

THE AMERICAN OIL & GAS REPORTER[®]

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Gas Production & Processing

Page 70



Roy Pitcock Jr.
Chairman Texas
Alliance

"Men and women in the industry are going to have to stick together to get anything done."
Page 117



Michael A. Ackal Jr.
Chairman LIOGA

"There is a lot of competition between states for capital. Louisiana has to communicate incentives to attract more drilling."
Page 124



Alan DeGood
President KIOGA

"We are a lot better off standing together than we are individually."
Page 127





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Technology Transforms Marginal Field

By Kathy Shirley
Special Correspondent

TONKAWA, OK.—A mature oil field in North Central Oklahoma could prove the start of something big in small-volume oil and gas production.

Rural Kay County, a few miles west of I-35, is an unlikely setting for high-impact technology. Nevertheless, it is where a small independent is successfully demonstrating the merits of a potential new solution to a problem facing producers everywhere: how to keep marginal properties economically viable in the face of escalating operating costs.

By all appearances, Tidewater Petroleum's operation looks like countless other older producing fields scattered across oil country, but with one key exception: a small, unassuming generator quietly chugs along transforming raw co-produced "junk" gas into enough electricity to power the field's production equipment—and without any kind of field processing to treat the gas before it enters the generator's engine.

The net result: gas that would otherwise be flared is being put to work to save thousands of dollars in annual operating expenditures, assesses Carlos Langston, Tidewater's vice president. In fact, without it, many of the high water cut stripper oil wells dotting the company's lease might not be pumping today, he surmises.

"Oil prices are at about the same level they were in 1985, but lease expenses have gone up tremendously since then. Small operators cannot control many cost variables, so we have to look at other ways to impact economics. By far, electricity consumption has the most significant impact on the bottom line," Langston says. "In Kay County, increasing electric rates were putting our wells in danger of falling below the economic threshold, so our choices were to either reduce that fixed monthly cost or plug the wells."

Generators fired by associated natural gas are not new, but what makes the Kay County installation noteworthy is that it uses smaller-scale induction generation technology coupled with an engine capable of burning untreated casinghead gas to drive lease equipment, supplemented by utility power. That combination not only removes the problem of what to do with uneconomic vol-

umes of co-produced and stranded gas, but also makes on-site generation viable for marginal wells.

Electric Costs

Electric service can account for 50 percent of lease operating costs, notes John Gibson, vice president of engineering and manufacturing with Bossier City, La.-based Global Power Systems, which manufactures the induction generator. "Small producers can get hit hard by power costs. They consume significant amounts of electricity, but not enough to have the leverage to negotiate for lower rates or avoid service interruptions," he explains. "Their costs can be onerous, but they need electricity to produce, and if they don't produce, they don't make money. They feel they have no choice."

Langston says the situation is compounded by the fact that most small operators don't understand the complex utility cost structure. "Small producers like myself get a bill every month and just pay it, without looking at fuel surcharges, power adjustments or the different ratios that rates are calculated on."

In Tidewater's case, Kay County Electric implemented a hefty rate hike following a large ice storm that decimated electric lines in the area. "Our Kay County lease produces 20 barrels of oil

a day or less per well, yet this area now constitutes by far our highest-priced electric costs at \$0.09-\$0.10 per kilowatt hour," Langston remarks. "Not only did it increase our costs, but the storm also illustrated our vulnerability to power outages. Operations were shut down for 100 days following the storm while electric service was being restored."

Tidewater's average well produces 2,500 barrels of water to every 20 barrels of oil a day. "These wells will produce for years and years if we can control operating costs to keep them in the black," Langston goes on. "But with the rate hike, a well making water was no longer profitable because of the electricity required to run the downhole submersible pumps."

Even smaller-volume wells can turn a handsome profit at today's pricing levels. "A 20 barrel a day well can be a good deal so long as all the profits are not sucked into electric costs, which are unlikely to go down," Langston maintains. "Wells like these are getting plugged every day by small operators because of high electric costs. That's a big reason why total oil production in Oklahoma is declining 10 percent a year."

Valuable Resource

The answer was in the 10 Mcf-15 Mcf



Since installing an induction generator system driven by a horizontal twin-cylinder engine capable of burning untreated high-Btu associated gas, Tidewater Petroleum has reduced lease electric costs by \$2,000 a month in its Kay County, Ok., production operations. The wells average 20 barrels of oil a day or less and have high water cuts.



a day of associated gas being vented from each stripper well on Tidewater's Kay County leases. "This was wasted gas because it wasn't feasible to run a 12-mile line to move such a small volume of gas to a pipeline connection. But we realized that if we could use this gas to generate electricity, it would suddenly become a valuable resource," ventures Langston.

