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Oil Refineries Striking Pay Dirt In The Ways To Use Technology

Digital Process Controls

Thinning profit margins, aging plants force firms to dig for better methods

BY DONNA HOWELL
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The business of oil has gotten more demanding.

With uncertain supply for the future, thin margins and aging production plants, refiners are trying to get more efficient and minimize risk. So they're methodically employing digital technologies, including those that control flow, temperature and other operating parameters.

"It's all about improving the utilization of the assets," said Dick Hill, a vice president at manufacturing consultancy ARC Advisory Group. "Every company, because this is a commodity-type business, has been trying to find ways to reduce costs any way they can."

The Shell Deer Park refinery in Texas, a joint venture between Shell Oil^{SC} and Mexico's Pemex, is among those transitioning to newer, digital, control systems.

"Probably 45%-50% of the refinery has a distributed (digital) control system," said Roger Erfurd, control systems manager at the plant. "The other 45% has a mixed bag of pneumatics,



Workers at Texas' Shell Deer Park refinery, which is owned jointly by U.S. energy company Shell Oil and Mexico's Pemex, can monitor a host of plant operations using Emerson Process Management's PlantWeb system.

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Dick Hill, ARC Advisory Group

single-loop electronics and old distributed control systems — just a mixed bag. Our technology was what I would consider lacking."

In 1999, refinery managers drew plans to upgrade the facility, and that's still a delicate work in progress. Improvements have to happen while a plant's running. Shutdowns are too costly.

"We were looking at putting in a system that could give us more information around what's going on

with the instrumentation in the field, primarily in the area of diagnostics — to let us know when something is having a problem — before it fails," Erfurd said.

Timelier Troubleshooting

In 2000, to try things out, Shell Deer Park hooked up just one small subunit of the plant, an effluent treater, to a digital data-reporting and diagnostics network called a fieldbus system. (Continued)

The next year, it started adding digital technologies to the plant's catalytic cracking unit, which splits petroleum into several different weights of fuels. That project finished this March.

In 2002, the refinery launched a much bigger fieldbus system project, which Erfurdt expects to complete this year. More technologies have yet to be added.

Erfurdt says the net gain will be better communications, better data with which to make crucial decisions and timelier troubleshooting.

Refineries represent about 75% of a typical oil company's physical assets. It's vital to run these plants flawlessly around-the-clock to avoid steep losses.

"That's where the investments are around refining — keeping that asset running at peak performance," Hill said. "This industry is trying to drive to something less than a percentage point's incidence of outages or unplanned events." Now suboptimal performance happens just 2%-5% of the time, he says.

Shell Deer Park is employing digital systems from a variety of vendors. Among them are Emerson Process Management, a unit of engineering giant Emerson^{EMR}, as well as Bentley Nevada and Triconex.

About \$32 million worth of business on initial Shell Deer Park projects went to Emerson, which started developing an innovative pro-

cess automation system called PlantWeb in the mid-1990s. The idea was to build more intelligence into digital control systems to improve the health and efficiency of industrial operations.

"What we realized was our customers were for the most part being asked to play chess blindfolded," said John Berra, president of Emerson Process Management. "For example, you can be measuring a level in a tank and the connection to that tank has been plugged up. The instrument's telling you something. But it's wrong — it's just measuring fluid trapped between the plug and the instrument."

Such hidden problems can lead to expensive shutdowns. Berra says one North American refiner reported losing about 7% of production capacity to unplanned shutdowns.

Along with digitally automating control systems, Emerson sought "to have a whole other system operating in parallel, doing predictive intelligence on what's going on," Berra said.

Over time Emerson has developed and refined such systems, aided by evolution in technology, such as low-power electronics.

"We can pack a lot of intelligence into a very low power small device," Berra said. "That, we couldn't do — say, 10 years ago."

Emerson's measurement instruments must naturally come into contact with flam-

mable fuels. So they have to be intrinsically safe, Berra says. "They can't draw enough power to ignite the atmosphere."

Emerson studied data collected by sensors inside tanks and in other areas of plants. It found that anomalies once thought to be "noise" could, when studied further, foretell the likelihood of a problem.

"A free flowing line will have a distinctly different vibration pattern than one that's been plugged up; a plugged line has far fewer vibrations," Berra said. "We've put this algorithm inside the instrument that learns (about what normal conditions are) and can tell the difference."

New Plants Cost \$2.5 Billion

A flow measurement device can cost \$2,000-\$3,000. To go digital, refineries need many of these, as well as other pieces of gear and software.

"To build a new refinery today, it will cost around \$2.5 billion probably, and maybe 7% of that might be attributable to automation," said Dave Reif, the head of Emerson's refining industry group. "While it's a fairly low overall percentage, that automation and the reliability of it has a profound impact on the overall profitability of the plant and time it takes to get it started and making money."

With digitization, startup of a new plant can happen

five to seven weeks earlier, Reif says.

ABB, Emerson, Honeywell, Invensys, Siemens, Yamatake and Yokogawa are the top suppliers of distributed control systems to the refining industry, Hill says.

The interest in control system modernization accompanies the oil industry's modernization efforts in other areas too, says Andrew Bartels, an analyst at Forrester Research.

"The majors have been investing in technology for a long time," he said. "They've been using it extensively for operations — for their drilling and exploration activities. For example, as part of the seismic activity in oil and gas exploration, tons and tons of seismic data have to be analyzed. It involves capturing data and bringing it into computers, even supercomputers — then sifting, sorting and trying to find in that data pockets of natural gas or oil they can use for drilling."

How does oil economics influence refinery upgrades?

"We become more energy efficient when the relative price of energy goes up and it is diminished when the relative price of oil declines," said Jonathan Noonan, chief investment strategist at Appleton Partners. "I think this has had an impact in where companies that did refining looked — at where they'd make their investments."