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March / April 2014

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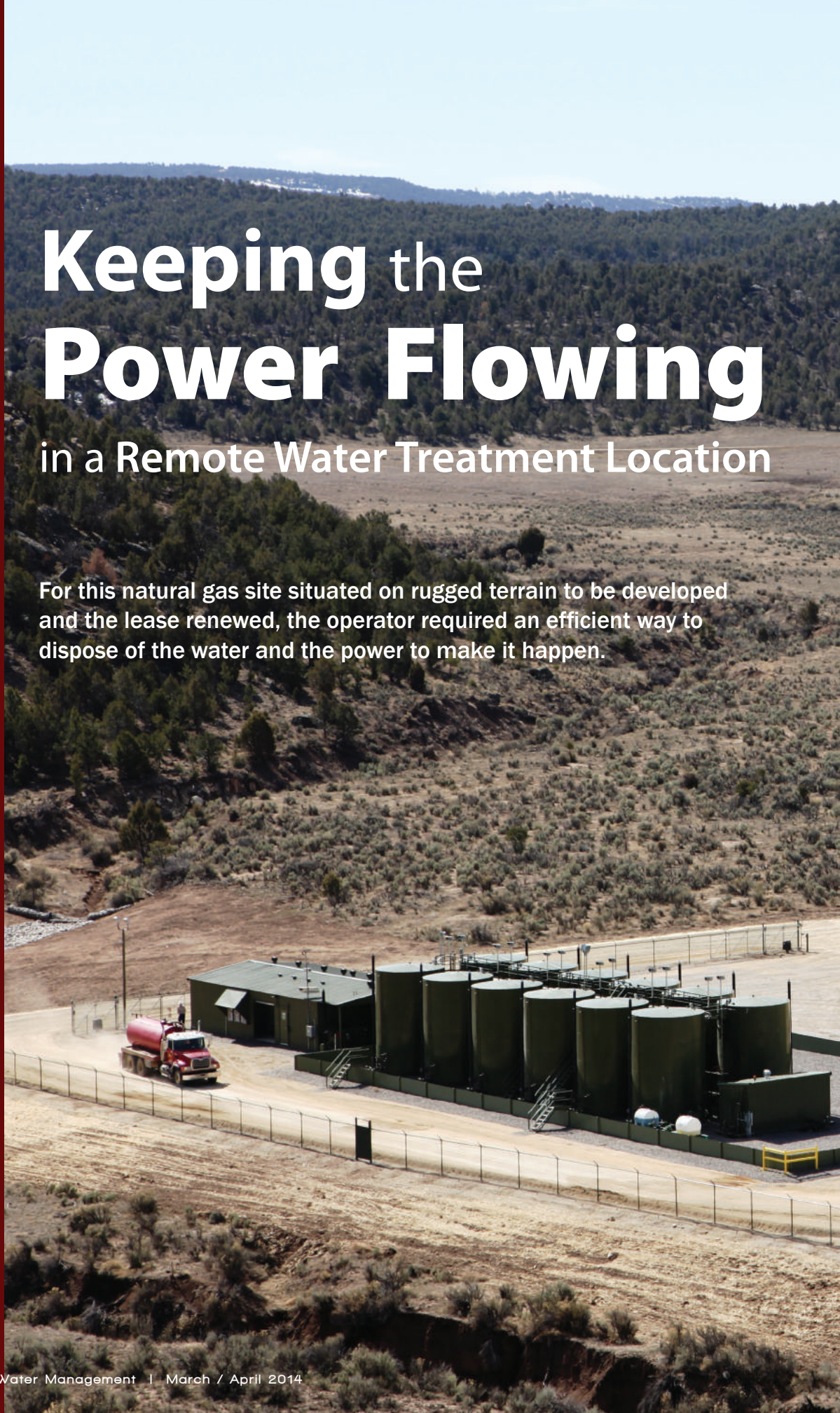
POWER POINTS

Keeping the Power Flowing in a Remote Water Treatment Location

For this natural gas site situated on rugged terrain to be developed and the lease renewed, the operator required an efficient way to dispose of the water and the power to make it happen.



Aerial view of the remote natural gas facility in the Southwestern United States.

OVER HILL ... OVER DALE

Many have said "getting there is half the battle," an iconic phrase that certainly applies to remotely-located oil and gas production sites, including a facility in the Southwestern United States.

Reaching this natural gas operation far removed from civilization requires traveling miles of winding roads over rugged terrain with nary a utility power pole in sight. For the site to be developed, and the lease renewed, the operators had to find an efficient way to dispose of produced water. Choosing the right technology to provide efficient, reliable 24/7 power for water processing at the isolated location proved a challenge.

The coal bed water injection well had to be able to manage hundreds of thousands of gallons of water daily, without interruption.

