A Mechanical Healthcare Plan

Motor Operation Gets Big Boost from Smart Technology (Here's How to Take Advantage)

Matthew Jaster, Senior Editor

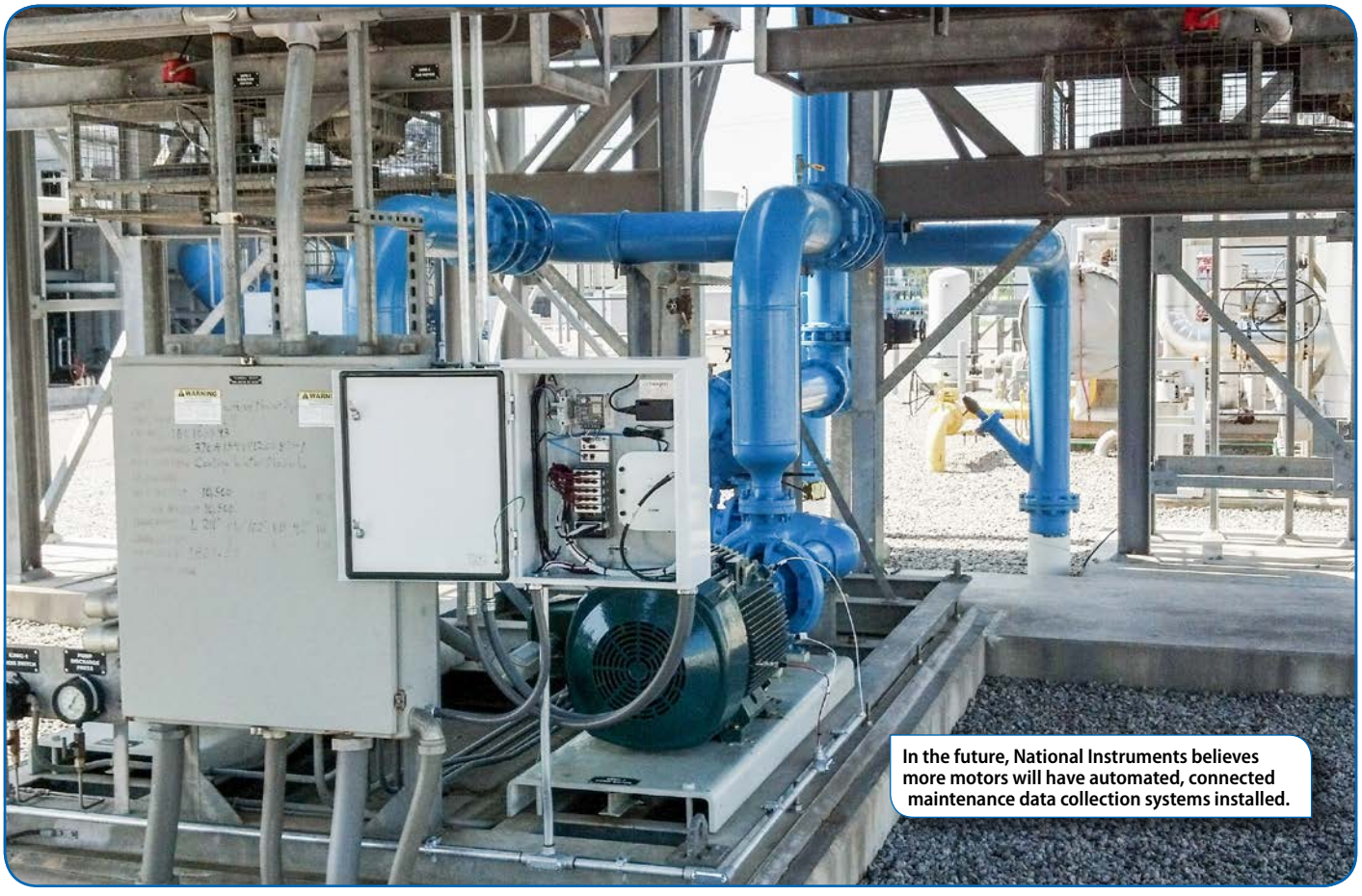
Let's say 100 motors are running in a mining, oil and gas, or metal refinement operation. These facilities are probably in the middle of nowhere; not exactly ideal conditions to have a full-time engineer on-site to make sure the mechanical assets are running properly 24/7. In the past, manufacturers had little choice but to be reactive when motor loss occurred or a mechanical system was in need of some troubleshooting for an application like this. From a cost and/or safety perspective, this was typically bad for business.

