Rate and Pressure Transient Analysis in Huff-n-Puff Gas EOR for Unconventional Reservoirs



APPLICATIONS OF RATE AND PRESSURE
TRANSIENT ANALYSIS IN HUFF-N-PUFF GAS
EOR FOR UNCONVENTIONAL RESERVOIRS

PRESENTED BY
FARHAD QANBARI, SEVEN GENERATIONS ENERGY.

Farhad Qanbari, a Senior Reservoir Specialist from Seven Generations Energy, was the keynote speaker for CSUR's January 2021 Technical Webinar. As the industry continues to move forward in optimizing processes and maximizing recoveries from their properties & reservoirs, a combination of innovation and new technologies, together with existing evaluation tools & methods, are being utilized to assess potential candidates for enhanced recovery schemes. The presentation was titled "Applications of Rate and Pressure Transient Analysis in Huff-n-Puff Gas EOR for Unconventional Reservoirs".

While there are no active enhanced recovery projects at his company, the speaker mentioned that preliminary work has been done to identify potential candidates for field implementation should future operational & economic conditions allow. He commenced the talk with a project overview of what appears to be the birthplace of this work – EOG Resources' Eagle Ford play in Texas. This project, and the subsequent positive results in the form of an uptick in oil production, has provided the impetus for the unconventional resources sector to science, engineer & apply this and other enhanced recovery techniques for various unconventional plays in North America.

In evaluating for potential candidates, Farhad listed the following four as the controlling factors for Gas Huff-n-Puff (HnP): Fluid Properties, Reservoir Containment, Stimulated Zone Parameters & Compressor Capacity. As with speakers from previous CSUR sessions on this topic, he stressed that all facets of the system need to be understood. In addition, proper collection and analysis of key data also needs to be a critical component in the evaluation process. Tools such as Rate Transient Analysis (RTA), Pressure Transient Analysis (PTA), Statistical Analysis and Reservoir Modeling all serve and should be used to characterize the target area for Gas HnP. He noted that of particular importance was to define or estimate the enhanced (stimulated) region using PTA & RTA, in relation to the surrounding matrix. The significance of well & regional diagnostic fracture injection test (DFIT) results were also crucial in assessing the local & surrounding stress distribution to ensure HnP injection remain below the fracture pressure and maintain reservoir containment. Finally, pressure interference testing and the corresponding modeling allowed for an estimation of the effective permeability between wells and the extent of inter-well communication.

The speaker concluded in his remarks and also during the subsequent Q/A period that while the technical merits and evaluation of an enhanced recovery scheme were necessary & prudent, the economics of the potential projects here in Canada are currently considered inferior to new drills for field implementation.

Summary

Gas injection huff and puff (HnP) has been successfully applied in parts of Eagle Ford over the past few years. The success is attributed to gas and oil miscibility achieved by injection of gas at high pressure and rate in a contained hydraulic fracture system with a considerable stimulated volume. Two key preliminary steps in gas HnP modeling include characterization of reservoir fluid (and its interaction with injected gas) and evaluation of hydraulic fracture system. This study focuses on applications of simplified analytical tools in characterization of multi-fractured horizontal wells and estimation of stimulated reservoir size.

Rate-transient analysis (RTA) is a tool for identification of flow regimes and estimation of key performance metrics for multi-fractured horizontal wells. The flow regimes include enhanced fractured region (EFR), bilinear flow, transient linear flow, transitional flow, and boundary-dominated flow. In this study, the size of stimulated rock and total effective fracture area are estimated using an RTA method. Furthermore, diagnostics fracture injection tests (DFITs) and pressure buildup tests are used to characterize the multi-fractured horizontal wells for the purpose of gas EOR evaluation. Pressure interference tests are also used to quantify the conductivity of connecting fractures between communication wells. The methods are applied to field cases from Montney and other unconventional formations in North America and the results are presented.

This study helps the engineers and managers with reservoir and hydraulic fracture characterization and the screening process for gas HnP candidates. The outputs of these methods serve as first pass of SRV size for more detailed numerical modeling studies.

PRESENTER: Farhad Qanbari, Seven Generations Energy.

Farhad Qanbari is a senior reservoir specialist at Seven Generations Energy and has been with 7G since 2017. His work has been focused on RTA, PTA, DCA, reservoir modeling, EOR in unconventional reservoirs, and PVT. Prior to working at 7G, he worked as a reservoir specialist at Black Swan Energy and Saguaro Resources. He holds a PhD and M.Eng. in petroleum engineering from U of Calgary and an M.Sc. and B.Sc. in reservoir engineering from Petroleum University of Technology, Iran. He has authored/co-authored more than 40 peer-reviewed and conference papers on unconventional reservoir evaluation and optimization.



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TECHNICAL WEBINAR

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Transient Analysis in Huff-n-Puff Gas EOR
for Unconventional Reservoirs**

presented by Farhad Qanbari, Seven Generations Energy.

Tuesday, January 26th, 2021 | 10:00am MST
pre-registration is mandatory

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