"The site needed an economical and reliable source to provide the electrical power required to run the water disposal equipment," says Hop Lee, Corporate Account Manager at Horizon Power Systems, distributor of Capstone Turbines.

"Based on prior success with Capstone turbines installed at other sites, the producer knew that Capstone MicroTurbine® generators provided what they needed for the water disposal well along with other site power requirements."

When the time came to dispose of the field's daily surplus of up to 294,000 gallons of produced water below ground, four Capstone C65 MicroTurbines were tapped to power the equipment needed to inject the water.

"Using an array of Capstone microturbines offered the capacity to generate prime power for the entire site," Lee tells *Shale Play Water Management*.

"The microturbines provide power to run the water injection plants and water transfer units, and all electricity needed to power the site, while being low maintenance and extremely dependable, which was critical in this isolated location."

Reliability was a key factor in the decision, and continues to be critical to the project's success today. The remote location, extreme weather conditions, and limited manpower demand Capstone's proven set-it-and-forget-it technology. With just one moving part, no gearbox, and no need for lubricants or coolants, the microturbines require minimal maintenance while providing reliable, dependable performance.

WATER GROWS IN IMPORTANCE

Industry experts estimate that, globally, oil wells produce about 220 million barrels of water per day (BWPD), equating to roughly three barrels of water for every barrel of oil. Add the related technical, logistical, and environmental challenges, and it's easy to see why water management can be the biggest operating cost for many oilfield operators.

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◀ Capstone C65 unit with panels removed. The systems are scalable from 30 kilowatts to several megawatts, and can run on natural gas, liquid fuels or renewables.

The remote field produces natural gas from coal seams at depths of 2,500-4,000 feet. When natural gas is brought to the surface, water laden with high amounts of salts and other solids is often a byproduct. While the natural gas is transferred to treatment plants, the production company needs to dispose the thousands of gallons of water collected each day. The most economically feasible option is to filter the water, then inject it back into a non-producing formation—often at depths thousands of feet below the coal seam.

The coal bed water injection well needed to manage hundreds of thousands of gallons of water daily, without interruption.

The unmanned site has secure access. Water is both piped and trucked into the water injection facility. Volumes of produced water trucked to the facility are automatically metered and recorded through a security system that requires individual access codes before the water can be offloaded at the facility.

According to the Society of Petroleum Engineers, the bulk of produced water from land-based operations is reinjected. Injection of these waters serves three purposes: To produce additional petroleum through secondary recovery (water flooding); dispose of potential pollutants; and, in some areas, control land subsidence.

NOT JUST PRIME TIME

Running on raw natural gas produced from the field, the four Capstone microturbines generate clean-and-green prime power to accommodate the myriad of components at the site, including booster pumps for filtration, air compressors for pneumatic controls, vapor recovery units, chemical and condensate injectors, heat-tracing systems, site lighting, control systems, automation, and computer systems.

"The Capstone microturbines are the primary power source for the entire facility," Lee says.

"We're using the clean exhaust heat from the turbines to provide building heat. This site is about 7,000 feet above sea level, and in the winter months temperatures can reach below zero degrees Fahrenheit. Even in these tough conditions the facility has continuously remained online."

LESS IS MORE

The remote locations of many shale play wellhead sites means onsite power systems must be low maintenance. It's vital to ensure continuous power for water processing. On average,

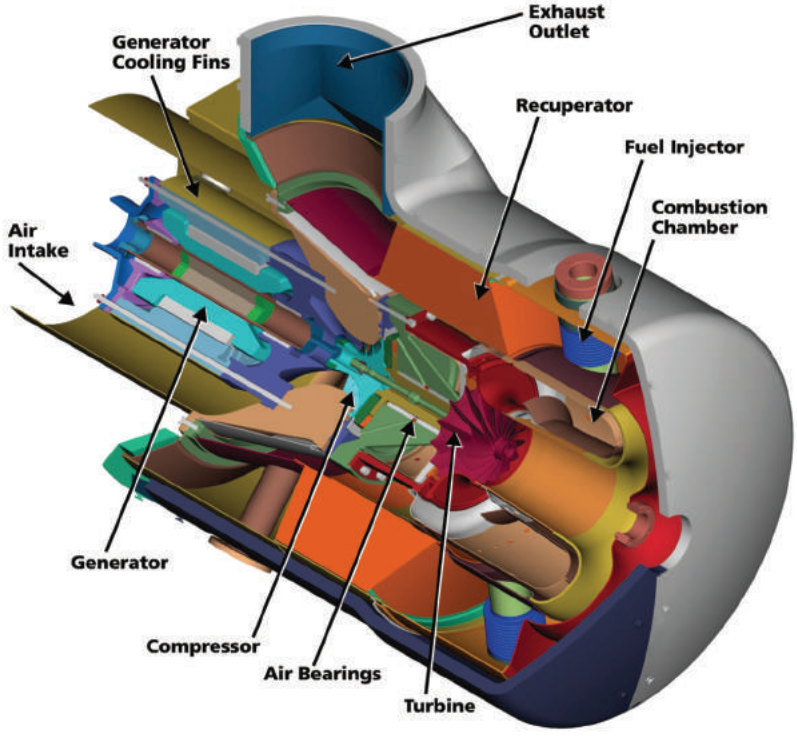
microturbines operate at 99% availability. This equates to 25 more operating days per year for oil and gas producers than a reciprocating engine. As a result, producers avoid high-cost power interruptions and maintenance downtime. In addition, microturbines can run on natural gas produced at the site.

