Storing CO_2 in Unconventional Gas Reservoirs Through the Development of an Optimum Hydraulic Fracturing Design

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The recent revolution of unconventional shale gas resources has flipped the coin to a new era in the oil and gas industry and the world. The primary motivation of this research is to utilize the unused resources of gas, which will be a major relief to reduce the current high usage of crude oil. This complies with the Saudi Arabia's 2030 vision to diversify the economy and use cleaner energy. The objective of this project is to use the depleted gas reservoir for CO_2 storage by optimizing gas from the unconventional gas well and estimating the volume of CO_2 that can be stored in the depleted reservoir. Storing CO_2 in the subsurface of unconventional shale gas reservoirs reduces greenhouse emissions and maintains the underground pressure. The key technology that is proven effective to unlocking hydrocarbon from unconventional reservoirs is hydraulic fracturing, a drilling process that produces ruptures in the rock formation to stimulate the flow of natural gas. The Computer Modelling Group GEM reservoir simulation software was used to study the case at hand. It was found that the optimum design was 25 hydraulic fractures, each with a half-length of 250 ft, with a maximum gas production of 30,000,000,000 ft3 and a minimum operational cost. In addition, it was proven that the depleted reservoir could accommodate approximately the same volume of CO_2 as for shale gas. This research could lead to higher levels of gas production and less CO_2 emissions from unconventional gas reservoirs by using the key technology required.