Often, these assets are spread out over the company's operating territory and managed by a smaller team that travels. Not only can truck rolls be interstate, but upon arrival the analyst may need to traverse catwalks or work in cramped, uncomfortable spaces to collect the needed vibration waveforms needed. In the case of power generation, energy contracts and possible regulations bring multiple sources of financial pressures making downtime all the more urgent.

The paradigm for motor functionality and efficiency has changed dramatically in recent years. Sensor data can report real-time motor functions, software can provide temperature profiles and machines can predict voltage changes at the push of the button. Smart technology is here to stay. How then, can manufacturers make the best use of the technology to make a significant impact to their business?

"Quite honestly, for years and years motors were relatively dumb," said Sherman Joshua, connected services global portfolio manager at Rockwell Automation. "What's changing today is the instrumentation and data that is now being built into these systems provides sensor, performance and field data that lets engineers know how their applications might be impacted both short and long term."

So we return to the mining facility with 100 motors in 2018 and find a predictive maintenance solution in place that gives engineers the flexibility to predict issues, pre-plan resources and schedule appropriate measures to keep the system running as efficiently as possible. It's a healthcare system for components.



In the future, National Instruments believes more motors will have automated, connected maintenance data collection systems installed.

Getting Better, Smarter and Easier to Operate

Brett Burger, principal solutions marketing manager at National Instruments, says that condition monitoring and preventive maintenance programs offer huge potential economic impact to businesses as they look to not be on the wrong side of disruptive technologies.

"McKinsey & Company sees predictive maintenance and equipment maintenance as major IoT application areas for factories and worksites by 2025. The prevalence of motors makes them a critical component in the drive to reap these economic gains and a wise asset on which to focus. Many challenges today are creating an environment where the status-quo will not be good enough and companies will look to technology, such as those used in online predictive maintenance solutions, to find a better way to operate," Burger said.

To improve condition monitoring, Burger says that customers need to be mindful of their workflow with regard to when and how they use data. By focusing on their workflow, they can better understand where the inefficiencies are such as excessive time spent collecting data or existing data that is currently unused. Workflows can also connect to other groups, leading to more opportunities for inefficiency.

"From my perspective, field monitoring today is beginning to focus less on the portable equipment carried by analysts, and more on intelligent technology used to automatically connect motor data to networks," Burger added. "Vendors traditionally known for handheld instrumentation are re-evaluating their product catalog and the trend of automated measurements is enabling new vendors to enter the industry. This dynamic is creating a wider variety of offerings to companies looking to monitor motors, but it is also creating a greater need to research technology and equipment since many of these solutions are enterprise-wide."

The Challenges of Predictive Maintenance Today

Being in the early stages of smart motor technology, customers looking for analytic and monitoring solutions typically fall into two categories according to Joshua.

"You have the customer that knows what systems and analytics they need, but they're not sure if they can do it on their own or if they need help from a vendor. Then you have the customer that's completely overwhelmed. They see so many technologies and solutions available regarding condition monitoring and predictive maintenance they simply don't know where to start," Joshua said.

Add to this the fact that motor technology *feels* like it's changing on a daily basis. Joshua explains how a customer might purchase a predictive maintenance system only to have better software or hardware available three months down the road.

"Do you need this technology every time something new hits the market? Is it necessary to changeover so quickly? These are the questions Rockwell Automation customers ask. We want our customers to focus on the '*what*' and let us focus on the '*how*.'"

NI sees several challenges as they work with turbomachinery maintenance professionals including time spent manually collecting data, data gaps (route adherence), dark data, as well as a workforce that is at or near retirement age.

Burger said that manually collecting data does get the expert into the plant to use the human sensors, but it comes at a great efficiency cost.

As an example, a recent case study released by IHS Markit examined how Duke Energy is using IIoT technology to replace monthly, manual data collection. "With almost 60,000 collections a month, analysts at Duke Energy were typically spending 80 percent of their time collecting the data and only 20 percent of their time analyzing it …" (Duke Energy Leverages IIoT for Predictive Maintenance Applications, Alex West, IHS Markit Technology, January 2018).

Looking at other examples and challenges, Burger says when routes are performed by on-site personnel it can be difficult to prioritize the data collection over other pressing plant issues. Lack of adherence to data collection leads to data gaps that could otherwise contain useful information that prevents the next outage.

Even when data is collected properly, Burger believes that doesn't always lead to an efficient use of a maintenance professional's time.