An article by *Facilities.net* recommended a variety of continuous maintenance actions traditional reciprocating engines need: record the operating parameters; manual inspection of the entire system for fuel, oil and water leaks; check belts for proper tension and integrity; inspect exhaust system for leaks, corrosion and signs of overheating; top off and record engine oil and coolant levels; inspect and clean all battery and starter connections; and, check all coolant lines and hoses for leaks and overall condition.

In contrast to these extensive maintenance requirements, the Capstone power solution has a significantly reduced scheduled maintenance plan. Depending on site conditions Capstone recommends an air filter cleaning or replacement for microturbines at 4,000 hours of operation, and factory engine service is recommended after 40,000 hours of intermittent or continuous use.

ENVIRONMENTALLY FRIENDLY

The project also needed to be compatible with the site's surrounding ecosystem. A Capstone system has much lower NOx and CO2 emissions than traditional sources of electrical and heat energy. One reason the site's producer, who places high value on environmental stewardship, chose Capstone's clean-and-green technology was to help protect the surrounding ecology. The quieter operations and ultra-low emissions mesh well with the area's abundant wildlife and the surrounding habitat. Additionally, unlike traditional generators, Capstone's patented air-bearing technology does not require oil, lubricants or coolants—



Cutaway of a Capstone C65 MicroTurbine. ▲

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Capstone C65 being assembled at plant.

which reduce the microturbines' environmental impact even further, since disposal of these materials is unnecessary.

Capstone's turbines meet or exceed the toughest emission standards worldwide. "The site didn't require any additional emission-reduction equipment since the Capstone microturbines already met EPA standards," Lee explains.

The unmanned site has secure access. Water is both piped and trucked into the water injection facility.

Compared to other traditional gensets, Capstone microturbines at this site are equivalent to planting 365 acres of forest, or removing 350 passenger vehicles from U.S. roads.

In addition to strict emission requirements for natural gas sites, the Environmental Protection Agency's regulations require extensive treatment of produced water from oil and gas productions before discharge. The Society of Professional Engineers has calculated that treatment and disposal costs the industry more than $40 billion annually worldwide.

RESULTS SPEAK VOLUMES

Originally installed in 2008, the microturbine units at the site are now each approaching 66,000 hours of runtime.

"These units are rugged, low-cost, dependable, and require limited maintenance," Lee says. In 2011, the successes of the first site lead to installation of a similar array of four Capstone C65s at a second nearby coal seam injection facility.

"In a remote facility like this one, Capstone turbines are a great fit for providing power," says Lee. "The cost of bringing traditional utility power can be very expensive."

Capstone microturbines have the ability to run off raw natural gas that is abundantly available. In many cases Capstone microturbines have the potential to produce utility-grade, 480-volt, three-phase electric power for less than the traditional cost of bringing electricity from a public utility company to a remote site.

"Additionally, the Capstone microturbines can easily be set on-site and also, if needed, be redeployed to other facilities requiring prime power. Both sites continue to perform at better than 99 percent availability," Lee says.

"If you are getting between 80 to 85 percent run time, you have to ask yourself what that downtime is really costing. Not having power at these sites is not an option."

Since their installation, the microturbines continue to get the job done. Combined, the two water disposal sites are capable of injecting up to 588,000 gallons of filtered wastewater back into the ground each day.

"North American oil and gas producers are continuing to adopt Capstone microturbines because they want the high reliability and low emission benefits," says Sam Henry, Horizon Power Systems President.

"In addition, this oil and gas producer is committed to conducting business safely, in a socially and environmentally responsible manner, which is precisely what Capstone microturbines deliver. This customer is also active in numerous shale play formations and is utilizing Capstone turbines at these facilities."

Capstone microturbine systems are scalable from 30 kilowatts to several megawatts, and can run on natural gas, liquid fuels or renewables. Their flexible nature makes them easily adaptable to a variety of applications.

CHANGE IS GOOD

Successful water management is vital to today's oilfield operations. Reliable and low-maintenance onsite power fueled by wellhead gas plays a vital role in profitable management of produced water, minimizing fresh water use, and boosting water conservation. As the industry's technology continues to evolve, so too should its onsite power technology. The result is more productive, profitable and environmentally friendly wellhead sites. Everybody wins. ◻