Bridging the Gap Between Produced Water and Source Water: Modeling Water Management Economics to Identify Cost Saving Potential for Operators

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Abstract

Increasing concerns about seismicity events and groundwater contamination are fueling increased regulations that can significantly burden an operator’s water management budget – especially in a low-cost market. Operators need alternatives to deep well disposal while at the same time they need large amounts of water for new well completions. Accordingly, our aim has been to evaluate the economics of produced water (PW) treatment and reuse as an alternative to well disposal. The primary objectives are: 1) determine general field conditions that economically favor treatment and reuse, 2) compare the relative economics between mobile (on-site) and centralized treatment, 3) evaluate pipeline infrastructure versus trucking and 4) investigate feasibility of a zero liquid discharge (ZLD) treatment versus conventional treatment approach.

The model, built to address the objectives, functions as a PW management planning and decision support tool for an operator. For input field conditions, the model simulates disposal and treatment and reuse – comparing mobile versus centralized treatment. Trucking and pipeline conveyance are evaluated for centralized treatment transportation. The model outputs the net water management cost and operator breakeven treatment cost (OBE) for each scenario. The OBE is the cost of treatment for which the economics of injection disposal and treatment and reuse are equal. When a service company’s treatment cost is less than or equal to the OBE, treatment and reuse is feasible.

A sensitivity analysis identified the primary economic drivers. The observed effects of each driver on the OBE indicate conditions that promote treatment and reuse. These conditions include long distances, high treatment recoveries, high injection costs and long project lifespans. Relative economics favor mobile treatment and reuse for long distances, high treatment recoveries, low project lifespans and an increase in pipeline cost. The opposite is observed for centralized with pipeline. The model was run with example field data. Results provide key insights into the effects on PW treatment economics and potential cost savings for operators.

With minimal input, this model was used to evaluate a number of “what-if” scenarios applicable for both operators and service companies and provides a better understanding of treatment and reuse economics. Knowing the best option for a specific water management plan results in reduced capital and operating expenses and better environmental compliance.

Introduction

Throughout the lifetime of oil and gas wells, a combination of oil, gas and water are produced. Water is the largest byproduct of this production (SPE 2011). With the growth in development of unconventional resources in the exploration and production (E&P) industry, the use of hydraulic fracturing has increased water consumption and attracted major public attention to water in the industry. On average, 0.5 to 10 million gallons of water are used per well to fracture, and 20 to 40% of this volume resurfaces in just a few weeks (Kondash, Albright, and Vengosh 2017, Marcellus-Shale 2011). This initial water is commonly termed flowback, whereas additional water during