Water Management Innovation Must Lead, Not Follow, Shale Revolution

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Unconventional oil and gas has transformed the energy industry in the last decade. Hydraulic fracturing and horizontal drilling techniques have revolutionized how we extract oil and gas from places that wasn't possible only a few years ago, but alongside this significant opportunity has come new challenges.

One of the biggest challenges is the management of water; how it is used, how it is disposed and increasingly how it is recycled. The energy industry and its regulators agree that sourcing and managing water in a cost effective and sustainable manner is the key issue that needs to be tackled with effective acceptable solutions. The question that poses problems is how can industry make it their reality, and in answering this challenge all stakeholders have to remember that shale oil and gas production are still in the embryonic stages. While technology advancement in fracking has been meteoric, the innovation surrounding water management has lagged.

Fracking requires large quantities of water to be combined with sand and chemicals. This mix is then forced in between impermeable shale rock formations in an attempt to unlock the potentially vast reserves of oil and gas. Around two to six million gallons of mix - up to 150,000 barrels, plus - is required to drill and fracture a typical well. Limited water supply is therefore an acute challenge, especially in dry climates.

Companies must also address the environmental concerns that surround the disposal and transport of water. A tightening regulatory landscape is forcing the industry to change for the better. But between 20% - 80% of oft-toxic water is pushed back to the surface during fracking as flowback, which means the scale of the environmental challenge is considerable. Shale water contains many contaminants. Gases like carbon dioxide, hydrogen sulphide, nitrogen, helium and brine are in the flowback, along with quantities of materials like mercury, arsenic and uranium. Consequently, the industry wants to reuse as much water as possible for fracking.

The advantages are clear. Reusing water reduces the discharge to storage ponds and the controversial injection of wastewater into underground wells, which critics say can contaminate aquifers and trigger seismic activity. Transport costs are also slashed because less water needs to be taken away from the site and disposed of.

Schemes to reuse 100% of the water produced at fracking basins have been successfully piloted in the US. This is a good start, but these programmes must be rolled out industry-wide and the relevant technologies and expertise must be shared, analysed and improved upon.

Investing and deploying a widespread water recycling programme will require a huge collaborative effort from engineers, technicians and operation specialists. Companies are discovering that a fully integrated process is the best foundation of an effective water management strategy, which needs to incorporate the complete life cycle of water from sourcing, transfer, storage, reuse and disposal.

Companies need to better understand how water can be recycled based on its composition and which technologies they need to then apply that knowledge. Other specific calculations must be worked out, such as the volume of water required for each fracking process and the precise volumes of the subsequent flowback and waste water.

There are already some recycling options available. Flowback water can be reused without treatment if it has a safe chemical profile and some companies are exploring the use of saline and not freshwater in the production process. Alternatively, companies can use deep well injections and there is a growing trend for treating water onsite. But managing wastewater at the wellhead is only a cosmetic solution to a bigger problem, as it doesn't address the long-term need for a large scale recycling framework that uses economies of scale.

A large scale framework could use centralized water management plants that are connected to wellheads by pipelines. Wastewater can be identified from a certain well and then processed and piped back to suit the requirements of that operation.

Managing shale water is not just about the environment as it can significantly affect economics in the field. Water analysis plays a key role in the modelling of reservoirs, estimating reserves and calculating costs, including the expense of drilling and surface equipment. Water-free fracking may emerge as the answer, but the technology is expensive and in its very early stages.

Many companies are promising a silver bullet that incorporates cost-effective and sustainable water management, but the challenges that come with managing water will be unique to every well and every geological site. A solution for one field may not work in another.

The costs associated with water management will no doubt make or break some shale operators in years to come. This highlights the importance of an integrated approach, where a complete water management team is armed with engineers who can help boost cost and operational efficiency to ultimately achieve a 100% recycling ratio. ■