[May/Jun 2019]

SHALE PLAY WATER MANAGEMENT

RESPONSIBLE SOLUTIONS FOR NORTH AMERICA'S OIL & GAS INDUSTRY

SAND WASH TANKS: LOCAL MINING DRIVES DEMAND

FULL CYCLE PLAN CONTROLS WATER COSTS

OFF-THE-SHELF RECOVERY SYSTEM

+ WATER SKILLS FOR THE DIGITAL OILFIELD

ShalePlayWaterManagement.com

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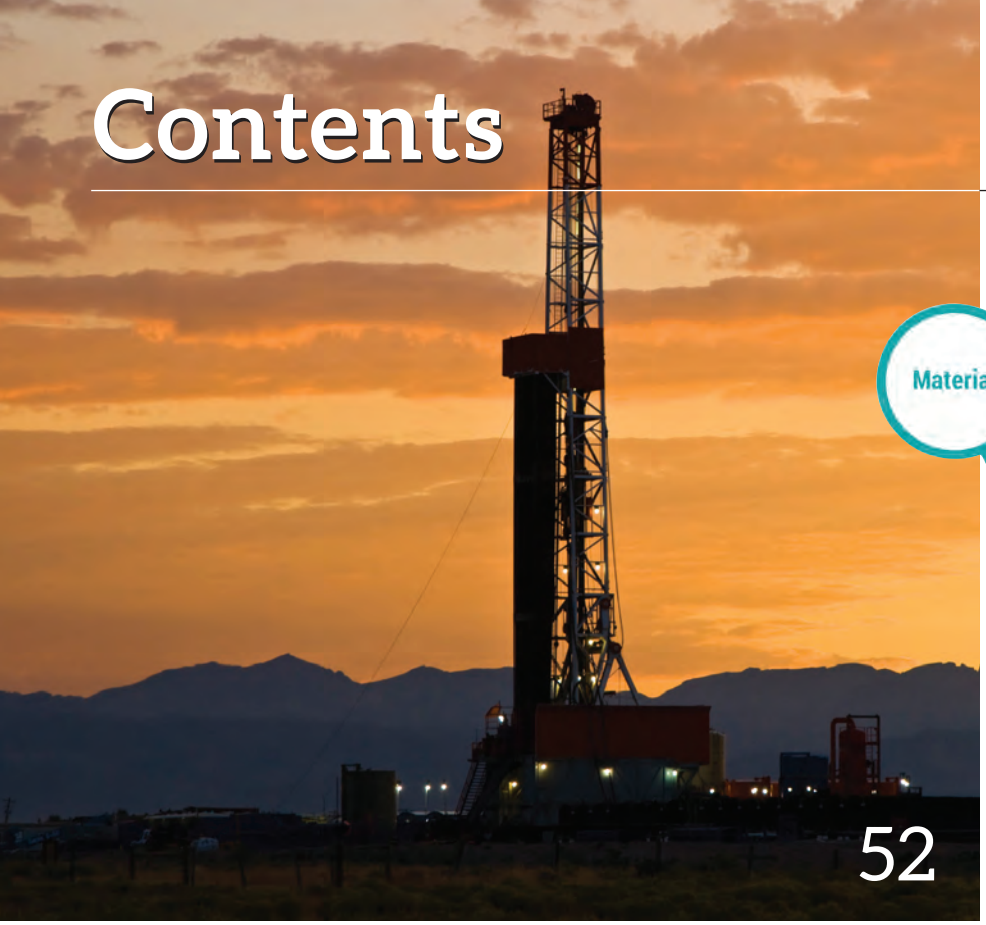

