



# A comprehensive overview on recent developments in refracturing technique for shale gas reservoirs



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## ABSTRACT

Refracturing is described as hydraulic fracturing the formation which has earlier been hydraulically fractured. Presently, it is among the most widely used restimulation techniques. The technique to refracture the wells which are less productive and having poor reservoir quality has been applied since 1940s. The perception, however, is that refracturing technique is generally unsuccessful. But with the recent advancement in technology and improved refracturing techniques, many operators have now successfully implemented this technique for not only poor but also good quality reservoirs to increase production rate and to enhance ultimate gas recovery from shale gas wells. It also serves as countermeasure against the declining rate of gas price, because refracturing operation is less costly compared to drilling and completing a new well. Refracturing operation, in general, is a complex process. Additional research and development is needed for its successful implementation and higher reliability. This paper explores the attributes responsible for successful refracturing treatment and conditions limiting the application of refracturing treatment. Furthermore, it presents the procedure for candidate well identification and discusses the refracturing treatment design, treatment diagnostic techniques and economical evaluation of the treatment. In addition, it also highlights the challenges for refracturing treatment. It also presents two case studies to support the concept and demonstrate recent developments. The paper provides significant insight into the refracturing technology and the guidelines for its successful application in shale gas reservoirs.

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## 1. Introduction

During the life of the well, additional fracture treatment may be economically considered to improve the well productivity. This treatment is known as a refracturing treatment or refrac. Presently, it is among the most widely used restimulation techniques. Refracturing is injecting treatment slurry from the same or new perforations to improve the performance of old fractures or create new fractures in the formation which was already stimulated by hydrofracturing. When a refracturing treatment is performed on a well which has already been refractured, it is known as tri-frac (Wolhart et al., 2007). Refracturing technique increases production rate and enhances ultimate recovery of gas. Refracturing is not a new technique, since 1940 the technique of refracturing is applied

to wells with less hydrocarbon potential and poor reservoir quality which has led to the perception that this technique may not be successful. But with recent advances and improvement in refracturing technology, many operators have been persuaded to apply it for poor as well as good quality shale gas reservoirs.

Jacobs (2014) analyzed that in shale gas reservoirs the production rate declines significantly in the first year and large volume of gas remains in the formation. So refracturing can be applied to revive the declining production rate and improve gas recovery. Jacobs (2015) calculated the approximate cost of refracturing as USD 1 million to USD 3 million and drilling and completing a new well for shale gas as USD 8 million to USD 16 million. Therefore, refracturing treatment can be applied as an alternative of drilling and completing a new well in the current low gas price environment. This can be the biggest driver for research and development on refracturing as it is one of the most complex process to implement successfully.

This paper explores the attributes responsible for successful refracturing treatment and conditions limiting the application of

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