SHALE PLAY WATER MANAGEMENT
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Desalination Update: Market Drives Changes

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Operators are reducing their capital-heavy development programs in response to the new market realities and digging deep to find efficiencies in operational costs. The techniques and technologies of water treatment are no exception.

As a link in the water-treatment chain, desalination is an established, effective process for removing salts from flowback and produced water. Advancements in desalination technology offer water managers options for treatment depending on inflow salinity, desired outflow and economics.

Lately, operators and their oilfield-service partners are using the slowdown in drilling and completions to examine overall water acquisition, flowback and produced water expenses. Operations are being reviewed for inefficiencies, and those technologies overlooked during the rush to make holes and fill pipes are getting a second take.

Treatment of brackish sources, reuse of produced water, regulatory compliance and transportation costs are all under the microscope, according to industry experts. And, many see falling rig counts and rising numbers of uncompleted wells as an ideal time to evaluate and adjust.

Definitions

Salinity based on dissolved salts	
Fresh water	< 0.05%
Brackish	0.05 - 3%
Saline	3 - 5%
Brine	> 5%
Saturated	26%

Source: Wikipedia

"The biggest cuts for many operators today are capital expenses in exploration and new developments," says Patrick Curran, Chief Executive Officer at Atlantis Technologies. "On the production side, the cost of treating water has not gone away. In fact, a greater percentage of their cash flow is going into managing that expense."

According to Curran, in many unconventional plays, a typical well produces five barrels of water for every barrel of oil at an average disposal cost of $2.50 bbl. "That's $12.50 for every barrel of oil they sell. With oil at $50 bbl, when an operator sees a line-item cost grow to one-quarter of the sale price, they know it's time to do something about it."

Although figures for produced-water to oil ratios and costs for disposal vary from field to field, it's clear that "many oil companies could be called water companies," according to report from Schlumberger.

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For an operator, managing water costs is more than sharpening a pencil. Often, it means taking a fresh look at an established production field and weighing options. For a supplier, it means understanding the challenges operators face and providing a solution that is flexible and a better value. By working together, some fixed operating costs can be "unfixed."

"We are definitely seeing a slowdown related to oil prices," says Nathan Zaugg, global industrial wastewater practice leader at MWH Global, a Broomfield, Colo.-based water-services company.

"Smart companies are taking this time as an opportunity. They are reassessing infrastructure and looking at new ways to make these fields more profitable. With the great rush to drill as many wells as possible, there wasn't a lot of thought put into water gathering, treatment and transportation expenses. Without a doubt, operators that get good at efficiently managing their water are going to be the winners."

Zaugg notes there are "myriad options available" for new developments to design systems that reduce treatment and transport costs. "If operators can make an investment in an intelligent infrastructure design," notes Zaugg, "they can reduce operational costs and return the investment many times over."

TREATMENT OPTIONS

When considering treatment options, Zaugg advises that membrane-desalination systems such as reverse osmosis (RO) are effective for low salinity waters with total dissolved solids (TDS) below 40,000 mg/l. Above that level, brine production increases, and a treatment operation becomes uneconomical, he says.

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At lower TDS levels, an RO system can be designed to reduce salinity to desired output levels. In general, operating costs increase with greater freshwater volumes. RO systems can also be used with other desalination techniques to produce brine concentrates if the goal is to reduce disposal volumes, notes Zaugg.

For treating water with higher TDS levels, water-treatment options include thermal desalination or vapor-compression systems. Ion-exchange systems are useful for managing scale issues from hard-water inputs.

A desalination system, such Atlantis Technology's, uses a radial deionization capacitor design to recover up to 95 percent fresh water at a lower cost, according to the company.

In designing a treatment system, "there is no 'one size fits all,'" says Zaugg. Investment decisions must consider all the specifics of the operation and still keep economics in the foreground.

In response to a call for water-management solutions that are practical and economical, service companies have carved out a niche by providing a range of offerings for operators big and small. They can include temporary treatment facilities at individual well sites up to large, merchant

operations that have centralized impoundments, water treatment, transportation and value-added services such as supply brokerages, equipment leasing and field staffing.

Clearly, the emphasis is on providing solutions that are weighted toward efficiency and expense management. According to Aquatech, based in Canonsburg, Pa., its integrated water services approach helps “each customer identify goals and create a customized plan for improved equipment uptime and performance, enhanced water productivity and optimized operating costs.”

Established in 1981, Aquatech claims industry leadership in desalination, water treatment and zero liquid discharge. Its services include membrane and thermal technology processes.

Recently, service companies have announced improvements in hydraulic-fracturing processes, frac-fluid formulas that tolerate higher salt levels and programs to coax more oil and gas from old wells with re-fracs.

And, according to the CEO of a Pennsylvania frac-sand supplier, making better decisions and driving down costs is “going to have to become very scientific. When you have $50 oil, everything matters.”

At Atlantis Technologies, flexibility means survival. “We may have to design a system that is unique to a single site or one that can handle large volumes and very high TDS loads,” says Curran.

In areas where water supplies are plentiful and ample disposal options keep transportation costs down, treatment for reuse or recycling may not pencil out, he adds.

In other fields, “with a lot of producing wells, no market for new water or long distances for disposal, you are going to have to address TDS in treatment.”

“In this business, people don’t care as much about the technology or what it looks like, so long as it makes an economic impact,” notes Curran. “You may be able to solve their problem, but if you can’t move the needle on expenses, then forget about it.”

ESTABLISHED TECHNOLOGY

Desalination technology has been available for centuries, going back to the first time someone imitated seawater evaporation by capturing steam from a boiling pot. But practical applications of thermal desalination are relatively recent.

The technique for moving salt water through a semi-permeable membrane to produce drinking water has been understood, and applied, for more than more than 125 years. The first commercial-scale RO desalination facilities came online in the mid-1970s.
According to International Desalination Association, nearly 17,000 thermal and membrane desalination facilities around the world are capable of treating 283-million cubic feet of salt water per day. More than 300 million people rely on desalinated water for some or all of their daily needs.

Other reports show that about 60 percent of treated salt water comes from seawater, followed by brackish water at 22 percent and river water, waste and other sources making up the rest. According to Global Water Intelligence, nearly two-thirds of desalinated water is produced for use by municipalities, followed by industrial users, power stations and agriculture.

Desalination has always been limited by energy requirements. Power is needed to drive the pumps for RO membranes to work and generate the heat that is the key to thermal desalination. Both techniques have become much more efficient in energy usage.

Improved treatment efficiencies can provide both operators and service companies with additional options building a new generation of water-management systems.