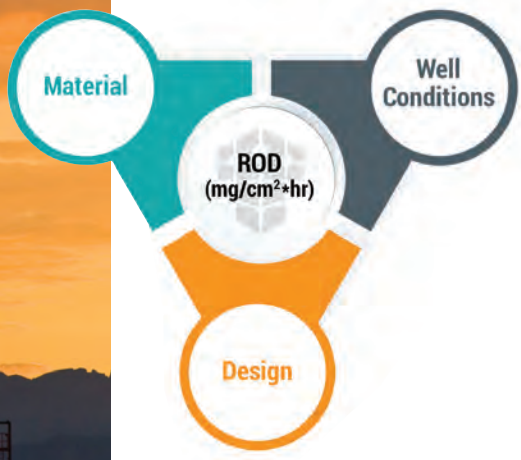

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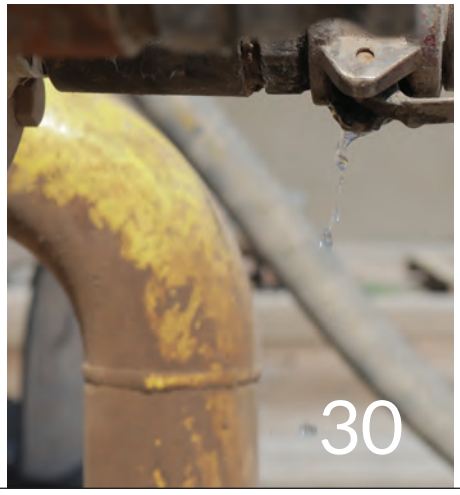

On the Cover: Sandwashing operations are a key element of new sand mines emerging in the Permian. Photo courtesy CST Industries.

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Business Headlines

Domestic Energy Production, Exports Continue to Climb

The United States has entered an era of energy abundance as domestic production from fossil, nuclear and renewable sources has climbed, according to an annual report from the Energy Information Administration.

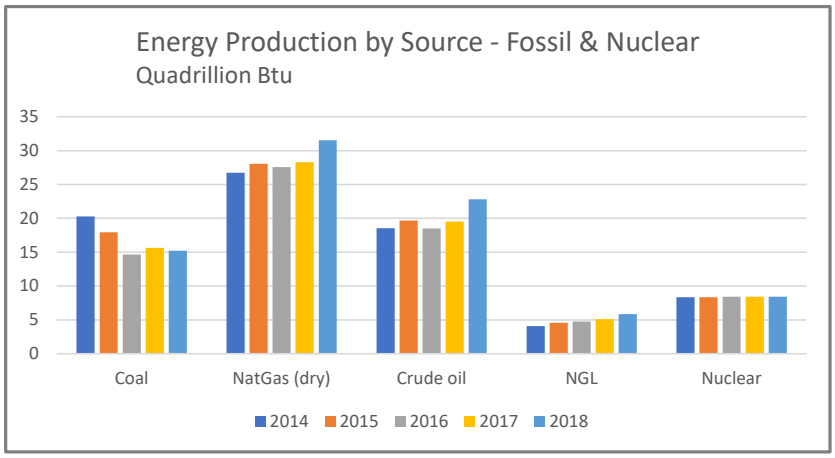
Energy produced from renewable sources continues to climb even as oil and natural gas production increases. Meanwhile, coal production has steadily declined since it peaked in 2008. Coal mined for use in electricity generation has decreased as more power companies switch to natural gas.

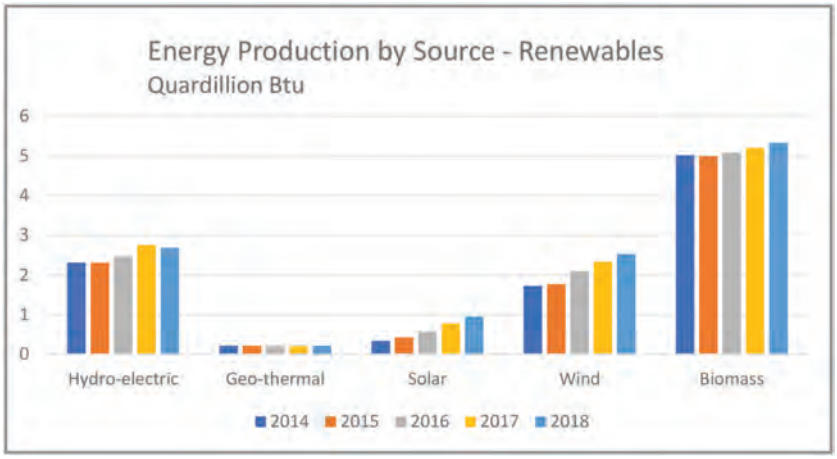
After nearly 40 years of declining domestic oil production, the trend reversed in 2009 until reaching near-record levels in 2015 and 2017. Concurrent to the rise in oil production, domestic production of gas and gas liquids has also risen to record levels, driving increases in demand and exports.

