WIRELESS TECHNOLOGY SPECIAL

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IN MY OPINION

**John Mason,
CIO,
Bottomline Technologies**

CIO INSIGHTS

**Stephen Brennan,
SVP-Cyber Network Defence,
DarkMatter**

Redpine Signals:
Spearheading the
Wireless IoT Revolution

Venkat Mattela,
Chairman & CEO

The IIoT is Making a Major Financial Impact in Refineries Worldwide

By Bob Karschnia, VP-Wireless, Emerson Process Management

There are about 650 major refineries globally, and these facilities are critical for producing the products that fuel the world's cars, truck, ships, and planes. Some of these plants are operating at peak performance, but many are not, causing significant financial impact.

Emerson's calculations show the difference in operating costs associated with equipment reliability and energy efficiency between a well-run refinery and an average one is about $12.3 million per year for a typical 250,000 barrel per day facility. Assuming about 60 percent of refineries are not operating as well as they could, the overall worldwide financial impact runs into hundreds of billions of dollars annually.

This of course has a direct impact on stock prices, as refineries performing in the top quartile make more money for their owners, and also enjoy other benefits in terms of fewer safety incidents. According to Goldman Sachs' latest Environmental, Social, and Governance Impact Report, industrial firms scoring well on issues like employee safety tend to also produce higher returns on investment.

So how does a refinery attain and maintain a peak performance and high levels of safety? In terms of safety, the answer can be found by in the Marsh Report on the top 100 hydrocarbon incidents, which found three primary reasons for major incidents: startup and shutdown (transition periods in operation), and piping integrity related to corrosion.

The Industrial Internet of Things (IIoT) provides solutions to deal with performance and safety issues in the form of Pervasive Sensing solutions. These solutions consist of adding wireless points of measurements throughout the plant, monitoring these points using predictive analysis, and alerting plant personnel so they can take timely action. These activities help optimize production processes by the asset health of pumps, motors, steam straps, heat exchangers, valves, piping systems and other items.

With more wireless measurement point 'eyes,' the sensors (the 'things' in the IIoT) in a refinery can be used to easily detect suboptimal operation or imminent failure, yielding more uptime and improved safety. This same information can be used by plant operators to improve performance, as information from wireless sensors can be used for analysis and to improve work processes. Refineries are taking notice, with significant investments being made recently in corrosion monitoring of piping systems following the Chevron Richmond refinery fire in 2012, for example.

Another important issue is the shortage of skilled personnel to run refineries, which can be addressed by applying IIoT Pervasive Sensing and predictive analytic strategies to increase the efficiency and effectiveness of the people running the plants. The IIoT does this by presenting plant operators and engineers with timely and actionable information with the help of asset management and other data analysis tools, allowing them to act to prevent failures and consequent safety and environmental incidents. The IIoT also gives operators the data they need to improve plant performance.