"Often, the team reacts to more urgent needs such as calls from operators that have noticed abnormalities in control dashboards or troubleshooting an important asset that is out of service," Burger said. "On top of all these challenges is the trend that many professionals in this industry are at or near retirement age and not being replaced at a sufficient rate meaning more assets need to be covered by fewer experienced maintenance professionals."

How Condition Monitoring & Smart Technology Can Help

So where do you start? How do you get the most from your motor applications by utilizing smart technology today? Companies like Rockwell Automation and National Instruments offer products and services that take ownership of the data and analytics so their customers don't have to.

Joshua said many large manufacturing organizations can handle the growing list of requirements needed when putting together a maintenance and condition monitoring plan. They have the skillsets and the sheer numbers to look at everything from analytics and the Cloud to cybersecurity, I. T. and software. Medium and small-sized companies don't have the infrastructure in place to handle implementing this technology in most cases.

"It's the 90-percent of the iceberg that's underwater that they don't see at the beginning," Joshua said. "If they're going to buy all the equipment to monitor motors, for example, they're going to need to connect all the pieces to make it work effectively. This costs time, money and effort."

Rockwell can do the grunt work for the customer. They will collect the data locally, store it in the cloud, leverage the software, develop predictive and remote engineering tools and essentially build the analytics from the ground up. It's a hardware/software platform with engineering expertise on-hand to solve a variety of challenges. The Dynamix 1444, for example, integrates machine protection with a standard control system and *Studio 5000 Designer* software lets customers configure the system within a single-design environment.

Burger said NI's core offering for condition monitoring applications is also a single platform with hardware and software. *NI InsightCM* can measure asset health data from any type of sensor technology (wired vibration and temperature, wireless vibration and temperature, motor-current/vibration, infrared, electromagnetic, and so on) and aggregate that data, including the full waveform captures, onto the *InsightCM* server.

SMEs can set intelligent triggers for data collection and perform analysis on the real-time or historical data. Aside from SMEs, *InsightCM* can connect to 3rd party software tools such as OSIsoft's *PI System* historian database or any software that uses *OPC UA*, meaning maintenance teams have more freedom to operate using their existing tools. Finally, *InsightCM* has a development kit available so in-house analysis, data from 3rd party hardware, and new communication protocols can be added to fit custom requirements of the end user.

The Toolbox is Expanding

Burger says the Industrial IoT megatrend includes several technologies that can help with field monitoring for motor applications. Sensing and processing technology continue to improve in performance and value helping to move much of the analysis that would typically happen on a laptop or a server to the field right next to the asset being monitored.

"Instead of walking routes to each motor to gather data, the motors are connected to the plant's network by intelligent measurement devices and screen the data 24 x 7 sending

only relevant, useful data to the plant server where SMEs can log in for further analysis. Wireless sensors are improving in communication bandwidth, measurement capability, and battery life, reducing the cost of connecting assets to a network. Since much of the cost of a system is in the installation of conduit/cabling for power and wired network a fully wireless solution can speed time to an ROI greater than one. Finally, a possibly most important, software technology to help manage and analyze automatically captured data is improving and helping maintenance teams better plan asset servicing during outages," Burger added.

In the future, Burger believes more motors will have automated, connected maintenance data collection systems installed (eventually they will be built-in to almost every motor of modest criticality). Data from automated measurement systems will be increasingly consumed by artificial intelligence using machine learning to detect pre-failure patterns in the data. Monitoring technology equipment will move to the "set top box" model allowing companies to reduce up-front cost and focus more on the data and less on maintaining measurement equipment.

Joshua says that while motor monitoring and preventive maintenance today is still being purpose-built on a case-by-case basis, he sees an evolution of sorts coming to the industry in the future.

"Let's look at the facility again with 100 motors. They have a 90 percent efficiency rate, but the customer wants it up to 98 percent. Down the road, we'll have libraries of analytics, algorithms and off-the-shelf solutions to increase uptime. And the monitoring will go to a performance-based model instead of a one-time engineering cost on top of the fees to maintain and support the system. I think these changes will deliver high value to the customer and provide a more cost-effective approach."

The end game with all this technology is to create more efficient, reliable mechanical systems. NI and Rockwell Automation are just two of the companies that can provide the resources necessary to fulfill these requirements.

"We're bringing industrial automation knowledge to the customers," Joshua said. "We have the engineering expertise, the support system and the technology in place, so our customers can focus on what they do best. This saves time, money and resources and could ultimately change what their staff looks like in the future." **PTE**

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