Rising production levels have for the most part, kept a lid on prices for fossil fuels. Likewise, increasing production from renewables has made those energy sources more price competitive, the agency reported.

Total renewable energy production and consumption both reached record highs of about 11 quadrillion Btu in 2017. Record-level wind and solar energy production in 2017 drove the increase in renewables totals, EIA said.

As fossil fuel production has grown, so have oil and gas exports.





Source: Energy Information Administration.

An annual summary of exports from the Gulf Coast, which is the primary export region in the country, showed crude oil exports exceeded imports for consecutive months at the end of the year, EIA reported.

Gulf Coast gross exports of oil hit a record of 2.3 mm b/d in December compared to gross imports of 2.0 mm b/d. December oil imports were the lowest since March 1986, the agency said.

Much of the increase in domestic oil production is light, sweet crude while Gulf Coast refineries are configured mostly to process heavy, sour crude. The mismatch means rising exports are mostly light, sweet crude from the domestic shale plays.

Finally, oil imports from OPEC countries, notably Venezuela, declined to 1.1 mm b/d in December from 1.5 mm b/d in first half of the year, EIA reported.

By Dan Larson

OIL RECOVERY DRIVES VALUE OF PLUG-AND-PLAY REUSE SYSTEM

Two-stage recovery and treatment for flowback reuse designed to fit into tight space.

As he was designing an oilfield water system five years ago, water treatment veteran Ed Newman kept two important features in mind: fit easily onto tight wellpads and provide a revenue offset through effective oil recovery.

"The wellpads we operate on are getting smaller and more crowded all the time," he said. "For an onsite treatment system to get a second look, it has to have a very small footprint."

Newman calls the treatment system he designed an "outside the box" oil recovery and water recycling service with plug-and-play simplicity. The system was built to deliver a reduction in oil, solids and metals, and return water acceptable for oilfield reuse.

A native Texan, Newman's long career in water treatment started when he was in his teens working on farm and ranch irrigation. From there, it progressed through machinery and into commercial construction. As his career progressed, Newman was called on to tackle ever more difficult challenges. "The funny thing is that the harder the project was, the more I wanted to take it on," he recalled.

Today, he is president of Quality Constructing Services LLC, (www.qcs-tx.com) based in Devine, TX, located about 30 miles southwest of San Antonio.

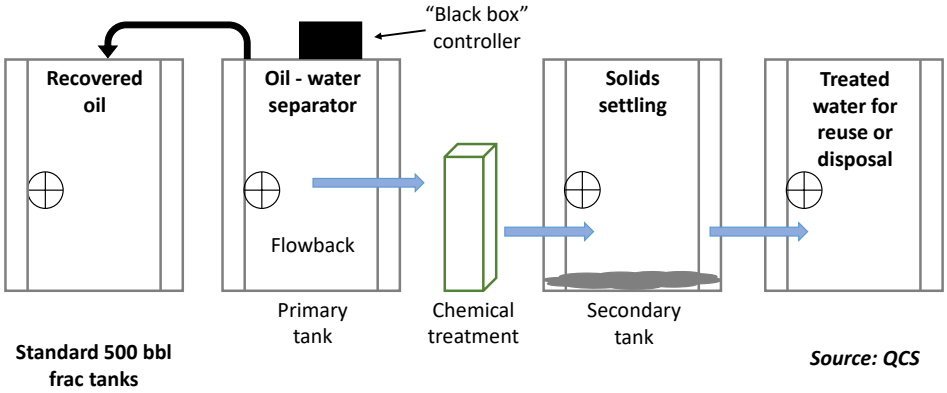
Plug and Play

Founded in 2008 as an industrial facility maintenance service, Newman's family-owned company has grown into project management, metal fabrication, commercial building construction,

> The system was built to deliver a reduction in oil, solids and metals, and return water acceptable for oilfield reuse.

Designed as a throughput process to fit into tight spaces on crowded well-pads, the oil recovery and water treatment system uses on-site frac tanks for recovered oil, solids and buffering. Photo by QCS

Flowchart: QCS "Outside the Box" Oil Recovery and Water Treatment System



Flowchart of the QCS oil recovery and reuse treatment system. Flowback oil is recovered in the primary tank while water is treated on the fly and solids settled in the secondary tank. Chart by SPWM, source QCS

earth moving, concrete and paving, site clean-up and remediation, equipment rigging, moving, rebuilding and maintenance, and wastewater treatment.