Tidewater began looking at its options, and discovered that an induction generator system was the best option. That is where Global Power Systems came in. Gibson explains that historically oil and gas applications have relied on larger synchronous-type generators capable of providing electricity without being attached to a utility grid—typically in instances where wells are located in remote areas where utility power is not available.

"They work great in the right applications, but synchronous generators are not a good fit for every situation," Gibson notes. "They are complicated and their cost is often prohibitive in smaller-sized operations."

Tidewater also was uncomfortable with having to completely disconnect from the utility grid. "Running a synchronous generator in conjunction with the electric utility can pose dangers by feeding excess power into the utility grid, which can create all kinds of safety issues unless you disconnect from the grid," he comments. "We could have tried to sell excess power back to the utility, but that is a long and involved process and we would have no guarantees what the utility would pay for that generated power."

Induction Generation

An induction generator, on the other hand, cannot self-generate electricity in a standalone mode, or create electricity higher in voltage or frequency than the referenced electricity it is connected to, Gibson points out. It must be attached to the utility grid to reference the type of electricity to generate.

"An induction generator is nearly identical to an electric induction motor. It generates electricity when the engine spins the generator above its synchronous speed, or the speed at which the shaft of an electric induction motor revolves when attached to the utility grid with no workload present on the motor," he explains. "Since the utility grid provides all the excitation or reference voltage for the attached induction generator, there is no need for complicated phase-

matching or phase locking equipment."

The technology was developed in the 1980s by Jim Barnes, a principal with Global Power. Gibson says the induction generation process is relatively simple and safe, with external and internal faults (power flow reversal, phase loss, phase unbalance, etc.), as well as mechanical faults (broken shaft, coupling slip, low oil pressure, fuel loss, etc.) causing the generator to disconnect from the commercial power grid.

Induction generators are also much easier to maintain and repair. "This is the lowest common denominator in terms of simple technology. A lot of people expect to see something out of Star Trek, but the local pumper and electrician can take care of this generator," Gibson relates. "That is a key component, because if the goal is to lower operating expenses, then existing employees must be able to handle maintenance and repairs. All the parts in the electrical panel are off the shelf, except for one circuit."

In the event a failure does occur or equipment load exceeds the generator's capacity, power from the grid is standing by. "We designed the system with a fail-safe, so that if a problem occurs, power from the utility will flow right through the generator system," he says. "There is no downtime, which is a major issue for small operators."

"Also, if a big motor kicks on that exceeds load capacity, additional power from the utility grid will handle that requirement," he goes on. "Induction generators provide the best of both worlds: the utility feeds in when a big power surge is required, and when the load comes down, it defaults back to the generator and the utility gets backed off the wire. There is no need to pay for generator capacity you don't need."

Given these advantages, Langston says Tidewater decided induction generation was the way to go. "The system cannot totally replace the electric utility, but it dramatically reduces the amount of power purchased from the utility, cutting per-Kwh costs by up to 90 percent," he enthuses.

Durable Engine

Initially Tidewater experimented with induction generators that used conventional internal combustion engines, but a problem cropped up almost immediately because the engines were too fuel-sensitive to handle the gas from the Kay County wells. "Every lease has different qualities of gas with wide variations in Btu content.

Our wells produce 1,400 Btu gas," Langston states. "We needed a durable engine that could tolerate the rich gas, but be reliable and simple to maintain. This lease is in the middle of nowhere. It can be expensive and take days to get service personnel on location."

To combat the gas content requirements, Tidewater purchased an amine chiller unit to lower the temperature of the feed gas and extract liquids. "The unit itself cost about \$60,000, and we had all kinds of trouble with it. If it would have failed for any reason, it could have ruined the engines. We decided treating the gas was not the answer," he says.

So Global Power went in search of an engine that could burn low-quality gas. "Stranded oil field gas, landfill gas and abandoned coal mine gas is often of such low quality that an operator could never justify the cost of processing or treating in order to sell it," observes Gibson. "Over the years, scores of operators have called with small electrical loads and really nasty, really rich wellhead gas that we could not accommodate. Tidewater's situation made us realize the large number of leases out there that could benefit from a generator system, but have the same gas quality problem."

Several years ago Global Power had talked with Tulsa-based Arrow Engine Co. about using Arrow's engines for smaller generating applications, instead of big industrial motors. "When we realized there was a market for an induction generation system for leases with low electrical needs and small amounts of associated gas, we gave Arrow another call," Gibson says. "When we learned Arrow's biggest 4-cycle engine can burn 1,500 Btu gas with up to 1 percent of untreated hydrogen sulfide straight through the engine, we knew we found our solution."

