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TITLE

The shale gas revolution: barriers, sustainability, and emerging opportunities

ABSTRACT

Shale gas and hydraulic refracturing has revolutionized the US energy sector in terms of prices, consumption, and CO_2 emissions. However, key questions remain including environmental concerns and extraction efficiencies that are leveling off. For the first time, we identify key discoveries, lessons learned, and recommendations from this shale gas revolution through extensive data mining and analysis of 23 years of production from 20,000 wells. Discoveries include identification of a learning-by-doing process where disruptive technology innovation led to a doubling in shale gas extraction, how refracturing with emerging technologies can transform existing wells, and how overall shale gas production is actually dominated by long-term tail production rather than the high-profile initial exponentially-declining production in the first 12 months. We hypothesize that tail production can be manipulated, through better fracturing techniques and alternative working fluids such as CO_2, to increase shale gas recovery and minimize environmental impacts such as through carbon sequestration.