The QCS water treatment system was designed for plug-and-play simplicity but can be tailored to any water treatment specification.

"We have the tools and equipment and skilled people to build bigger units if that's what is needed," he said. The system is designed to fit into any drilling or completion layout without taking up additional space. The skid-mounted oil recovery, treatment and control units are shipped on smaller trailers and set up between frac tanks or other available space. It operates without a control room and uses a self-contained "black box" for monitoring and recovery. SCADA supervision and control capabilities are included, he said.

"On some sites, you wouldn't even notice they were there," he observed. Because the system is designed for oilfield reuse effluent levels, there are no filter pods, reverse osmosis or distillation components. "With the typical frac tank layout, we can provide economical oil recovery and solids removal and return water that meets oilfield reuse specs," he added.

Over time, the company has developed water treatment systems that can take everything from blackwater sewerage to high-TDS flowback and high-H2S produced water.

For oilfield projects, the system "can accept almost any level of flowback or produced water and manage the day-to-day variables, including volumes. Our best fit is completion flowbacks because we tie right into the frac tanks already onsite," he said.

The treatment system is designed to plug into an existing frac tank battery for oil recovery, water treatment and a flow buffer using standard connections. On a typical site, it includes one or two oil recovery tanks and a chemical treatment tank, if reuse is the goal.

> Almost any solids level of flowback can be accepted with the day-to-day variables, including volumes, managed onsite or remotely.

Oil Recovery

Using a proprietary technique, oil recovery from flowback is a key benefit his system provides the operator.

"We got into the oilfield business because of my experience with water treatment," Newman said. "That was my initial goal, but when I saw the amount of oil we could recover, it

changed the value we can offer the customer."

At most wellsites, the system can recover 250 to 300 b/d of oil, enough to dent the cost of operating the treatment system, he said.

The price downturn in 2015 seriously crimped demand for oil recovery and water treatment across the Texas oilfields, slowing early development of the system. "Had it not been for the decline, today we would be much further along in building our customer base," Newman said.

He noted that during an early pilot project in the Eagle Ford, the oil recovered on flowback water turned the operation to a net positive revenue stream for the operator. He added that the pilot project took place at the top of the oil price run-up in 2014, but it confirmed onsite oil recovery during completion flowback was able to produce real value for the operator.

The QCS system uses a self-contained control module that mounts on top of a primary frac tank. The typical three-phase separator takes a rough cut at flowback as it exits the well, but additional oil can be recovered at a second separator where entrained gas is also released.

The black box includes radar-based sensors to pinpoint the oil-water interface and, based on pre-determined levels, determine how much oil to pull from the top and water from the bottom. A coaxial hose dropped into the tank pumps oil to a recovery tank and water through a treatment system to a secondary tank if reuse is the goal. Otherwise, untreated water is sent for disposal.

Onsite oil recovery during flowback produced real value for the operator.

▲ An early pilot of the oil recovery and water treatment system in the Eagle Ford provided an opportunity to test processes and equipment. Photo by QCS

"We set where we want the oil-water line and the system maintains the right level automatically," he said. "We can then monitor the residence time and hold the inflow in a buffer tank upstream."

Aggressive Drop Out

For flowback with a high brine content, the system includes an ionizer that allows oil to separate with less residence time.

"Our system was designed for throughput instead of batch treatment," Newman said. "By reducing residence, we can use fewer tanks and increase volume through the system."

For water reuse, flowback is pumped through a treatment tank where a proprietary clay-based polymer is added that causes solids to "aggressively drop out," he said. Flocculation occurs in the secondary tank and clean water is pumped from the top.

Solids are collected from the secondary water tank during regular tank clean out at the end of the frac job. For a stationary treatment facility, round-bottom tanks allow solids to be collected on the fly without entering the secondary tank.

The result is "perfectly good, clean produced water that has whatever salt was there to begin with," he said.

The system also includes inline testing for conductivity and temperature and a flowmeter measures volume. Other tests for components such as metals, boron and oil can be completed on a tailgate using an off-the-shelf minilab. "We designed this system to use available technology and equipment," he concluded.