The result is an induction generator powered by an Arrow's C-255 slow-speed, heavy-duty horizontal twin-cylinder four-cycle engine. According to Bob Fornell, sales consultant at Arrow Engine, the C-255 has a 700-750 rpm range and a 7.5-to-1 compression ratio. The low compression ratio, slow speed, and heavy-duty combustion chamber give the 60-horsepower, 4,000-pound engine a wide fuel tolerance.

"The engine and induction generator combination allows operators like Tidewater to take natural gas that would otherwise be wasted and pose an environmental nuisance, and turn it into useful, saleable power," Fornell comments. "To

accomplish that goal, the engine has to be reliable, dependable and extremely durable—just like the electricity in your home. When you flip the switch, and the power is there,” he says.

The C series engines date to the 1940s, when they were developed to work with oil field pumping units and run on field-quality produced gas, offers Fornell. “The engine was designed with a less-than-ideal fuel source in mind,” he says. “If you can burn poorer-quality fuel directly, you eliminate the cost and trouble of having to treat the gas.”

There’s also an environmental advantage, Gibson adds. “It has historically been difficult to catalyze air emissions on slow-speed, low-compression engines, because exhaust temperatures are not hot enough to use non-selective catalyst systems,” he explains. “Under full load and at maximum power, the C-255 produces a ± 900 degree exhaust temperature, making it relatively simple and inexpensive to deal with emissions.”

New Economic Picture

From Tidewater’s perspective, however, the only thing that really mattered is whether the system would work in its Kay County operations. After Global Power and Arrow Engine built and tested the first 40-kilowatt system at Arrow’s Tulsa manufacturing facility, it was installed last September on Tidewater’s lease.

“The cost benefits have been significant, completely changing the economic picture,” Langston reports. “In fact, the system is performing so well that we have ordered a second unit to provide additional power at this lease. Previously, if oil prices dipped below \$22 a barrel, this lease was a loser without some drastic measures to reduce electric costs. Now these wells would stay in the black at considerably lower oil prices.”

Total system cost was about \$50,000, and Langston says his company estimates payout within 24-36 months. “We went to our bank, Summit Bank, and showed them what the system can do, the cost savings we would realize, and the anticipated payout, and the bank was happy to finance the deal,” he expounds. “Anybody who can afford to buy a new car these days can afford one of these systems. We are just a small producer operating 70 wells in Oklahoma. If we can do it, anybody can.”

In terms of reduced utility electric consumption, Gibson says it has been difficult to nail down the savings because of the complicated nature of the Kay County Electric billing system. The co-op buys power from other generators and resells it to its customers, which creates

variability in power costs. He says he met with electric company officials in February to try to determine Tidewater’s usage and cost savings.

“The co-op’s fuel costs are all over the place. For example, in 2000, Tidewater’s power cost adjustment was \$17. Today, it is about \$400. Based on the figures we obtained, we determined that Tidewater’s power factors were low and it was being penalized for that. Once all adjustments are factored in, Tidewater is saving nearly \$2,000 a month. That’s the difference between profitability and plugging the wells,” Gibson asserts.

Compared to paying up to \$0.10 per kilowatt hour, the system enables operators to reduce electric costs to the range of \$0.02/Kwh during system payout and to below \$0.01/Kwh after paying off the equipment, Gibson evaluates. “Plus, there is residual value in owning the generator system,” he notes. “It is skid-mounted, so the operator can move it to another lease at any time or even sell it should he no longer need the unit.”

For even the smallest of operators, Langston says they system can make sound economic sense. “As utility costs continue to escalate, I think a growing number of small companies are going to begin reaching the same end of the road

that we did. There is too much liability and exposure to continue operating a marginal lease that is not making money. This technology is a means to change the whole equation for marginal leases,” he states. “We intend to buy more units and put them on all our leases where we can reduce power costs and achieve payout in 24-36 months. In fact, our second unit will be installed in March.”

In fact, Langston reports that Tidewater is now negotiating to purchase two leases where it can immediately apply the technology to make the operations profitable. “There are numerous marginal properties all over the country where this power generation system could make all the difference in economics,” he remarks. “There is no reason other operators cannot do the same thing that we are doing.”

Fornell agrees, noting the system’s potential will only grow as producing fields continue to age. “Everybody has a story to tell about a lease where there is stranded gas and prohibitively high electricity rates,” he concludes. “This is definitely a case where two plus two equals six; the whole is much greater than the individual parts. When applied correctly, it is a win-win situation that keeps marginal fields producing.” □



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