Companies building new refineries are well aware of the benefits of using IIoT through pervasive sensing applications. A typical modern facility will thus have about 50,000 inputs and outputs to and from control and monitoring systems, with all connections made through plant intranets, which replaces the
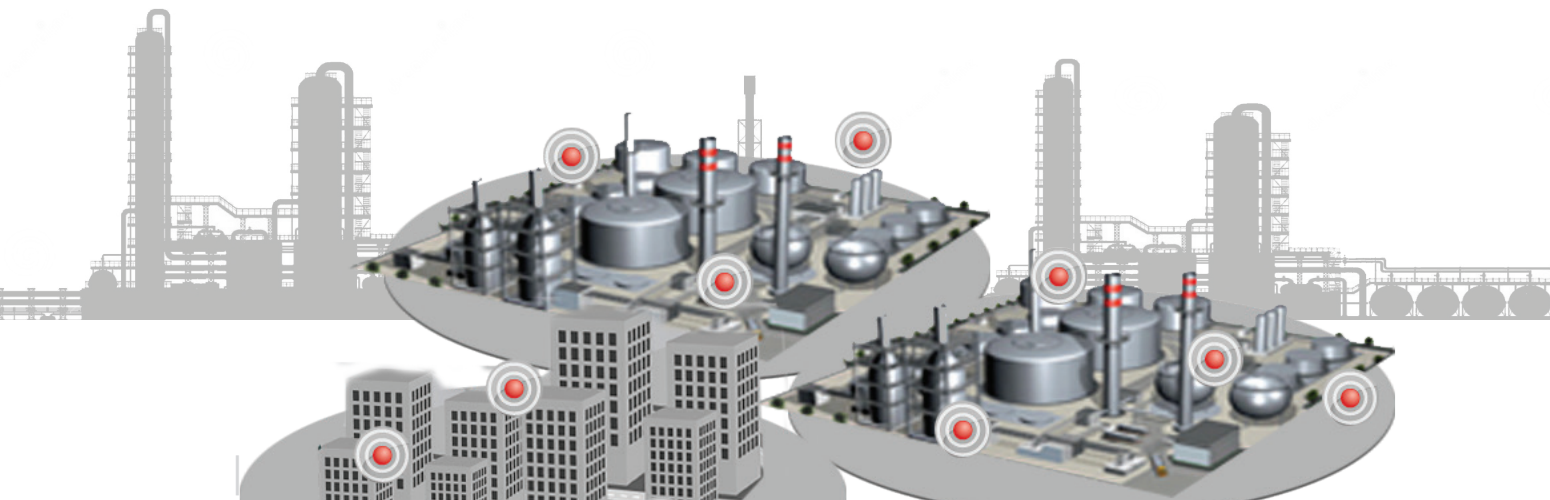
Bob Karschnia

IIoT investments in wireless sensor systems increase reliability, directly impacting refineries bottom line.

Internet in these IIoT applications. These connections are both wired and wireless, depending on the specific nature and location of each input and output.

But an older refinery will typically have closer to 20,000 inputs and outputs, with the 30,000 shortfall the root cause of much inefficiency, operational issues and safety incidents. Most of these facilities were designed and built with the minimum amount of instrumentation needed to safely operate the plant, and weren't designed for optimal operation because adding additional points of measurement was too expensive. The vast majority of this 30,000 shortfall of input and outputs are missing points of measurement,

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which causes the plant to run blind in many critical areas, or to perform expensive manual checks via operator rounds.

So why haven't all refineries added thousands more points of measurement, given the proven financial benefits? One reason is that in the past, these inputs would have been wired from the sensing point, maybe a pump, to a control and monitoring system. Adding this wiring to an existing facility is usually a very expensive undertaking, and it often requires significant downtime, which isn't an option as many refineries operate at or near full capacity.

But proven technologies allow these points of measurement to be added quickly and inexpensively with wireless sensors. These sensors are connected through a plant-wide wireless mesh network to control and monitoring systems. Wireless sensors allow points of measurement to be added at a fraction of the cost and time of their wired equivalents, and sensors not requiring process penetrations can be installed without any required downtime.

In short, adding wireless applications pervasively throughout the refinery is the quick and cost-effective way to create a comprehensive plant-wide IIoT. These key measurement points coupled with data analysis and asset management systems improve operating performance, asset reliability, and safety—resulting in higher profits.

Solomon Associates, a benchmarking company for refineries, has found that refiners investing in reliability by adding points of measurements and corresponding asset management systems have the lowest maintenance costs because they are able to predict problems before they occur and act in time to prevent the failure. This allows relatively inexpensive proactive maintenance rather than very costly reactive repairs.

Refiners focusing on cutting the maintenance budget and minimizing IIoT and related investments actually end up with not only the highest maintenance costs—but also with poor reliability, excessive downtime and a higher probability of safety incidents. This short-term culture of avoiding relatively small maintenance investments usually ends up in an unplanned shutdown, and a much higher probability of a major incident making the news and driving down the stock price.

The preferred alternative is to create a plant-wide IIoT via a wireless Pervasive Sensing system, a project that can start small by adding the most critical wireless points of measurement first, and then continue by adding thousands more wireless sensors. This will increase uptime, improve performance and reduce safety incidents—and yield top quartile performance for refiners.**CR**