▲ Treatment tanks and controllers are skid-mounted and easily transported. Photo by QCS

Proven Technology

As someone who has spent a career treating water, Newman said he believes there are too many obstacles in treating produced water for something other than oilfield reuse. "The economics just are not there," he observed. "The TDS levels from most produced water are too high to economically treat for agriculture or surface discharge."

About the only way to turn that assumption upside down, he said, is if the number of completions were to increase so quickly that operators' only source for drilling and frac fluid was groundwater.

"If the oil companies had to rely only on freshwater for drilling and completions, they'd find the money it takes to treat high solids levels in flowback. Otherwise, it's too expensive," he said.

On the other hand, treating water to oilfield reuse levels has been a feature of the oilfield for many years, he observed.

Water reuse is a practice that is common and inexpensive and relies on proven, existing technology. In parts of Texas, water treatment is cost competitive with hauling and disposal. According to state regulations, water treatment for oilfield reuse is considered a permit by rule, meaning special permits for treatment of produced or flowback water are not needed.

Once a company is authorized by the Railroad Commission of Texas "to treat, handle and recycle grey water and produced water for reuse on a non-commercial basis for downhole operations and processes including drilling and fracing," it can operate without a permit for each job. Newman's company was granted such authorization by the RRC in February 2015.

Then, it gets down to economics, he said. "An oil company will only pay for water treatment if it fits into their well economics."

Treating solids-heavy produced water to discharge level is possible, but expensive, Newman said.

His company set up a pilot project in 2012 that was located adjacent to an

existing saltwater disposal well near Pleasanton. This allowed the project to test water from different sources with variable TDS and other component levels.

"We could pick the loads we wanted, adjust our treatments, record the results and then just send the water next door for disposal," he recalled.

The company sponsoring the pilot eventually stepped back, deciding oilfield water treatment was outside their business goals, but Newman came away with valuable knowledge of treatment techniques and the readily available equipment needed to do the job.

"The most important thing we learned was that the API and gun barrel oil-water separators on the market could not pull enough oil out of the stream without longer residence times," he said.

Likewise, water treatment has practical limits on clean up. Between the energy and operational costs required for reverse osmosis or filtration and the disposal costs for the reject stream, treatment for cleaner than oilfield reuse is not practical, he said.

Desal Limitsy

In 2009, a pilot program was operated by a municipal waste district in the Eagle Ford that was designed to see if RO desalination would be practical at scale. In addition to the energy cost to power the pumps, the volumes of brine that were produced overwhelmed the economics.

"With very high solids in oilfield water, every gallon of useable water would produce 10 gallons of reject," he said. "That project didn't go very far; they just should have known better."

▲ Ed Newman, president of Quality Constructing Solutions

Desalination can be made to work for municipal and central wastewater treatment plants where the influent water TDS is less than 50 ppm. Several such systems, both public and privately operated have been built or planned across western Texas, with the most recent in the City of Odessa. There, it was announced the city would add an $80 million RO plant to a planned overhaul of its existing treatment plant.

According to a local news report, the city's public works director called the addition of RO treatment a significant improvement to the quality of the city's water.

"To be able to drink the water at your house and be happy with it would be of some benefit," said Odessa's Mike Kerr.

Supply Clause

In the state's oil production regions where fresh or brackish waters are readily available, oil companies often include a water supply clause in landowner surface use agreements. Those water supply agreements can become a sticking point when the operator considers reuse of treated produced water.

"In parts of the Eagle Ford, the oil companies purchase water from the landowner as part of their agreement," Newman noted. "The company runs the risk of upsetting the landowner if water reuse means they purchase fewer barrels of freshwater."

"It's not that the landowners are against recycling water," he concluded. "What they are against is losing that revenue."

Consequently, if the company insists on treating flowback water for reuse, the surface use agreement allows the landowner to restrict land access for placement of pipes and pumps, effectively putting a clamp on water movement.

Newman says he believes there is room for growth in water treatment for oilfield reuse, although he admits that response in the Eagle Ford has not been as robust as he had anticipated. In the meantime, the oilfield services, equipment and fabrication business remains solid.

"Water treatment is not that hard when you have a background in water," he said. "Making the transition from ag and wastewater treatment, we learned a lot about how the oilfield operates."

Discussions with oil companies in the Permian continue, he said. With oil prices firming up, there are companies looking for simple, onsite oil recovery and treatment. And, water reuse now makes more sense than ever. ■